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Abstract

A simple multi-market framework is built to simulate the likely effects of trade liberalisation in the yellow maize market on the most relevant group of agricultural products in Guatemala.
Households are affected by this policy in their double role of producers and consumers. Changes in welfare are assessed by means of a measure that accounts for the responses from different regions and socioeconomic conditions to changes in prices after the implementation of policy changes.
The results indicate that the policy measure is likely to relatively improve the well being of the poorest households in Guatemala. However, after distinguishing peasants according to their land tenure characteristics, in the regions where agricultural products have greater relevance, some losses appear.

1. Introduction

The Guatemalan economy relies strongly on agricultural products. Most of the population in the lower scale of income bases their livelihoods on this kind of products, which also accounts for most of their consumption basket.
Recently, Guatemala has signed, along with other Central American Countries[1], a trade agreement with the United States which is likely to have an impact on the prices and quantities of both the agricultural products involved and of related goods and factors. However, little research has been devoted so far to evaluate the impacts of this kind of policies in the country.
Among the products that have elicit more discrepancy across countries when negotiating the agreement, agricultural products are the most conflictive ones, due to both the ongoing subsidies in the United States and the fact that they are outstandingly important for the Central American economies.
Maize is the single most important crop in Guatemala, not only because its high shares in the area of land devoted to the cultivation of this crop, but also due to historical and cultural reasons. Consequently, white maize, which is the variety mostly adopted by Guatemalan farmers and consumers, has been left outside of the negotiation of tariff liberalization. Yellow maize, however, is among the group of sensitive products for which a gradual liberalization scheme has been put forth. Voices of concern have risen about the effects this policy could have not only on the producers and consumers of this good, but especially on those of associated products.
The goal of the current investigation is to establish direct and indirect effects of a trade liberalization policy that affects a sensitive product, yellow maize; and to measure these transmission effects of the policy to different Guatemalan households. The methodology follows a partial equilibrium multimarket approach, in which key substitutes in the production and consumption of this crop are included, along with a product that uses yellow maize as an input. The importance of the exercise, despite its simplicity, is the identification of possible directions for the policies needed to complement or counteract the effects of the liberalization.

[1] CAFTA (Central American Free Trade Agreement) was signed by Guatemala, Nicaragua, Costa Rica, El Salvador, Honduras and United States. Dominican Republic has associated recently to what is known thereafter as DR-CAFTA.

2. BACKGROUND INFORMATION.

Guatemala is one of the countries in Central America that can be considered a middle income country (its per capita income is USD 1,740), yet its socioeconomic indicators place it among the countries with the highest percentage of the population living below the poverty line, and with very low education and health indicators. The rural population accounts for 60 percent of the total, and the Guatemalan economy is largely based in agriculture production and exports. However, in the last decade the industry and services sectors showed a considerable growth.

As many other Latin American countries, after a decade of negative growth in the 80s (which in this case included also the last years of a lengthy civil strife), Guatemala adopted policies of trade and financial liberalization in the 90s. As a result, trade has increased, although the growth in the trade/GDP ratio was only 11% between 1991 and 2001 (World Bank, 2005). This evolution was mostly driven by the growth of imports, since the decline in traditional agro-exports was only partially compensated by the increase in nontraditional exports and the maquila sector.

Recently, Guatemala along with other Central American countries (Nicaragua, Honduras, El Salvador, Costa Rica, and Dominican Republic) signed with the United States a free trade agreement (DR-CAFTA) which, on the one hand secured access to the US market for most of the regional exports that previously benefited from the Caribbean Basin Initiative, and on the other hand reduced many of the barriers to US imports. Despite the political agitation about the signature of CAFTA, it is worth mentioning that the Guatemalan economy had already lowered significantly the levels of protection in most of the product lines during the 90s.

The special clauses of the agreement specify that each country has a set of products considered as sensitive products, which are not subject to immediate liberalization, but will be opened gradually to free trade in a period of time ranging from five to twenty years, during which either the quota will be augmented, the tariff reduced, or a combination of both. Moreover, some key products were excluded of the agreement.

