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MODELLING FOOD SECURITY MEASURES IN SUDANOSAHELIAN ZONE OF CAMEROON: COMPARISON OF PARTIAL AND GENERAL EQUILIBRIUM MODELS AGLINK AND GTAP

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SUMMARY

We used one approach based on a total model of general balance, the model of the world trade analysis project (*Global Trade Analysis Project*, *GTAP*), which supplements the model of partial balance modelling of food security measures projections in sudanosahelian zone of Cameroon, area often prone to food crises. Models of partial balance (*Aglink*) and of general balance (*GTAP*) used in this study bring each other different meaning on the problem and produce sets distinct from food security measures. Among these measurements, some represent characteristics common to both types of model, but in a general view, their differences reflect the divergence of the priorities fixed at the time of development of the models. In most of the agricultural products studies, the model of balance General (*GTAP*) give possibilities to extend the analysis of commercial liberalization to local "embryonary" agro alimentary industry, non-agricultural products and services. with the interactions between these sectors via the markets of products intermediaries, as with competition that the producers deliver themselves for to use resources limited and to their contribution to the income of households.

Key words: Aglink, GTAP, Food security, sudanosahelian zone of Cameroon.

INTRODUCTION

One major concerns expressed - to differing degree - by sub-Saharan African countries not members of OECD is to determine if continuation of the trade reforms will be prejudicial to these countries. According to FAO, "food safety exists when all population has at any time material and socio-economic access guaranteed to food and nutritive in sufficient quantity without danger, to meet his physiological needs, links to its food preferences, and allowing him to carry out an active life and to be in good health. To attend food security means to make food available in sufficient quantities, to ensure that the stock is relatively stable and that those which need food can obtain enough ". At the end of this study, we wish to use this definition to measure food security according to three aspects: *availability* of foodstuffs, *stability* of stocks of foodstuffs, even they are national or imported products, a permanent *access* to these food products to all individuals, so that they can satisfy their food needs. World production of food products is not the fundamental cause of the food security problem, because the increase in production is stronger than demographic growth, thus a long-term decrease in the prices of primary food products in real terms (Mitchell, Ingco and Duncan, 1997). The problem is link to the fact that developed countries increased their production, leading to important subsidies, so that problems of food security concern primarily countries with low incomes (USDA, 1999).

Context:

Sudanosahelian zone of Cameroon is divided in 15 Commercial zones according to the Ministry in charge of industrial and commercial activities. Rural populations of this zone of Cameroon, is characterized especially by activities related to subsistence agriculture which is low in productivity, and have only limited access to factors of production, with technologies and imported foodstuffs likely to supplement the availability of local products, because of foreign currencies missing and bad distribution of infrastructures. Despite the fact that the total offer of foodstuffs in Cameroon is sufficient, there remains pocket of food insecurity in the sudanosahelian zone this is link to problems of access to these products. In fact, the access to the foodstuffs depends on the correct trade operations on markets, of the networks distribution, the adequacy of the network infrastructures, governmental measures, stability of the country, respect of the right and order, and especially sufficient incomes (and correctly distributed !!!) to allow foodstuffs availability at any level (ABARE, 2000). The insufficiency of available food products can be responsible for the food insecurity when the sum of volumes of national products and imported products is not enough to meet the needs of the population. In such cases, the insufficiency of offered foodstuffs is the principal cause of the food insecurity, but this can be link to the problem of access at the national level, primarily due to lack of foreign currencies which would allow for example to buy imported food (OECD, 1998). Principal factors influencing the regional exchanges and even international will thus be able beings considered as determinants on food security in this part of the country. Even if it is shown that the liberalization of the exchanges supports the improvement of level of wellbeing, most fear is that the profits are not distributed equitably between all sections of population of the country. A great part of Cameroonian population concentrated in the three Northern provinces, economically, less advanced, strongly bound to agriculture fears, where a more open commercial system does not put in position of competing, disadvantage in regard to other provinces. Moreover, some parts of the region are persuaded that the loss or erosion of their preferential access to the markets of the south (of Cameroon) would add to their difficulties of current adjustment. If it's proven that these factors affect them, indeed export earnings or prices of the basic foodstuffs increase or become more unstable following the liberalization of the exchanges, continuation of the agricultural and commercial policies reform, could then thwart the objectives of accession to food security of some poor part of northern Cameroon and thus by more stripped populations. Even if these concerns are comprehensible and that they were partially taken into account by the AACU, it is probable that the advent of a more open and more equitable trade system will have also considerable positive repercussions on the Sudanosahelian Zone of Cameroon (SSZC). In addition they are at the origin of the most important distortions on the world markets of basic commodities, agricultural policies and their subsidies applied in developed countries represent a source of additional instability for the world markets. If this protectionism cost enormously to the developed countries economies themselves, it imposes also a considerable burden with the poor countries. In these circumstances, it is probably the degree of exhaustiveness of the negotiated reforms and particular situation of poor country or groups of poor countries - in particular the fact of being an importer or exporter of food products - which will determine the occurred possible one of negative effects for the countries and, if necessary, the width of these effects. Consequently, it probable result of the liberalization from the point of view of food security becomes mainly an empirical object of evaluation. Food insecurity in SSZC present both transient and a chronic dimension, the first being characterized by periodic food shortages and the second by a durable insufficiencies. The chronic food insecurity, daily problem of the populations of North Cameroon, is a durable phenomenon of inadequacy of access to food products which results primarily from poverty and insufficiency in purchasing power. The factors which can be at the origin of this food insecurity are numerous. This is mainly related to natural resources, climate, economic, social and demographic instability,

from multiple instabilities in sub region (frontiers with Chad, RCA...) cultural and resulting policies. But the most direct causes of the chronic or permanent food insecurity in this area, is especially strong demographic growth, fast urbanization, important rural population without qualification or on low school level…etc

Problems and Working hypotheses

SSZC is in a situation concern with two possibilities: poverty and insufficiency in purchasing power, even if agricultural potentialities and demographic characteristics are different. Developed Countries as well as international NGO often bring assistance in the form of food assistance or aid in development, but let us note that responsibility for the food security of the populations in the long term is the government. This one must take measures to bring solutions to encountered problems, to increase the agricultural productivity, which influences prospects for national food security (IIDD, 2001). Moreover, populations or households touched by food insecurity in this zone have more easily access to available food stock, it is necessary to increase their incomes to give them, means of acquiring need product. It acts normally as a function of economic growth and of the development. It is from this point of view that the exchanges can play a decisive part, even if the contribution which they can bring is not the same one in all countries.

Trade reforms, apart from their effects on the exchanges, can be translate by a strongest economic growth and best national share of resources, while allowing countries to better benefit of their comparative advantages (FAO, 1999). Thus, these part of the world can draw directly profit of the reforms, or profit indirectly, within the framework of the exchanges liberalization engaged in developed countries. However, these evolutions can be long and depend also of the situation of each country, i.e. of their capacity to benefit from the new possibilities offered by the opening of the markets and reduction of the less favoured activities. Effects of the growth created by the exchanges will depend on the allocation of profit, and in particular raise or decrease of the effective income of the population, which will allow more or less people to have access to foodstuffs and to acquire it in sufficient quantities.

In the model of food autonomy, on the other hand, the interior production is supplemented by imports, with the advantages and the risks related to international trade (FAO, 1996). This strategy involved improvement at the food security level and profits of efficiency including in the countries where agriculture continues to represent a significant share of the GDP. This is done by inducing a transfer of resources in production of “non food goods” of export and the importation of one part of the necessary foodstuffs. As the liberalization of world trade extended and covered a growing range of goods and services, the strategy of food autonomy became standard.

Work objectives:

This study enter in a global step which concentrates on the role that could play a more open trade system in food security in the sudanosahelian zone of North Cameroon. More precisely it’s targets the links between domestic trade policies and food security. The work endeavours in particular to determine how the continuation of liberalization of the domestic trade policies from the OECD countries would assign food security in a sample of regional scale in terms of availability, stability and total accesses in the medium term. The study use two frameworks of modelling to examine the incidence on food security of the 15 regions of North Cameroon, passage of a sectoral liberalization plain of the exchanges (in agriculture) with a more

exhaustive commercial reform in OECD countries, and to estimate the indicators of three dimensions of food security at the aggregate level.

By concentrating on this aspect of the problem of food security, it voluntarily leaves side of other causes. Factors such as the culture or the existence of a conflict, likely to play a part important in the problems of food security of the country, are not approached here, and cannot undoubtedly be influenced besides by a change of trades' policies.

MATERIAL AND METHODS

- Modelling Frameworks

The study use two frameworks of models to examine the incidence on food security of 15 regions of sudanosahelian zone of Cameroon (SSZC), the passage of a sectoral liberalization plain of exchanges (in agriculture) with a more exhaustive commercial reform in the OECD countries, and to estimate the indicators of three dimensions of food security at the aggregate level. In so far as each model have at the same time advantages and disadvantages for this type of analysis, the use of two models in parallel makes possible to obtain an more complete evaluation. The OECD model *Aglink*, which is based on structure of partial balance and contains detailed specifications of policies of the Member States, makes possible to determine how the changes of agro-commercial policies of OECD alone will affect the indicators of food security at the regional scale. With this aims, Cameroonian Ministry in charge of Industrial and Commercial Development (MICD) worked out detailed specifications of the markets of the agricultural products of Cameroon completed according to the MAM Model of the world food Model (*MAM*) of FAO, specifications which it introduced instead of the component of the cultures of the remaining world of the model *Aglink* in a perfectly interactive system. By this manner, we can follow the effects of the changes of the policies of OECD on the world markets and within the regions.

The study in addition use a second approach based on a general model of global balance, the model of the Project of analysis of the world trade (*Global Trade Analysis Project*, *GTAP*), which supplements the model of partial balance. The global model of global balance includes a representation of whole saving in all the countries and areas. In more of the agricultural products, this model makes possible to extend the analysis of commercial liberalization to agro alimentary industry, with the non-agricultural products and services, with interactions between these sectors via the intermediate products markets, with competition that the producers deliver themselves to use limited resources and to their contribution to household's income.