The agricultural products of interest for this study are maize, beans and poultry meat. All of them preserve some import restrictions in Guatemala according to the CAFTA treaty. White maize was excluded indefinitely from the agreement, whereas for yellow maize there is a period of protection of 10 years during which there is a continuous growth of the quota and a reduction in the tariff until free trade is reached. This period is of 15 years for beans and of 18 years for poultry meat.

As can be seen in Table 1, the products under consideration account for a significant percentage of consumption and production for Guatemalan households across the whole country. Maize is the single most consumed crop in the country by all population strata, and its production as a percentage of total income is also of significant importance. Furthermore, white maize along with beans are the main source of calories for Guatemalans, especially for the poor and even more so for the extreme poor. On the production side, these crops are usually grown together (beans are usually growth alongside the lines of plantations of maize), and many households produce and consume them; with the households in the northern regions and Peten relying the most on the production of maize and beans to make their living. The production of poultry meat is an activity that has shown an important increase along the last decade (Carrera, 2004).

The importance of the policies that affect directly or indirectly the markets of these products is, therefore, clear. As a result, many of the worries of economists and citizens alike are centered in what will happen at the end of the protection phase, particularly if the country does not make use of this

period to apply the compensatory policies needed to adjust or prepare the related markets for the more competitive conditions after the protection period expires.
In this study, the effects of the liberalization of the yellow maize market are explored through its links with the mentioned group of related markets.

2.1 The strategic importance of maize in Guatemala

Yellow and white maize are the main crops produced by the majority of households across Guatemala. Additionally this product is the most important item in their food basket. Almost 90 percent of the families produces maize and a vast majority consume some of their own production, specially in rural areas. Figure 1 shows the importance of yellow maize production in the different regions of the country. Moreover, if the distribution of regional production is compared with the regional incidence of poverty (Figure 2), it is noticeable that in most of the poorer regions this crop is cultivated more intensively. This is an additional reason to study the impact of liberalization of yellow maize on the livelihoods of Guatemalan households.

In the signing of DR-CAFTA by Guatemala, yellow maize was one of the products that generated an wide debate about the reduction in its protection. The agreement established that the evolution of yellow maize imports and trade taxes will be the following:

Year	Imports (in tons metrics)
1st	525,000
2nd	550,000
3rd	575,000
4th	600,000
5th	625,000
6th	650,000
7th	675,000
8th	700,000
9th	725,000
10th	No limits

Source: Ministerio de Economía de Guatemala.

Between the 1st and the 9th year imports above the quota pay the trade taxes.

3. METHODOLOGY

Any economic policy measure has direct effects upon the sectors it aims at, but also affects related sectors indirectly.

The effects of complex policies, such as trade agreements, can be assessed by means of diverse techniques, which may lead sometimes to different or even contradictory results.

Partial equilibrium models are often used to evaluate the expected impact of a specific policy on production and consumption levels, on prices and on the international trade of a single agricultural product or of the whole agricultural sector.

However, policies such as trade agreements related to a production sector (or to a region) will also have consequences on the related sectors (or regions) in the economy; e.g. an economic policy directed towards an agricultural sector, can as well have significant impacts on the sectors connected to it through the consumption or production system.

In particular, the impacts on goods produced and consumed massively by the population deserve special attention. For Guatemala, this is the particular case of yellow and white maize, beans and poultry meat. Therefore, the use of a model that considers the linkages among these markets is suitable to carry on a comprehensive analysis of the effects of economic policies that affect any of these markets on Guatemalan households.

The linkages above-mentioned are incorporated in a more complete way in economic models such as multi-market partial equilibrium models and computable general equilibrium models; which incorporate the sectoral interrelations in more detail.