- Indicators:

Food security indicators

Food security covering many facets and dimensions, there is not single indicator which allows measuring it at regional scale. In the situations where the volume of foodstuffs available per capita is sufficient and provisioning relatively stable, the best means to evaluate the effects of the OECD policies change on food security of the SSZC consists in measuring resulting world prices variation and consumption of foodstuffs. Food consumption is expressed in calories per body and can be measured at the same time like variation of the use of food energy by a body and compared to the minimum quantity of calories necessary to a person carrying out a normal and healthy life to satisfy its food energy needs (deficit or surplus). However, it is not

realistic to hope to find or derive from information on effective food consumption of individuals. So we tries to describe whole indicators, in total terms, how continuation of the liberalization of the exchanges in the OECD countries risks to affect food security of (large) individual "similar" region or SSZC groups (i.e. showing characteristics similar in the field of food security and trade). Indicators used in the study were retained according to following criteria's: they bring explanations on three dimensions of food security - *availability*, *stability* and *accessibility;* they are regarded as robust; and they can be calculated using modelling. Proposed indicators include approximations effective individual data. Average consumption by body provides a useful measurement of *availability*, *stability* and *accessibility* dimensions of food security in each region. Although the average yearly consumption is regarded as the aggregate indicator of *availability* most useful, it does not inform us on the stability of the foodstuffs supply - on one or more years – taking into account a sudden change of an fundamental aspect of the situation of the SSZC (output of agricultures, rate of exchange, import price or earnings export for example). To take into account this aspect, it is necessary to use additional indicators centred on stock *stability*. These indicators include production, imports and the stocks, expressed in total volume, in percentage of the use or using an index of variability. Nevertheless, these measurements of physical quantities have also disadvantages, since they do not integrate directly some parameters which present interest as indicators of *access* to the foodstuffs on current market, such as or the import price market trends by report/ratio with the export earnings.

One advantages of the model of global balance is that it makes possible to measure the variation of the income or the GDP by anybody resulting of a reform of the agro-commercial policy or more complete reforms concerning other sectors. This makes possible to determine possibilities of setting work of a policy of food autonomy - in other words, possibilities for various region of SSZC of improving their situation with the glance of food security by transferring a part of their resources in non-agricultural export goods production and into important part of foodstuffs which they need to export their earnings.

Stability measurements of foodstuffs used in this study present limitations. These indicators do not seek to measure effects of the liberalization of the market according to the possible variability of prices or the production on a worldwide scale. In addition, even if the stock-consumption ratio is probably a good indicator of buffer effect exerted on the offer by stocks, self-sufficiency brought by the production is an ambiguous indicator

Although the average yearly consumption is regarded as aggregate indicator of most useful *availability*, it does not inform us about the stability of the food products supply - over one or more years – with regard to a sudden change of fundamental aspect of SSZC's economic situation (output of cultures, rate of exchange, import price or earnings export for example). To take into account this aspect, it is necessary to use additional indicators focused on stock *stability*. These indicators include production, imports and stocks, expressed in total volume, expressed as a percentage of the use or with assistance of an index of variability. Nevertheless, these measurements of physical quantities has also disadvantages, since they do not integrate directly some parameters which are of interest in much *access* indicators of the foodstuffs on the current market, such as or the import price market trends compared to export earnings.

Measurements of the stability of food products used in this study present some limitations. These indicators do not seek to measure the effects of liberalization of market according to the possible variability of the prices or the production on the world scale. Moreover, even if the stock-consumption ratio is probably a good indicator of buffer effect exerted on the offer by

stocks, the self-sufficiency brought by production is an ambiguous indicator. If variability of weather conditions makes national production important source of volatility, a higher rate of self-sufficiency must be associated with a greater volatility of the prices and domestic consumption. In other words, self-sufficiency can indicate the market up to point where internal country is isolated from the variations from the world market or the rates from change, but a negative shock affecting the internal production can in contrary have strong effects on self-sufficiency. Indicators used in this study do not take into account the fact that other mechanisms can limit or prevent transmission of volatility - world or national production - with consumption. It's in particular not taking into account the possibility of acquiring financial options or other instruments to compensate the price volatility of the market, rather than to preserve material stocks. With regard to the question of volatility, it is justified to expect a greater liberalization translates by a stressing or an attenuation of volatility on domestic market of a country, but there is not evidence about this until now. It can be say that elimination of mode prices imposition on domestic market increases the volatility of the internal prices and consumption, but this conclusion does not take into account the limits which can have such modes in event national shortages, nor the implicit tax who weighs on the consumers nor of the dysfunctions which accompany such policies. On the international markets, we can think that the reduction of obstacles would be translated by decrease volatility, because increased transmissions of prices suppose a stronger reaction in the field of supply and from one country to another. Moreover, reduction of interventions of government, often founded on others considerations of which the world prices, can attenuate uncertainty on world markets. On another side, any reduction of intervention of government can be accompanied by lower stocks, which can involve a rise of the volatility of the world prices, stocks varying in reverses proportion with world prices. In all implicated states, empirical elements lays out since the AACU implementation does not confirm any variation assumption, in any direction, of world prices thus of liberalization. However, authors of analyses carried out often note that it is difficult to separate AACU influencing effects from other factors on the world markets.

Aglink model was used within this framework to study the consequences of the shocks caused by shortages affecting the agricultural production of a SSZC economy or these from the OECD countries, by reproducing experiment under two different modes, i.e. with and without protection measures at the border. This work shows that such shocks can be absorbed on a national scale by international market in a situation of free trade. However, they underline also the complexity of the study of this problem on a worldwide scale. Indeed, it is necessary to determine at least which are the principal sources of volatility on the markets of various countries, by establishing their degree of volatility and perhaps their degree of correlation with other sources, so that the analysis is widened and allows estimating the effects of policy changes on the world markets.

Table 1: Measurements relevant for food security

Aglink (balance partial)	Produced quantities, consumed, exchanged and stored for a selection of goods Price of a selection of goods
GTAP (general balance)	Produced quantities, consumed and exchanged in all the sectors, with identification of bilateral exchanges Price in all them sectors, including the markets of factors

Index of competitiveness

An index of competitiveness was built with the aim of determining if primary products represent a big part of total exports of a SSZC region competed with or not production of other countries. In other words, the index is high when a big part of earnings export of SSZC comes from the sale of primary agricultural product, and in addition, these exports compete with production of developed countries. This index takes into account at the same time the importance of exports of a primary product given in the total earnings export of a given region and importance of this product for the whole developed countries by multiplying the share of the product *J* in exports of country *I* by the share of the developed countries in the world production:

$$C_I = \Sigma_J [X_I / X_I * Y_{J, cd.} / Y_{J, wrld}]$$

I=Country j = Raw agricultural product

C_I = index of competitiveness for one composite sector of the country

$X_{j,i}$= value of export of the product J in country I

X_I= value of total export in country I

$Y_{J, cd.}$ = production of product J in the developed countries

$Y_{J, wrld}$ = production product J in the world

This index was calculated for the raw agricultural products using quantitative information on the value of export and production (in tons) over 2003, drawn from MINDIC database. If a product represents a big part of exports of a SSZC region as well as the production of developed countries, then the couple product/country is judged competitive. Conversely, if a product represents a small fraction of exports of a SSZC or production of the whole developed countries, then the couple product/country is regarded as non competitive. In practical, the limiting value of the index was fixed at 0.19, which corresponds to the average value of the index of the whole LDCS (according to UN's classification). If the index is higher than 0.19, country (or group of country) is regarded as competitive compared to developed countries on the market of the primary agricultural products.

Index of potential self-sufficiency

This index was built to measure the possibility, for a region of SSZC, to satisfy its food needs entirely with the internal production. This index does not take into account the possibility for a given zone to attend food autonomy but makes possible to estimate the degree of food self-sufficiency of each region of the SSZC. With the obviousness, this ratio is useful to set up groups of SSZC on the basis of importance of their direct links with the world markets of primary products. In others terms, this measure does not fit in the context of the debates on the strategic approaches of food security, insofar as the objective is here to group the regions or countries according to the extent of the changes which can bring on domestic markets of the SSZC world market trends. The index "potential self-sufficiency" of a given region I is obtained while correcting internal production of clear exports:

$$S_I = 1 (X_I - M_I)/Y_I$$

M_I= imports of agricultural primary products in country (or region) I

X_I= exports of agricultural primary products in country I

Y_I= production of agricultural primary products in country I

This index was calculated for the primary agricultural products using quantitative information on exports, their imports and production (in tons) from 2003, drawn from MINDIC database. If the index is lower than -0.75, region are regarded as not potentially self-sufficing, although this level is arbitrarily selected.

It should be noted that this formula is identical to the ratio of self-sufficiency, definite like the report/ratio of domestic consumption on internal production (if one does not take into account stocks).

- Table 2 represents the 21 groups obtained according to this double classification (3 categories related to food security and 7 categories related to commercial characteristics). The OECD countries also appear so far in this classification as GTAP analyses take them into account.

Table 2: SSZC and NEM in the *Aglink* model

Status with regard to food security	**Trade status/regions**	**Regions of the group**
Regions in Food insecurity	not self-sufficient net importers,	*Mayo kani*, *Mayo Tsanaga*, Bostwana, Lesotho, Tajikistan, Yemen
	self-sufficient net importers,	*Mayo Danay, Diamare,* Albania, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Burkina Faso, Burundi, Central African Republic, Democratic republic of Congo, Republic of Congo, Cuba, Dominican Republic, Salvador, Ethiopia, Gambia, Georgia, Haiti, Liberia, Malawi, Mozambique, Peru, Rwanda, Senegal, Sierra, Leone, Sri Lanka, Togo, Zambia
	Primary product net importers	*Mayo Sava, Mayo Rey*, Ghana, Kenya, Pakistan, Papouasia-New-Guinea, Philippines
	Non concurrent nets exporters	Cambodia, Cameroon, Ivory coast, Chad, Guatemala, Guinea, Bissau-Guinea, Honduras, Laos, Madagascar, Mali, Mauritania, Namibia, Nepal, Nicaragua, Niger, Somalia, Sudan, Tanzania, Uganda, Viet Nam, Zimbabwe
	Concurrent nets exporters	Afghanistan, Bolivia, Mongolia, *Mbere,*
Regions in neutral Food security	not self-sufficient net importers,	Algeria, Cap Verde, Jordanian, Kuwait, Libya, Saudi Arabia, Trinidad, Tobago
	self-sufficient net importers	Egypt, Estonia, Fiji Islands, Gabon, Iran, Jamaica, Lebanon, Macedonia, Mauricio, Nigeria, Russia Federation, Uzbekistan, Venezuela, *Benoue, Vina*
	Net importers primary products	Bulgaria, Colombia, Guyana Kyrgyzstan, Leetonia, Malaysia, Maldivian, Swaziland, Tunisia
	Non concurrent net exporters	Belize, Costa Rica, Dominican Republic, Equator, Morocco, Myanmar, Panama, Suriname, *Logone et chari*
	Concurrent net exporters	South Africa, Brasilia, Chilli, Moldavian Republic, Paraguay, Syria, Thailand
	china	china
	Indonesia	Indonesia
Regions in Food security	All categories	Argentina, Belarus, Hong Kong, Israel, Kazakstan, Lituania, Roumania, Ukrainia, Vina, EAU

ONU	Less advanced countries	Afghanistan, Bissau Guinea, Ethiopia, Angola, Haiti, Gambia, Bangladesh, Kiribati, Guinea, Benin, Laos, Samoa, Bhutan, Lesotho, Sao Tome & Principe, Burkina Faso, Liberia, Sierra Leone, Burundi, Madagascar, Central African Republic, Salomon Islands, Cambodia, Tanzania, Chad, Malawi, Somalia, Togo, Mauritania, Cap Verde, Comoros, Mozambique, Tuvalu, Congo, Myanmar, Maldives, Sudan, Uganda, Djibouti, Nepal, Vanuatu, Equatorial Guinea, Niger, Yemen, Eritrea, Rwanda, Zambia.
	agricultural products net importers developing countries	Barbade, Botswana, Cuba, Ivory Coast, Dominican Republic, Egypt, Honduras, Jamaica, Kenya, Mauritius, Pakistan, Peru, Ste Lucia, Senegal, Sri Lanka, Trinidad and Tunisia, Venezuela

Note: This classification is adapted of Diaz-Bonilla and Meijl and Tongeren, but clear trading position on the market of processed products is not used because the model *Aglink* do not make strict distinction between primary and processed products.

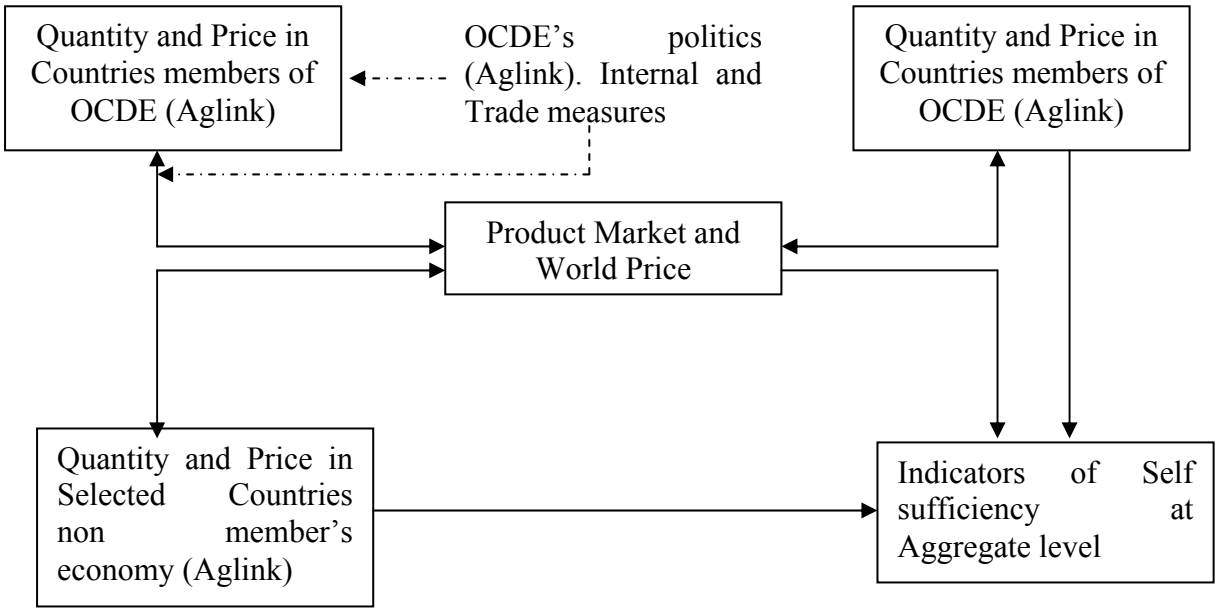
- Application of the system within empirical framework: *Aglink* model

Aglink is a model of partial balance managed by the Secretariat and correspondents of some number of OECD member states. It rests on the assumption that a perfect competition and strong substitutability between types of use and between various crops products or animal offers at the aggregate level constitute useful simplifications for study of some agricultural products on the world markets. *Aglink* is a model of partial balance used to generate annual projections in the medium term markets of agricultural products, in order to highlight the role of policies and to analyze how various policies of substitution can influence these results. Balance is partial: *Aglink* examine only some agricultural products markets, considering that the results obtained are not affected by the interactions with other market/sectors not represented in model, or that these possible effects are taken into account in the equations of supply and the model. Being based on the assumption of the maintenance of announced policies and of some macroeconomic environment, *Aglink* establishes medium-term projections of the produced and consumed quantities, stocks, exchanges and prices contract. The model concentrates on the OECD countries and agricultural products of moderate zone affected by policies of these countries.

Products represented in the model are: corn, rice, grains coarse, oilseeds, oilcakes, vegetable oil, beef and veal, pig meat, poultry, milk, butter, cheese, skimmed milk powder (SMP) and unskimmed milk powder. Sheep meat, whey casein and powder are also represented in *Aglink* but are not specifically covered by analysis described in this report/ratio.
In majority cases, *Aglink* give estimates contract prices and quantities produced, consumed, stored and exchanged. Contract prices are generally measured in terms of price with production or of wholesale price. Generally, production is expressed under the shape of the surface components and output in the case of agricultural products and of breeding stocks, and in terms of production per multiplied animal by the number of heads in the case of some

livestock products (example, beef and veal and dairy products). Consumption includes human consumption and, if necessary, animal feeds.
The representation of policies in *Aglink* wants to be complete in regards to the devices which affect more exchanges and vary according to details of each device. Policies represented in the model vary according to countries, as it is the case in reality. Distinction between smallest price and highest price of the east market of course maintained, just like the characteristics which make these instruments to not operate on levels completely identical to indicated targets. Secretariat and correspondents Member States endeavour to reconcile two often contradictory objectives: to represent the policies with the maximum details now a reasonable number of equations, being able to be managed by reduced team. Also model concentrates on OECD policies supposed to have the greatest incidence on above-mentioned products markets.
Lastly, *Aglink* product the results which must be compared with a scenario of reference over a period of six years projection approximately (medium-term horizon). In the annual exercise of agricultural outlines, the model is used to project the market trends on one period of about six years as from the current year. Results of scenarios are generally expressed in terms of variation expressed as a percentage by report/ratio with the scenario outlines reference. In other words, their scenarios consist in modifying an unspecified exogenic assumption by report/ratio with initial projections of prospects - lowering for the limits subsidized exports or access to the improved market for example. Results of the model are then compared with the results of prospects, which allows highlighting the influence of the new assumption on world markets for the period of projection. This process allows examining the effects of the policies in a prospective context and those results depend partly on the initial levels of reference of the endogenous and exogenic variables.

Fig 2 : Representation of the world markets using *Aglink* and of relations drawn from *MAM*



- When this general classification is applied for a given model, it is necessary to take into account some practical constraints and to bring adjustments to the general system. It is thus possible that the regional aggregates model be gathered in only one category of situation in

comparison with food security and exchanges. Moreover, dimensions of the classification of exchanges do not present inevitably a whole an interest for the interpretation of results of the various models. In this situation, it is not always useful to present all groups of regions separately when indicators are related to trade situation and on food security obtained using model and when this do not varies appreciably from a group of country or regions to another. In *Aglink* model no distinction is established between primary agricultural product and processed products, so that this element of commercial dimension is not taken into account. Thus, the use of the framework in the case of *Aglink* allows the identification of fifty groups of SSZC and other countries. The OECD members are not the principal object of present food security study, so that there were no indicators related to them. In addition, it is also possible to identify the traditional categories LDC and PDNIPA, in more of the most described suitable high groups. All these groups are represented in Table 2.

- *Aglink* model does not allow representing all SSZC. Even after having added several regions of SSZC to the model, there is not a co-operation with FAO, we could not include some countries and regions in analysis. The LDCS and PDNIPA which are not represented are: Barbados, Comoros, Djibouti, Erythrea, Kiribati, St Lucia, Solomon Islands, Samoa, Sao tome-and-Principe, Tuvalu and Vanuatu.

- Application of the system within an empirical framework: model *GTAP*

In the case of *GTAP* analysis, the classification of countries and regions is slightly different but establishes a distinction between primary products and processed products and does not preserve distinction on the basis of competitiveness/non-competitiveness on the market of primary products. Moreover, regions and countries in food security situation and OECD countries are treated separately on trade dimension - choice which is justified by the object of the study, focused on the regions in situation of food insecurity - which facilitates the use of this model. In addition, although it also acts of a world model, the number of regions of SSZC represented in the model (pre version 5.3) is lower comparing to theses trade analyses of *Aglink*. However, whole representative country was defined for each aggregate of country or regions for present study. Table 3 presents the classification of the countries and *GTAP* areas and gives a list of initials and definitions corresponding to different groups. On the basis of this mode of classification, we can distinguished 14 areas for the analysis from the liberalization of the exchanges: 7 groups of countries and regions in food insecurity situation and neutral food situation, differentiated according to their characteristics on plan of the exchanges, plus India and China, and five groups of countries/regions in food security situation and the OECD countries. (These last five groups, not entering within the framework of this study, are identified by the structure of the data *GTAP* base and not by theirs trade characteristics). Denominations used are valid only for the results of the analysis *GTAP*.

- It was necessary to carry out some adjustments for the countries groups used of in GTAP model. Firstly, Argentina and Uruguay were added to the group of exporters of primary foodstuffs and transformed into neutral food situation (NEUAGREXP). Secondly, Mexico was placed in the group of the Agreement of North-American (ALENA) free trade and Korea in the remainder of OECD (ROCDE), given that they are Members of OECD and that the study is focused on the SSZC economies. Thirdly, countries of the European Free Trade Association (EFTA) were also placed in the group of other OECD countries (ROCDE). The Czech Republic and the Slovak Republic, on their side, are link to the group of countries in neutral food situation importing agricultural products (NEUAGRIMP) because they cannot be dissociated from the group PECO in the model *GTAP*. It is possible that other countries, being integrated into a regional group, are not identifiable inside group which relates to them.

However, these adjustments are brought only to facilitate GTAP analysis and to maintain the stress laid on SSZC's food security. They should not have important effects on the results or general conclusions; all precautions were taken to avoid any transfer in direction or starting from the groups of country in situation of food insecurity, which constitutes the principal object of present study.

Table 3: Aggregates of country in model GTAP: Regions/countries in food insecurity situation or neutral food security situation classify according to their position regarding trade exchanges

Position regarding exchanges	**Food insecurity**	**Neutral Food security situation**
Net positive exportation for Processed agricultural Product	Central America, India, Viet Nam, Zimbabwe, *Mayo Tsanaga, Mayo kani* INSAGREXP	Argentina, Brasilia, Chilli, Colombia, Morocco, Thailand, Remaining UDAA, Uruguay, Remaining South America, Remaining Andin Pact, NEUAGREXP, Mbere
Net positive exportation for agricultural Product and negative for Processed agricultural Product	Tanzania, Uganda, *Benoue,* Remaining sub-Saharan Africa, INSPRIEXP	
Net negative exportation for agricultural Product and positive for Processed agricultural Product	Other countries from southern Africa, INSPROEXP	China, Indonesia, Diamaré, Malaisia, NEUPROEXP
Net negative exportations for agricultural product and Processed agricultural Product, for self-sufficient.	Bangladesh, Malawi, *Mayo Sava, Logone et chari,* Mozambique, Peru, Philippines, Sri Lanka, Zambia, Remaining world, Remaining South Asia INSAGRIMP, Bostwana	Venezuela, Ex URSS, Remaining PECA, *Vina,* Remaining Midle Ouest and North Africa, NEUAGRIMP
Net negative exportations for agricultural product for self-sufficient.		

Countries in Food security situation and Member of the OCDE	
Name of the group	**Regions or GTAP group**
AUSNZL	Australia, New Zealand
ALENA	Canada, USA, Mexico
EU	Member of European Union
ROCDE	Hongry, Japan, Korea, Pologne, Swizerland, Turkish, Remaining AELE and SSZC
AUT	Chinese Taipeh, Hong Kong, China, Singapour

Note: This Classification is adapted from Diaz-Bonilla et al., and Meijl and Tongeren, but concurrent/non concurrent aspect is not use in a context of GTAP analysis. In other hand, north Cameroon's regions in food insecurity situation or in neutral food security situation identify by Diaz-Bonilla and al., are distinguish in trade dimension of Meijl and Tongeren, while North Cameroon regions in Food insecurity situation are aggregated according to the structure of introduce MINDIC database (without reference to exchange characteristics)

Global Trade Analysis Project (*GTAP*) is a model of general balance which accounts for the effects of a broad range reforms of the policies on the whole economy of the countries, and which gives thus a more general sight of the bonds linking the marketing policies of OECD and the food security. This study uses the data base *GTAP* (version 5.3) and the model *GTAP* (version 5.0). The data base covers 66 countries and areas and 57 sectors. It acts of pre-version 5.3, but the differences with the public final version are limited. To facilitate the analysis, it was decided to amalgamate some sectors and to gather the regions sharing the same characteristics in comparison with food security and of the trade situation. The model is designed to represent the medium-term results of an external shock, but not their dynamic responses or long-term.

GTAP is a model of general balance. That means that the final solution of modelling integrates all sectors and all of their economic agents. In other words, all the markets are balanced, consumers maximize their utility on all the line of goods and their producers maximize their benefit on all the range of goods produced and bought inputs. The standard model is based on several important assumptions: competition is perfect, the resources (including labour) are entirely used and the completely mobile resources (except for the grounds), the outputs of scale are constant and, when it is possible, the products or even the sectors are aggregate.

Limits of the executives of modelling

- The classification of the regions described here presents some difficulties of application. Most important is perhaps divergence between the lists of products. Classifications are based on one broader definition of the foodstuffs, which includes fish products, whereas they are not taken into account in this report/ratio. In partial balance analysis, this component of the provisioning of foodstuffs remains constant (in terms of calories per body), while, in the global balance analysis, fishery products are classified in extraction sectors rather than in agro alimentary industry (although production of fisheries sector can be useful as input in the agro alimentary sector, when it enters manufacture of processed products). Thus, insofar as food products or exchanges associated with the fisheries sector are sufficiently important to modify the situation of a country, definite on the basis of exchanges of agricultural product only, in classification, results of this country can be different from those of the group to which it belongs. It was however inevitable to be based on classifications existing, in the absence of substantial revision of former studies which would have allowed to eliminate fishery products. In addition, analysis realized in remaining study does not approach fishing policies in the same way as the agricultural policies, on which are focused this study. Lastly, as the results presented show to follow section, effects of the scenarios examined in this study according to various classifications of the countries and SSZC's regions do not vary sufficiently.

RESULTS AND DISCUSSION

RESULTS OF PARTIAL BALANCE MODEL (Aglink)

- Indicators produced by *Aglink*

Aglink model, extended to the SSZC using *MAM*, allows obtaining several indicators of food security in SSZC regions. None of the indicators used here is perfect because there is not single and final measurement of food security. Moreover, the study concentrates on the aggregate indicators and not on the indicators on an individual scale: however, the situations of food insecurity can exist independently of the level of national indicators. The indicators

quoted hereafter account for characteristics which are relevant for given questions in this study and which is compatible with the empirical tool used in this section.
The indicator of *availability* is the average consumption of calories per anybody and day. Number of calories provided by the products not represented in *Aglink* is addition of the whole calories provided by products represented in model. Consumption of these other categories of calories per body and per day is supposed to be constant over all the period of projection. Even if it's useful to take into account the relative contribution of these other products not represented in *Aglink*, and that can distort somewhat tendencies and results of policies analysis. Tendencies can largely influence results of reference scenario; results of the policies analysis depend on the degree to which variations of the prices of the products *Aglink* modify consumption of crop products and the degree to which OECD policy act directly on markets of products not on *Aglink*. However, it's possible that some of these products even occupy less dominating place (negligible) in the exchanges and the marketing policies of the OECD countries.
Effects of a change of policy on food accessibility is measured by change of the world price of the cereals to which is confronted a group of country. Prices of cereals *Aglink* (corn, rice and grains coarse) are balanced according to the share of each product in total consumption of calories, which makes possible to build an index representing price with consumption. However, we can doubt that prices of the consumer accurately reflect the variation of the world prices in the SSZC, the degree of transmission of prices being generally weak in *MAM*. Provided that a change of the world prices involves a change of the prices and the consumer, this indicator makes possible to measure effect of a reform of policies on the accessibility of food. On another side, the world price of cereals should reflect the cost of the access to imported cereals at the world levels - in brief the cost increase in commercial imports of foodstuffs. (Knowing that import prices variations only measure an aspect of purchasing power, analysis *GTAP* complete one by the incomes variations, in particular receipts with export, induced by the policies reform.)
Two indicators are used to measure stock *stability* of foodstuffs: ratio of self-sufficiency and stock-consumption ratio. The first ratio is obtained by the division of products production *Aglink* expressed in calories per body and by day by the consumption of *Aglink* products also expressed in calories per body and day. This measurement is related to the measurement of self-sufficiency used for the classification of the countries (see the preceding section), while stressing the products *Aglink*. It allows determining consumption up to which point is protected from shocks occurring on the level of the exchanges (lowers foreign production, variations of the rates of exchange or variations of the world prices for example). On another side, as we said in the introduction, a high level of food self-sufficiency consumption makes more sensitive to variability of internal production. The second indicator of stability used is the report/ratio of the cereal stock on the cereal consumption (both expressed in calories), in which stocks and of SSZC production depend on the prices provided by *MAM*. It probably acts as better indicator of stability, because a country can attenuate the shocks of all types by taking goods on its stocks.
- to apply *Aglink* for this study, it was necessary to extend the representation, up to the limited point, given to SSZC regions. FAO uses a model of partial balance called world food Model (*MAM*), which contains clarify markets representation of basic commodities of many SSZC. It gives them thus information necessary on the way in which the production, stocks consumption, and exchanges of agricultural products in the SSZC react to variations of world prices. From these relations, drawn from a reference scenario realized by FAO in March 2001, the models from approximately 125 countries were built and added to *Aglink*. Relations drawn from *MAM* replace the description of the products markets- relatively surface for the majority of the SSZC - which appeared in the initial *Aglink* model. Figure 2 gives an example of the

complete structure of the model (for the markets agricultural products). It is not easy to coordinate results of these two models insofar as definitions of products and markets are not identical. The complete model establishes projections of the markets of corn, rice, secondary cereals, oilcakes, vegetable oil, bovine meat, pig meat, poultry, sheep meat, milk and of butter in the SSZC and, in addition, described variations volumes in function of the trend of world prices.

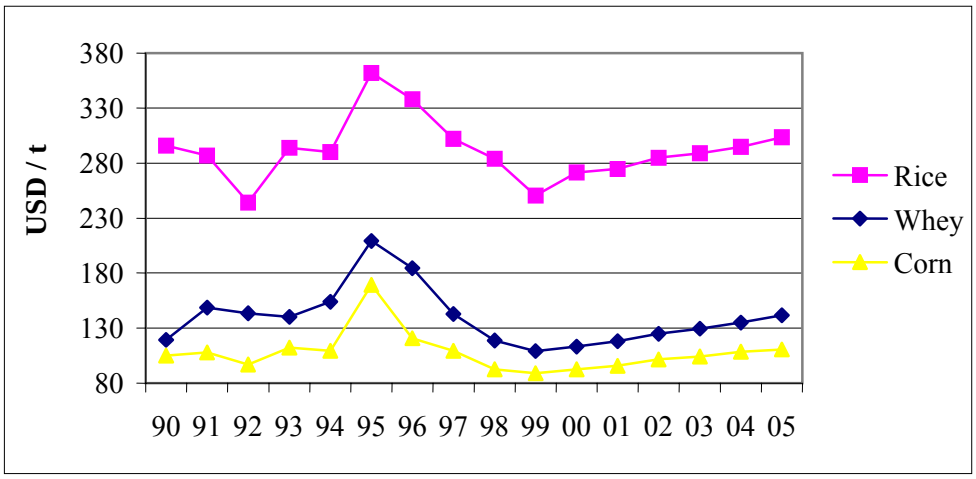
- Final quantities projected by the model are then aggregate on the basis of their equivalent calorie. Indeed, with the place to simply add quantities or expenditure corresponding to various products, we can applied the conversion rates of FAO for transforming quantities into calories, number of calories per body and by day being regarded as the base of aggregation the most adapted in context of food security. Conversion rates used are averages by product and country of 2002 and 2003. These equivalents calories can then be used to build indicators of food security.

The reference scenario

- Suggested solution initially by *Aglink*, before any scenario of reform of the policies is not carried out, is important for three reasons. Firstly, this scenario of reference provides whole projections accepted in the medium term of the market trends and informs us about the consequences for the existing markets policies. For example, projection of the quantities of calories consumed per body and per day, starting from the *Aglink* products, can give indication of the prospects for food availability in medium term in SSZC. Secondly, results of the *Aglink* analysis are measured by report/ratio with this reference scenario, in order to highlight effects of one unspecified change of the scenario. Insofar as all other external factors are maintained on the same level in the scenario of reference and policies reform scenarios, any variation compared to the reference scenario can be charged to the assumptions underlying the reform scenario. Thirdly, the results of analyses can vary according to assumptions of the scenario of reference, because of the existence of asymmetrical answers with various market situations.

- The reference scenario used in this study has been made up starting from edition 2000 of *Agricultural prospects OECD* (*Outlines* here after) and of whole projections drawn from *MAM* FAO and going back to March 2001. Reason which justified the use of 2000 *Outlines* is that this projection unit was used as reference to former analysis work of futurology of the policies carried out by the Secretariat within the framework of program of work on trade questions. It thus possible to direct the choice of reforms to be modelled in a manner such as it is possible to establish comparisons with former work. At the moment when this study started, projections of March 2001 of FAO were the only additional data which lay out to derive the effects of the world prices on the individual SSZC regions. Even if personnel of FAO cooperated closely with the Secretariat of OECD to generate these data, force is to recognize that the volume of necessary additional data was considerably higher than the usual production of the model. The results of the two sets of projections were amalgamated to produce a new series of projections.

Fig 3 : Nominal world prices of cereals in the scenario of reference *Aglink*



- Modified reference scenario used in this study is not sufficiently different from the scenario of *Outlines* reference to justify a long description. We can nevertheless refer to fig 3 to observe trend of cereals world price for the projection period.

- Principal difference of the new scenario of reference compared to the initial scenario is the addition of the aggregate indicators of food security, like the consumption of calories per body and per day in the SSZC, calculated starting from *Outlines* data supplemented by the representation of the SSZC drawn from *MAM* and MINDIC database. Data of scenario show evolution of calories number and contribution of each product with overall consumption of calories per body in each region of SSZC. The averages for 2000-2005 appear in fig 4. The graph present two different categories of aggregates for the SSZC: aggregates used in the context of *GTAP* analysis and aggregates of UNO - the least advanced countries (LDC) and importing developing countries Nets foodstuffs (PDNIPA).

- Categories of SSZC established, projections relating to the PDNIPA and the LDCS indicate that two thirds approximately consumed calories come from modelled products of agriculture in *Aglink;* 30 % of the total calories come from corn in the case of the PDNIPA. In the LDCS, the most important products are coarse rice and grains, whose shares are assembled respectively to 31 % and 20 %, whereas corn and sorghum only represents 9 % of average consumption. For these two groups of country, meats and dairy products included in *Aglink* are relatively little important, since they bring less than 10 % of total calories. If we uses other classification, near the one used in the *GTAP* analysis, the results are more complex but relatively similar: two thirds products of *Aglink* represent approximately consumption of calories, rice and corn occupying a broad place in daily food.

- scenario of medium-term reference does not envisage notable improvement of daily average consumption per body calories drawn from these products. In fact, any of three measurements - *availability, accessibility* and *stability* - improve appreciably on the assumption of *status quo* scenario of reference - characterized by a continuation of the policies applied or announced, a regular economic growth, application of the tendencies of the productivity to long term and of the normal climatic conditions. With regard to availability of foodstuffs, consumption of calories per body drawn from products of agriculture is stable for the majority of the groups, growth from the overall consumption being accompanied by population growth. Two extremes are not very distant: in the case of nets exporting countries of competing products in food insecurity situation, the average consumption of calories drops by 2 %, whereas average

consumption of the SSZC in food security situation increases by 2 %. Average consumption of calories per body drawn from livestock products progresses slightly, but these food products represents relatively weak share of the total food. As no projection is available for not included products in the *Aglink* and *MAM* models, like the roots and tubers or fishery products, this quantity is regarded as constant in the reference scenario (in other words, quantity of calories drawn from other sources consumed per body and per day remains stable between 2000 and 2005). Consequently, it is impossible to draw solid conclusions on food products *availability* starting from the overall consumption of calories, but to judge some by availability of *Aglink* products only, there is no reason to think, in the scenario of reference, that the situation will develop appreciably.

- Since the intern prices are correlated with world prices (which is not always the case when mechanisms of transmission of the prices are not very operative), an increase in the cost of cereals imply, for the regions with low income, an increasing difficulty *to reach* the need food resources, at the same time near interior sources by the means of exchanges. In nominal terms, world rice price increases by 12 % between 2000 and 2005, that of secondary cereals by 19 % and corn by 25 %. To measure *access* of each group of SSZC, we incorporated world prices of corn, rice and coarse grains by balancing them according to their share in calories consumption by various groups. This index reveals that on the assumption continuation of the existing policies, regions in food security situation, 22 % of imported cereals per unit will pay. The price means of cereals to the importation increases in less proportions for other groups of SSZC and other non members economies, but never less than the price of the corn which gains 12 %. The average price of cereals increases by 12 % for the LDCS and of 18 % for the PDNIPA. Projections thus state that these regions will be handicapped in the medium term: insofar as they must buy their necessary foodstuffs to world prices or under the influence of more raised world prices, their access conditions will degrade. However, we can not draw firm conclusion on the access to foodstuffs without projecting evolution of incomes, in particular in the poorest region of SSZC.

- With regard to *stability* of the foodstuffs supply, the reference scenario does not give clear indication. Projections, which are based on climatic conditions and normal productivity, do not take into account any significant change of the ratio stock-consumption compared to the recent period, but rather of a gradual decline. Countries in food insecurity situation show only one light reduction in their ratio stock-consumption. Stocks pass from 9 to 19 % of consumption in 2000 to 8 to 18 % in 2005. The countries in neutral food situation record a stronger fall of this ratio (from 5 to 15 %), but start from more raised levels: of 24 % with step less than 48 % in 2000. On another side, projections do not reveal significant decline of relative importance of the interior production and the imports for SSZC; the ratios of self-sufficiency move overall very little, even if some slow progress over the period is noticed. Under the rising effect of price, the interior production should increase compared to domestic consumption, ensuring a more important protection counters than external shocks or on the level of the exchange rates. The only exception relates to countries in food insecurity situation which are nets exporters of competing products. For this group, the ratio of self-sufficiency in *Aglink* products decrease from 118 % in 2000 to 105 % in 2005. In addition to this particular case, reinforcement of self-sufficiency implies that shocks on the world price level or of the exchange rates should slightly less affect consumption at the end of the projection period, increase in interior production exerting buffer effect counters this source of instability. However, in the scenario of reference, SSZC continue to be exposed to the shocks affecting the interior production, this one representing a part slightly more significant of the domestic consumption at the beginning of the reference period.

- three reasons explain why indicators of food security of SSZC move little in the scenario of reference: significant part of the products consumption not represented in *Aglink*, a transmission of the relatively weak price and the moderate response of the markets SSZC with regard to the increasing of world prices. Products represented in *Aglink* - who were selected because of their relative importance for the OECD agricultural policies - on average two thirds represent approximately the calories consumption of SSZC. So even if variation of world prices affects consumption of *Aglink* products, third of calories consumption and food production associated in the SSZC is not directly affected.

- two other factors - weak transmission prices and modest response of the SSZC markets - are reflected the little effect produced by changes of the world prices on the produced and consumed quantities in the SSZC. In function of drawn answer from *MAM* FAO, the coefficient of the combined effects of the transmission of the prices and prices elasticity of supply and appear weak. The transmission of price coefficient resource of the world markets towards the markets of the SSZC is lower or equal to 0.5, and average elasticity of supply and are lower than 0.4, in absolute value. The product of these two parameters gives a total weak effect. In the case of corn, only half of the variation of the world price is transmitted to the national agents and elasticity are about 0.4 (in absolute value); that means that following change of 1 % of the world price of corn, change of the production or of corn consumption in the SSZC should represent on average less +/- 0.2 %. Thus, even when the world prices increase appreciably in the reference scenario of the consumed and produced quantities react moderately.

- projections of scenario of reference are useful for the direction where they have an informative value and where they provide one mark bench for the later scenarios. On the basis of measuring foodstuffs *availability*, *the access* to these food products and stock *stability*, indicators, projections make appearing very little changes in the food security level of SSZC. These conclusions depend on the general situation of the market depicted in the reference scenario, namely a rise situation of world price due to a favourable macroeconomic environment, which involves acceleration of growth demand compared to the price growth. The rise of the prices tends to slow down the growth of consumption and to inflect stocks, but it encourages interior production in addition if this one answers the signals emitted by the world prices. Consequences of the rise of the world prices for food security indicators used are clear and do not result from changes from agricultural OECD policies other than the announced changes or already applied, and when these policies affect food security, it is by the means of their incidence on the world prices.

- average consumption of calories per body is the indicator selected to illustrate *availability* of food products in each group of SSZC. We noticed that average effects of the reduction of the export subsidies on the prices and consumption are extremely reduced. Variation of average consumption never exceeds 0.5 %. They are importers of primary products in food insecurity situation which show more important variation, -0.3 %. In the same way, the average consumption of calories of primary nets products importers in neutral food situation drops of -0.2 %; it's the case of *Benoué region*. It is possible that in the case of these regions, the effects of the prices transmission and elasticity-price were slightly more important, but results are also ascribable with the relatively high share of *Aglink* products in the overall consumption (approximately 81 % in *Benoué region*). However, in general, the weak variation of the price of cereals involves a variation still weaker of the consumption of the SSZC, with the reduced prices transmission and to little elasticity of the domestic demand. Knowing that the cereals are determining for food security, we can conclude that total consumption (which is measured here) is relatively unchanged and that availability of foodstuffs is not modified. Effects are

more notable in the regions which depend on the world markets for a substantial share of their consumption and for their commercial exports. Nevertheless, drop of consumption remains relatively modest.

- in the same manner, effects on *access* to the foodstuffs are slightly negative. Admittedly, the mean level of price of cereals increases (up to 1.2 % of rise whenever rice do not play a major part in comparison with corn and coarse grains supply), but effects are tiny. Regions in food security situation, which will know a rise in the price of cereals of this width, should not see their access to food products food threatened; on the other hand, same increase expressed as a percentage in the regions in food insecurity situation nets importers which are and non self-sufficing, and increase of 1.0 % recorded by the regions in food insecurity situation which is nets competing primary products exporters, announce a risk for the access of the regions by more poor with the foodstuffs, even a degradation of their access conditions is noticed. However, in the scenario of subsidies reduction, the most important rises prices are recorded on some markets of animal products, but in the scenario of reference, export subsidies represent more significant part of the exchanges on the world markets of these products. If we exclude the case of the regions which export these products - and in which the rise in the price of the livestock products could induce one reorientation of the use of cereals of human consumption towards animal feeds - the meat and the dairy products have minor importance for the food security of the majority of the countries. In revenge, weak variation of the price of the products of agriculture presents more interest.

- consequences of the reduction of the subsidies for *stability* provisioning are mitigated. The ratio cereal stock-consumption moves little. For its part, the ratio by self-sufficiency increases slightly in the majority of the countries or groups of country. The rise of the world prices induced by the fall of the subsidies with export in the OECD countries encourages the SSZC to produce themselves agricultural food products and dissuades them to consume. So the ratio production-consumption increases. Nevertheless, these indicators give only one approximate idea of the capacity of these regions of the SSZC to resist shocks such as one sudden variation of the import prices and, in the case of the ratio stock-consumption, of the shocks affecting the interior production. No matter what it in is, the total effects on stability are mitigated but relatively weak.

- this study does not examine all aspects of the access to the market. For example, it does not presuppose any change in system of allowance of the import quotas. Preferential agreements are not integrated into *Aglink*. So it is not possible to estimate the extent of the losses or the profits which the regions would record recipients of a preferential access in the possibility of generalized reduction of the customs duties and of an extension of the quotas. However, even if this study is provisional and it does not cover all the aspects of the access to the market, the results makes possible to have an idea of the effects of such measurement on a specific whole markets of world products. Moreover, results obtained with the model of general balance - which do not present some of these defects at the direction where it models the bilateral exchanges and where the list of products is more complete there - seem to agree with those of the model of partial balance commented on here.

- regarding the incidence of variations of the world prices on the food security indicators selected as previously describe, food products *availability* is measured by average consumption; variation of balanced average price of cereals gives an idea of the effects of the scenario on foodstuffs *accessibility* to the consumers who discharge them at dependent prices at the world prices; finally, the ratio of self-sufficiency and the ratio stock-use give an

indication on stocks *stability*, with regard to external shocks in the first case and with more general shocks in the second.

- variation of the average consumption of calories resulting from the variation of the world prices is not important in any of groups of SSZC, which means that the reform has little impact on foodstuffs *availability*. The most significant variation of average consumption of calories per body is of -0.1 %.

- in the same way, effects on *access* to the food products are moderate. Weak variation of the world prices indicated involves a weak variation of the average price of cereals. Thus, even the countries or region which are strongly tributary of the imports and of which the interns price vary directly according to the world prices are not ordinately affected by the policy of OECD opening markets examined in it scenario. Liberalization, if as well raises the prices to consumption, should have an unfavourable effect on the accessibility of foodstuffs. However, taking into account the weak variation of the world prices and of their reduced transmission on the markets of the SSZC, this aspect of food security has few chances to be strongly affected.

- about stock *stability*, the widening of the access to the markets of OECD has very little effects on indicators. In fact, in the case of self-sufficiency indicator, the food level of security improves slightly, it increase the price involving a rise of the interior production by report/ratio with the domestic consumption, in light retreat. As a whole, those effects of the scenario on stability are mitigated but no in substantial case.

RESULTS OF GLOBAL BALANCE (GTAP) MODEL

Indicators produce by GTAP

GTAP can produce several food security indicators applicable to SSZC, condition from which criteria of aggregation of the sectors are clearly defined and regrouping regions. None indicators used here is perfect because a single and final measurement does not exist for food security. This study concentrates on all indicators and not on individual scale indicators: however, there are some situations where food insecurity can exist dependently of the level of national indicators. Indicators quoted here after taken into account the characteristics which are relevant for the questions tackled in this study and are compatible with the empirical tool used in this section.

Indicator of foodstuffs availability is average consumption by body of primary and processed products. This indicator measures the quantity of foodstuffs being able to be consumed. Products are incorporated by category of expenditure**.** Variation of the consumption of foodstuffs (indicator of *availability*) following a new reduction of support for agriculture and commercial measurements in OECD under the AACU is in general slightly lower for the SSZC. Exceptions are *Mayo banyo* and regions in food insecurity situation which are nets exporters of primary agricultural product (importing or not of transformed products). Countries or regions in food insecurity situation which are nets exporters of processed foodstuffs but importing primary foodstuffs record the strongest decrease of average food consumption (-0.3 %). In addition, average consumption drops in all countries or groups in neutral food security situation. In the variation unit, relatively modest consumption is to be put with into account of the weak change of the world prices and absence of reforms in the SSZC themselves.

Foodstuffs accessibility is measured by the purchasing power of no qualified labour. This indicator is calculated for the income of the factors resulting from no qualified labour. This choice is justified by the fact that relatively poor segments from the population incomes draw mainly activated relatively little qualified and possession of small pieces of ground. Evolution of the income factor not qualified by ratio with the trend of the price of the foodstuffs thus gives a first indication of the food purchasing power of the poor categories of population. According to the theory integrated into the model, the income factor increase for factors of production which are used in relatively intensive way in the growth sectors. If we assume that no qualified labour is used in relatively intensive manner in agriculture, industry of manufacture and some services and that these sectors will develop following liberalization of the exchanges, it could follow an increase of it in wages of no qualified labour. However, purchasing power and income from food can be improved only if internal price of the foodstuffs increases less quickly than the remuneration factors. Moreover, even if this indicator provides an approximation of the capacity of average purchase of the poorest consumers, it is necessary to keep in mind that the model presupposes a full use of the factors. Data provided by GTAP include world prices of the foodstuffs, which give an idea of *accessibility* of these food products. It is possible more precisely to target this measurement on consumers of which the access to food would be threatened by a rise of world prices, by comparing the trend of the prices of the foodstuffs with that of the income of non qualified labour. Incomes of the factors coming from this resource (wages of little qualified labour) are indicated in Table 10, at the same time in absolute terms and relative terms (compared to the price of the foodstuffs). The renewal of the AACU on the basis of initial reduction ratio involves a rise of wages of the less qualified workers in the SSZC, in particular those which export processed products. However, since rising of prices is taken into account the foodstuffs, we sees that the increase in incomes is counterbalanced by increase of the costs of foodstuffs. The net effect of the reform of agricultural policies of OECD should be summarized with a light reduction in food purchasing power of the poor consumers in many SSZC. Countries in food insecurity situation which export transformed products and import primary products are those which show stronger decrease purchasing power to them, even if it is also those which know the strongest progression of the income of the factors. In their case, the prices of the primary products are stimulated at the same time by the raising of world prices and by the increase in the request for intermediate products (necessary to the production of a greater number of processed products) on the domestic market.

Stock stability

Stock *stability* is measured - in a very approximate way - by the ratio of self-sufficiency. (Results indicate variation expressed as a percentage value of the ratios, but not absolute variation of values.) In general, SSZC's production increases compared to their consumption - which is a logical response to the rise of the world prices. That means that the stability of the SSZC's food provisioning could only improve, are taken into account shocks finding their origin outside the region. On the other hand, increased dependence of regions with respect to the interior production will not at all contribute to protect them provisioning against shocks affecting the internal production. The ratio of self-sufficiency gives an idea of stock *stability*. This ratio is defined like the ratio of the production of primary or transformed food products on consumption. Once again, products are aggregated according to their value, even if some food products have more significant part than others in terms of calories. Apart from existing differences in units and products taken into account, measurement is in relation with the ratio of self-sufficiency applied in the classification of regions. An important point may be described concerning self-sufficiency like stability indicator: a strong dependence with respect to the internal production can makes harm the stability of stocks since this source of foodstuffs is very unstable. Here still, the ratio stock-consumption provides the best indication

of the degree of insulation of the markets against shocks of all natures. However, when there are no stocks, self-sufficiency gives all the same a small idea of against protection from which the market shocks profits at the level of the world markets or the rates of exchange. Change expressed as a percentage ratio of self-sufficiency caused by the scenarios of reform will be thus used as indicator of stability, even if it is ambiguous.

Sectoral aggregation

Sectoral aggregation is a major element of this study. In this study focused on agricultural products, the distinction between primary products and processed products is reflected in the choice of the sectoral aggregates. Aggregates which include cereals, correspond to *primary* agricultural products and aggregates with *transformed* agricultural products. For manufacturing industry, the sectors are gathered in two categories - sectors with strong intensity of labour and sectors with strong capital intensity. Distribution is based on the median value of the observed capital coefficients (standardized), relative shares factors being calculated starting from statistics of input-outputs of *GTAP* database

Table 4: Sectoral *GTAP* aggregates

	Used Aggregate	**Description**	**GTAPv5 Initial Products**
1	Rice	Paddy and Processed rice	Paddy and Processed rice
2	whey	whey	whey
3	Secondary cereals	Secondary cereals	nde cereals
4	Oleaginous	Oleaginous	Oleaginous
5	Other agricultural Products	Horticulture and other agricultural Products	Legumes, fruits, other nde agricultural Products, Fibbers Sugar Cane, beterave,
6	Crude Milk	Crude Milk	Crude Milk
7	Other animal products	Other animal products	Goat, sheep, horse, lain, nde animal products
8	Bovine meat	Red meat	Meat: Bovine, ovine, horse
9	Pork and chicken meat	Pork meat, White meat, and chicken	nde Meat products
10	Milk products	Milk products	Milk products
11	Processed foods	nde food products and Processed foods	nde food products, drinks, tobacco, sugar, oil, and vegetal oil.
12	Extraction,	Natural resources and Extraction	Petroleum, gas, nde minerals, fish
13	Manufactures and high intensity of manpower	Manufactures and high intensity of manpower	Wood products, Paper products, edition, metallic products, transports material, motors and spares, textile, leather

14	Manufactures and high intensity of capitals	Manufactures and high intensity of capitals	Petroleum and coal products, chemical, rubber, plastics, nde mineral products, iron metals, nde metals, electronic material, manufacture products.
15	service	Service and nde activities	Gaz and electricity production and distribution, water, BTP, Trade, nde transport maritime transport, air transport, communication, nde financial services, insurance, services to enterprises, administration/defence/health, education, lodgement

"nde" = not described elsewhere

Data bench-mark

Before examining the results of the scenarios, it is useful to present the bench-mark data for two reasons. Firstly, these data have informative value. They indicate for which products the SSZC are tributary (imported and produced foodstuffs of export generators of receipts) and effects of protectionism. Secondly, results of modelling *GTAP* depend partly of these starting data. With the obviousness, the decrease expressed as a percentage of any variables of marketing policy will produce more effect if the initial level of this variable is high. Moreover, a reform will have a more important impact if it directly influences a flow which represents a relatively large share of the market. The short description of *GTAP* data bench-mark which appears in the following section can be compared with the presentation of scenario of reference in the part devoted to *Aglink*. The starting point of *GTAP* analysis is base data *GTAP* version 5.3. Data bench-mark describes and state market situation of the policies in 1997. Information more detailed on the basis of data and its construction can be obtained near other sources. For exporting countries, the extent of effects of marketing reform policies on national economy depends on the ratio Export-GDP. In general, this ratio is higher for relatively small countries or groups of small countries than for the large countries. For example, exports represent a greater part of GDP in countries in food insecurity situation than in the average of countries; contrary, the share of exports in the total GDP is weaker in the groups including the OECD countries, but there exists exceptions. In so far as they produce internally broader range of goods, large countries can generally exploit different comparative advantages over their territory, whereas the small countries must be based on the exchanges to benefit from their comparative advantage. Even if that does not appear in the table, some small regions of SSZC are tributary of a limited number of export products (basically of primary products) and of a relatively restricted trade partners number to a large extent of their exports. So many SSZC maintain the asymmetrical trade with a small number of trade partners, which are often the OECD countries. Lastly, the share of the GDP of each country or groups country in World GDP show that the countries in food insecurity situation represent 4 %, neutral countries 15.0 % and countries in food security situation 80.6 %.

Table 5: Exchanges in the GDP in 1997

Countries Situation in regard to food security		**Exportations (not included taxes and subventions) in % of PIB**				**Importations (not included taxes and subventions) in % of PIB**				Part of country or group in World PIB
		Primary. Products	Transformed. Food Products	Other Sectors	All Sectors	Primary. Products	Transformed. Food products	Other Sectors	All Sectors	
						(%)				
Countries in food insecurity situation (INS)	AGREXP	5.5	4.1	30.5	40.1	1.9	3.8	54.1	59.9	0.4
	PRIEXP	4.2	1.3	19.7	25.2	0.8	1.9	27.9	30.7	0.6
	PROEXP	0.3	3.9	51.3	55.5	1.1	4.2	30.8	36.1	0.1
	INDIA	0.9	0.9	9.2	11.0	0.3	0.3	11.7	12.3	1.4
	AGRIMP	0.7	1.2	17.9	19.8	1.1	1.8	23.8	26.6	1.9
Countries in Neutral food Security situation (NEU)	AGREXP	1.3	1.8	11.5	14.6	0.5	0.7	15.7	17.0	5.8
	PROEXP	0.8	2.9	44.5	48.2	1.6	1.4	43.0	46.0	1.1
	CHINA	0.7	0.9	26.1	27.6	0.6	1.0	23.6	25.2	3.0
	AGRIMP	0.6	0.6	28.4	29.6	1.2	2.4	27.3	30.9	5.2
Countries in Food security situation (SEC)	AUSNZL	1.9	2.7	14.4	19.0	0.2	0.6	18.8	19.6	1.6
	ALENA	0.5	0.4	12.2	13.2	0.3	0.4	14.3	15.0	30.9
	UE	0.6	1.8	27.4	29.7	0.9	1.6	27.2	29.7	27.5
	ROCDE	0.1	0.3	15.7	16.1	0.5	0.8	14.0	15.4	18.9
	AUT	0.2	0.8	59.7	60.7	1.5	2.5	61.7	65.7	1.8
All countries		0.6	1.0	19.7	21.3	0.6	1.1	20.4	22.1	100

Source: Pre-version 5.3 of the data base GTAP

The right part of Table 5 indicates the weight imports in the GDP. For importing countries also, reform effects of agro-commercial policies on the national economy are strongly correlated with ratio importation-GDP, since an increase in world prices of foodstuffs constrain countries to devote higher part of their GDP to foodstuffs imports. For given level of GDP, these regions have fewer funds to devote to imports essential machines and other articles. For example, importing countries agricultural products in food insecurity situation is relatively opened, with ratios of importation of primary products and transformed products (1.1 % and 1.8 % of the GDP) higher than the average (0.6 % and 1.1%). For their part, exporting regions of agricultural countries in food insecurity situation are even more tributary of the imports but they export a good part of their agricultural production.

The ratio of self-sufficiency presented in Table 6 is defined like the ratio of internal production on internal consumption. This ratio indicates in which way various sectors from different groups of countries are likely to be affected by liberalization of exchanges. For example, ratios of self-sufficiency of agricultural products importing countries in food insecurity situation 100 % only exceed in the sectors of other products of agriculture and services. At 73 %, the ratio of self-sufficiency of the sector of corn is particularly weak by ratio with that of the other sectors. That means that the generalized rise of price of exchanged basic commodities, as corn, consecutive with liberalization of OECD policies will directly come to drop down invoice corn imports of these countries, while at the same time they will have limited capacity to generate additional export earnings to leave other sectors. For agricultural product exporting countries in neutral food situation, ratios of self-sufficiency of whole agricultural and agro alimentary sectors except two reach at least 100 % (the two exceptions are corn, with a ratio of 97 %, and the slags products, with a ratio of 96 %).

Majority of the countries in situation of food insecurity are not self-sufficing in the sectors to which marketing policies and interior of the OECD countries inflict them the most important distortions. Table 6 provides some proof: with regard to the primary products, countries/regions in situation of food insecurity appearing in the left-hand column of the table less low ratios of self-sufficiency for rice, corn, their post coarse grains and oilseeds than for

the other agriculture products. Countries in food insecurity situation are generally exporters of other agricultural products (horticulture, natural rubber, etc.) and some are nets exporters of oilseeds. However, they have tendency to depend on the imports to satisfy their requirements in particular in cereals. The sector of the processed products is also source of receipts of export for certain countries in food insecurity situation. It is not the case of the sectors of beef and veal and dairy products, which are more massively constant in the OECD countries.

Table 6: Ratios production-consumption in 1997

Sector	Countries in food insecurity situation (INS)					Countries in neutral food security (NEU)				Countries in food security situation (SEC)				
	AGR EXP	PRI EXP	PRO EXP	INDIA	AGR IMP	AGR EXP	PRO EXP	CHINA	AGR IMP	AUS NZL	ALENA	UE	ROCDE	AUT
Rice	100	99	75	104	99	105	99	100	90	126	109	78	97	92
Whey	58	64	48	98	73	97	3	94	73	334	169	101	49	14
Secondary cereals	74	94	95	100	94	107	84	102	76	117	111	100	38	33
Oleaginous	94	112	98	102	96	109	76	84	98	164	140	69	22	15
Other agricultural products	145	134	93	103	101	110	97	100	91	125	96	83	88	67
Milk	100	100	100	100	100	100	97	100	100	100	100	100	100	99
Other animal Products	100	101	96	99	99	100	101	100	99	135	101	98	90	85
Bovine meat	95	89	47	100	92	102	84	89	87	197	102	97	81	33
Pork and Poultry meat	86	91	66	74	97	108	91	101	63	108	103	102	75	91
Milk products	64	58	9	100	82	96	59	81	73	171	98	104	89	65
Processed foods	103	96	101	107	96	107	116	96	82	105	99	101	91	76
Extraction	88	210	714	81	98	104	145	97	202	147	86	53	58	59
Manufact. High man power	68	67	68	111	94	95	109	109	82	86	95	101	103	95
Manufact. High capital	61	64	57	88	78	89	89	96	89	80	96	103	107	89
Services	103	92	103	101	102	100	99	100	99	101	101	101	100	106

Source: Pre-version 5.3 of the data base GTAP (April 2001)

Table 7: Shares in total production in 1997

Sector	Countries in food insecurity situation (INS)					Countries in neutral food security situation (NEU)				Countries in food security situation (SEC)				
	AGR EXP	PRI EXP	PRO EXP	INDIA	AGR IMP	AGR EXP	PRO EXP	CHINA	AGR IMP	AUS NZL	ALENA	UE	ROCDE	AUT
Rice	2.6	7.2	0.2	3.6	3.6	0.7	5.9	2.7	0.4	0.1	0.0	0.0	0.7	0.4
Whey	0.3	0.3	0.1	1.6	0.5	0.4	0.0	0.5	0.5	0.4	0.1	0.1	0.1	0.0
Secondary cereals	0.4	1.4	0.9	1.1	0.7	0.4	0.5	0.6	0.4	0.2	0.4	0.1	0.1	0.0
Oleaginous	0.3	0.5	0.2	2.1	0.5	0.6	0.3	0.4	0.1	0.0	0.2	0.1	0.0	0.0
Other agricultural products	7.0	8.0	3.7	5.9	4.5	3.2	3.4	4.0	1.5	1.1	0.6	0.7	1.0	0.5
Milk	0.7	0.4	0.0	2.7	1.0	0.9	0.0	0.1	0.7	0.6	0.2	0.4	0.2	0.0
Other animal products	1.6	2.5	1.5	2.2	2.2	1.4	2.0	3.5	1.6	1.4	0.8	0.8	0.4	0.8
Total primary products	*12.9*	*20.3*	*6.6*	*19.2*	*13.0*	*7.6*	*12.1*	*11.8*	*5.2*	*3.8*	*2.3*	*2.2*	*2.5*	*1.7*
Bovine meat	0.9	0.2	0.2	0.0	0.6	1.2	0.2	0.1	0.7	1.1	0.5	0.5	0.3	0.0
Pork and Poultry meat	0.7	0.5	0.4	0.0	1.1	0.8	0.3	0.6	0.3	0.4	0.5	0.7	0.2	0.5
Milk products	0.6	0.2	0.0	0.2	0.6	0.9	0.1	0.0	0.6	1.1	0.5	0.8	0.4	0.1
Processed foods	7.6	6.8	6.7	3.5	7.1	6.6	5.7	3.9	4.2	3.1	3.1	3.5	3.7	1.9
Total processed foods	*9.8*	*7.7*	*7.3*	*3.7*	*9.4*	*9.5*	*6.3*	*4.6*	*5.8*	*5.7*	*4.6*	*5.5*	*4.6*	*2.5*
Extraction	3.2	11.2	21.6	3.0	3.7	2.5	7.5	4.3	9.7	4.1	1.6	0.7	0.9	2.0
Manuf. Higth man power	15.0	6.2	9.4	10.9	11.4	14.2	9.9	16.6	10.3	9.4	12.3	11.2	10.7	10.0
Manuf. Hight capital	14.3	8.2	9.7	21.7	14.3	18.7	20.8	31.2	18.0	10.6	15.6	18.0	20.6	27.7
Services	44.9	46.3	45.3	41.4	48.2	47.4	43.4	31.5	51.0	66.6	63.7	62.2	60.9	56.0
Total other	*77.4*	*71.9*	*86.0*	*77.0*	*77.6*	*82.8*	*81.6*	*83.6*	*89.0*	*90.7*	*93.2*	*92.1*	*93.1*	*95.7*
All sectors	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Pre-version 5.3 of the data base GTAP (April 2001)

Table 8 indicates the share of each sector in the total production. In a general way, the share of primary agricultural products in the production weakens as one move towards right-hand side of the table, whereas the share of the manufacturing industry and of services increases. In other words, primary agriculture is crucial for countries in food insecurity situation (7 to 20 % of the production total), important for neutral countries (5 to 12 % of the total production) and relatively less important for countries in food security situation (2 to 4 %). Sector of processed products follows similar tendency, and other sectors the reverses tendency (see the bottom of table). Lastly, other agricultural products and processed foodstuffs represent a

rather important component of the production of the countries in food insecurity situation, just as they represent a significant component of their exports, as we saw previously.

Table 8: Average rights balanced according to the exchanges applied to exports by country or group exporting country in 1997

	Countries in food insecurity situation (INS)					Countries in neutral food security situation (NEU)				Countries in food security situation (SEC)				
Sector	AGR EXP	PRI EXP	PRO EXP	INDIA	AGR IMP	AGR EXP	PRO EXP	CHINA	AGR IMP	AUS NZL	ALENA	UE	ROCDE	AUT
Rice	40	98	100	19	22	50	102	67	62	188	90	21	38	66
Blé	26	14	74	44	55	32	9	75	41	41	63	32	38	66
Secondary cereals	23	28	26	38	16	39	26	157	26	79	42	31	28	23
Oleaginous	27	50	22	17	21	23	9	46	5	62	40	23	5	17
Other agricultural products	12	10	14	18	20	14	16	26	9	15	20	30	18	33
Milk Products	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other animal products	8	15	21	15	12	8	2	7	14	12	16	28	16	8
Bovine meat	37	70	52	32	64	80	16	16	60	40	40	37	49	28
Pork and Poultry meat	22	39	32	47	109	50	23	42	37	38	34	57	25	55
Milk products	76	112	98	78	88	53	17	25	93	68	99	69	65	41
Processed foods	29	29	62	28	26	24	25	25	28	25	30	33	25	33
Extraction	1	1	1	2	2	2	2	1	1	2	2	1	1	4
Manufact.High intensity man power	11	3	12	10	11	8	9	11	8	6	6	9	11	14
Manufact.High intensity capitals	6	2	5	6	5	6	7	5	7	4	6	6	5	5
Services	0	-2	-3	-4	-5	0	-3	0	-3	6	-1	-1	1	0

Source: Pre-version 5.3 of the data base GTAP (April 2001)

Exclusion of measurements of OECD targeted on the sectors of the transformed food products.

GTAP data show that customs duties are progressive, it's feel that OECD countries apply rights higher on imports processed foodstuffs than on the primary food products. Moreover, *Aglink* analysis indicates that the effects of a renewal of the AACU could be more important for certain markets of livestock products. So it can be expect that *GTAP* results differ according to whether renewal of the AACU applies or not to the sector of the processed products into more sectors of the primary products. Taking into account the multiple roles that given to the sector of the processed products as a source of food products, source of export earnings important consumer of primary products, it is justified to undertake additional research on the relative weight of the sector of processed products in the context of a renewal of the AACU. A scenario highlighting the importance of liberalization of the exchanges of processed products for the SSZC was modelled. In this scenario, renewal AACU on the basis of initial rate of reduction relates to only their primary agricultural products. By comparing the results of this exercise with those obtained previously (in a situation where the renewal of the AACU related to the primary products as well as the processed products), we have an indication of the importance of the liberalization of the exchanges obtains for processed products for the SSZC. Results are recapitulated in Table 9. By convenience, results of the preceding scenario, which modelled a renewal of the AACU on the base of the ratios reduction registered in engagements (rather than on a 50 % reduction) in the whole agricultural sector (primary and transformed products), are also indicated for memory. By comparing the effects on the world prices (left part of the table), we notice, that prices of the beef and veal, dairy products and of processed products are higher when the renewal of the AACU relate to also the processed products. When policies of the countries of OECD concerning the processed dairy products are excluded from the field from reforms, the prices of the dairy products fall below the price reference period.

Table 9: Comparison of the effects of a renewal AACU integrating or excluding the sector from the processed products

Sector	Effect on world price		Countries or groups		Real effects in le PIB	
	Liberalization Agriculture	Liberalization Primary products	Situation in regard to food security.	Trade Position	Liberalization Agriculture	Liberalization Primary products
	(Variation in %)				(Variation in %)	
Rice	0.6	0.3		AGREXP	0.09	0.00
Whey	4.6	4.4	**Countries in food insecurity Situation (INS)**	PRIEXP	0.01	-0.01
Secondary cereals	3.4	3.3		PROEXP	0.10	0.00
Oleaginous	1.2	1.1		INDE	-0.01	0.00
Other agricultural product	-1.2	-1.4		AGRIMP	0.00	0.00
Milk	0.2	0.1	**Countries in neutral food security (NEU)**	AGREXP	0.02	0.00
Other animal products	1.1	1.0		PROEXP	0.01	0.00
Bovine Meat	1.3	0.7		CHINE	0.00	-0.01
Pork and chicken	0.8	0.8		AGRIMP	-0.03	-0.01
Milk products	1.3	-0.5	**Countries in food security situation (SEC)**	AUSNZL	0.00	0.00
Processed Food	0.3	0.1		ALENA	0.02	0.01
Extraction	0.2	0.2		UE	0.12	0.07
Manuf. high manpower intensity	0.1	0.2		ROCDE	0.17	0.08
Manuf. high capitals intensity	0.1	0.2		AUT	0.01	0.00
Services	0.1	0.2				

Note: Results represent here depends on the model structure, scenario intention and hypothesis made for the key parameters like elasticity, technologies and mechanisms of exchange rates thus can no be compare to results of other analyses.

Table 9 also represents the real effects on the GDP, by using their groups of usual countries. The overall effects are not very sensitive. However, a durable increase, even if it were 0.1 %, could have important consequences. For example, total rise of the GDP rise to 20 billion USD after evolution of the policies applicable to primary and processed products. If we exclude the processed products, this figure brought back to 11 billion USD. (In both cases, the rise of the GDP in these scenarios could be compared with the 40 billion USD of public assistance with the development provided in 1997). As we already indicated precedently, it is supposed within the framework of this medium-term study that many factors which act on the GDP, like the resources and technologies, are fixed, so that the profits come from the improvement existing allocation of resources taking into account technologies of used production.

Only India and importers of agricultural produce in neutral food situation (NEUAGRIMP) are favoured by the exclusion of processed products field from the reforms, but even in their case, the difference compared to preceding scenario is not very important. On the other hand, the inclusion of the sector of processed products in the reform involves significant profits for exporting SSZC's processed agricultural products, which are or not primary products importers of (AGREXP and PROEXP), for the European Union (EU) and for the remaining OECD (ROCDE). In general, for countries in food insecurity situation, consecutive profits of production with liberalization are lower when only primary products are concerned by the reform. Partial elimination of the rights progressiveness in scenario of wide liberalization creates new outlets for trade for countries in food insecurity situation; in the scenario of restricted liberalization, these outlets disappear. By the means of the bonds of production upstream, expansion of the sector of processed products stimulates request for primary products, which stimulates in its turn internal production of countries in food insecurity situation. Lastly, official reduction support for the sector of processed products in OECD countries involves an increase in their GDP, primarily because reduction distortions of the market support better allowance of the resources.

It may be that variations of world products markets, of wellbeing and GDP account only imperfectly for liberalization effects of agricultural trade in OECD on SSZC's food security. In fact, it is necessary to examine three dimensions of food security situation (availability, stability and accessibility) with the elements of the indicators described previously. Results for these indicators appear in Table 10.

Table 10: Renewal of the AACU by the OECD countries, variation in % compared to the reference data

(Renewal of the matched AACU of the reduction ratios registered in initial engagements)

Countries or regions		**Consumption of food products**		**Self sufficient**		**Non-qualified manpower**	
Situation in regard to Food security	Trade position	Primary products	Processed foods	Primary products	Processed foods	income factors	Purchasing power
		(change in percentage in regard with base scenario de base					
Countries in Food insecurity situation (INS)	AGREXP	0.2	0.2	0.0	4.3	0.9	0.0
	PRIEXP	0.0	0.0	-0.1	2.9	0.5	0.0
	PROEXP	-0.3	-0.1	5.1	17.2	2.8	-1.3
	INDE	0.0	0.0	0.1	1.1	0.3	-0.2
	AGRIMP	-0.1	-0.1	0.4	1.5	0.5	-0.5
Countries in Neutral food situation (NEU)	AGREXP	-0.1	0.0	0.8	1.3	0.6	-0.5
	PROEXP	-0.1	-0.1	0.3	1.2	0.3	-0.2
	CHINE	-0.1	-0.1	0.4	0.6	0.2	-0.5
	AGRIMP	-0.1	-0.1	0.8	1.5	0.3	-0.5

We compare some aspects of the executives hereafter of analysis and let us indicate the respective contributions of the two models on plan of the factors which they take into account, of measurements useful for the analysis that they produce and of the scenarios used:

Table 11: Main key differences between Aglink and GTAP

Types of analysis	**Differences observed**
Aglink (balance partial)	Focusing on details of a selection of policies
	Focusing on details of a selection of markets
GTAP (general balance)	Standardized representation policies
	Cover the whole of sectors and of the resources

DISCUSSION

- *Aglink* model was extended for purposes of present analysis so as to integrate some aspects of food security. The most important modification, operated is the addition of the markets of products of 15 regions of the Sudanosahelian Zone of Cameroon (SSZC), obtained from Ministry of Industrial and Commercial Development Cameroon (*MINDIC*) database. By integrating the effects of the prices world on consumption, the production, stocks and the exchanges of products *Aglink* in the SSZC, we obtains a whole indicators useful describing the consequences of a scenario of liberalization for food security of these regions, at the national level or an aggregate level.

- empirical results of the two scenarios modelled, which relates respectively to the renewal of engagements of reduction of the export subsidies and opening of the markets to the title AACU, shows that these effects are tiny. In fact, the changes are so much not very significant that it was not considered useful to indicate the evolution indicators over all the period of

implementation of the reforms. This situation has several causes: a relatively reduced variation of the world price of cereals, the small level of integration on the world market of all regions of SSZC and the fact that a third of consumed calories come from products which, in general, are not directly affected by the OECD policies. While the increase of the world prices involves degradation of some food security indicators at the incorporated level, such as *availability and accessibility* to food products, the effects are mitigated in regards of *stability* of provisioning.

- These results are drawn from a model of partial balance. If this approach has advantages because of the degree of detail with which it represents the agro-commercial policies and of particular indicators that it produces, it does not take into account implications of the agricultural policies for the economy as a whole and, reciprocally, of the whole economy for the agricultural sector and food security indicators, which can however be important in the framework of this approach.

In the data base GTAP version 5.3, there is no data on each flow of bilateral exchanges and each intern variation, so that it is impossible to determine them up to what point limits imposed on the support exceed the level of support applied (if however they exceed it). Taking into account the different treatment from policies in the two models, it is not easy to compare results obtained. This is why, even if the results can appear different, the divergences are less large when care is taken to identify the comparable variables. Thus, an apparent difference can be caused partly by the definition of the world markets or the exchanged products markets, corresponding to different assumptions concerning homogeneity or the heterogeneity of the products on the world markets. Perhaps it would be more useful to establish comparisons with other recent studies realized starting from the same model, like the one of the USDA (2001). Even in this case, it can happen that the results appear as a whole similar, but the studies differ in the field of the bench-mark data, aggregates of country and products and design of the scenario. It should be noted that the real prices are expressed by report/ratio with the world price index of primary factors. Moreover, in this experimental model, it is presupposed that the majority of the sources of growth of the income are fixed at exogenic levels: the factors equipments are constant and the growth of productivity is null. Consequently, in any scenario of policies change, increase in the GDP necessarily results from the improvement of the allowance supplies in hand and not of the use of a new stock of resources or of the increase in the productivity of a region or a countries group - even if, in fact, the trend of prices is likely to stimulate the investment and thus, by by-effect, to support the expansion of capital and productivity. This characteristic allows better of understand why the level of the results is limited to medium term. Scenario involves a decrease of the price differences, which are favourable to production of cereals and oilseeds, thus a reduction in the production of these food products. Following the decline of the production - and the reduction of price differences applied to the grounds buy/rent for this type of use whenever the interns support founded on the surface is reduced - ask inputs, in the form of grounds, by these decreases sectors, which fact of lowering the price of the grounds. As the other products of agriculture are in compete with cereals and the oilseeds for the inputs, in private individual grounds, this sector benefits indirectly from the policies reform because of the decrease in the price of inputs.

GENERAL CONCLUSION

Models of balance partial (*Aglink*) and of general balance (*GTAP*) used in this study bring each one a different lighting on the problem and sets distinct from food security measures produce. Among these measurements, some represent characteristics common to both types of

model, but in a general way, their differences reflect divergence of the priorities fixed at the time of the development of the models. One important difference relates to the treatment of the regional exchanges of one goods given. With *Aglink*, the exchanged goods are generally regarded as a homogeneous unit, and any distinction is not established on the basis of area of origin. On the other hand, *GTAP* consider that the goods produced in the various provinces of the country are imperfect substitutes, which leads it to identify the bilateral exchanges and to consider that there is not fixed price in all the country.

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