Clearly, there is no model capable of fully measuring all the impacts of a given policy. Therefore, in the analysis one must equilibrate the incorporation of a number of markets, products, policies and regions, with the data availability and resource requirements. As a result, the use of an analysis that includes only closely related factors and products is sometimes preferred to a general equilibrium analysis, especially when dealing with the agricultural sector and the households linked to it.

Moreover, the use of a complex model with a high number of interlinked sectors does not always secure more accurate findings, and even could hamper the understanding of the results.

Multimarket partial equilibrium models are, thus, suitable to analyze the direct and indirect links between changes in a group of sectors of the economy, and the adjustment in the livelihoods of the people or households related to them through production or consumption activities. As such, these models are particularly useful when the policy that is being analyzed affects a group of agricultural products, whose set of related (substitute and complementary) goods and factors is reasonably well determined. In addition, the changes in prices and quantities obtained through these models can be related to measures of welfare for the families that are most likely to be affected by the policy. Finally, one must bear in mind that while this technique has not to be considered a forecast tool, it is useful to asses the expected or ex ante effects of a policy measure. In this way, it is possible to foresee who might win and who might lose from the reform, and to have an idea of the possible set of suitable compensatory policies.

Multimarket partial equilibrium analysis has proven to be an effective tool to conduct the ex ante impact evaluation of policy reforms whose objective is to change the functioning of a given market or sector. Its main advantage when compared to a simple partial equilibrium analysis is that it takes into account explicitly the interdependence among markets, and consequently the results and the conclusions that can be drawn from this type of models are more complete. The drawbacks of these

models are that they frequently ignore the role of the investment sector or of the public sector (which general equilibrium models do consider). Nevertheless, this disadvantage may not be significant when the sector under analysis is the agricultural sector. Particularly, most of the multimarket models applied so far deal with agriculture related policies and markets. Braverman et al. (1987); Dorosh et al. (1995) and Minot and Goletti (1998), are among the best examples of the multimarket approach to assess the results of agricultural policy.
In what follows, the simple multimarket partial equilibrium model that will be utilized in the exercise is presented in more detail.

4. STRUCTURE OF THE MODEL

The particular structure of the model is conditioned by the election of goods to include in it. It is obvious that the choice of disaggregated categories of products would lead to a very large model. Thus, at this stage of the research, it is preferable to focus on the more important set of goods for the country under analysis.
Four products were chosen in this initial stage of the research; white maize, yellow maize, beans and poultry meat. As discussed in the previous sections, these products are not only among the most important consumed and produced goods, but also appear prominently in the list of sensitive products negotiated in the CAFTA agreement.
The simplifying assumptions are the following; white maize and beans are consumed by the households and are treated as nontradable goods. This is supported by two facts. One is the exceptionally high trade restrictions imposed and the subsequent insignificant level of imports registered in these markets. The other is the particular characteristics of each of the markets. White maize is identified with food security issues and Guatemalan idiosyncrasy, being considered as the national product. Regarding to beans, the variety consumed in Guatemala (black) is not the same as the produced by the trade partners (red) and as a consequence the market of beans behaves as that of a nontradable good.
Yellow maize and poultry, contrastingly, are considered tradable goods, with the former being exclusively used as an input (animal feed) in the production of the latter. Despite the fact that the country's household statistics do not differentiate among the production and consumption of the different varieties of maize, yellow maize is traditionally not used for human consumption, but to feed farm animals, particularly in the poultry sector.
The simplicity of the model does not preclude, however, a meaningful assessment of some important characteristics of the agricultural sector such as the substitutability in production of the two varieties of maize and beans, the complementarity in production of white maize and beans, and the links to the poultry market through production and consumption impacts.

4.1 Production

The complete specification of the supply and derived-demand block in the model is assumed to derive from a well behaved profit function. Producers maximize profits and their supply response should include not only prices of all outputs and factors (p), but also fixed factors (Z)

$$S = q(p, Z) \qquad (1)$$

However, given the nature of partial equilibrium analysis of this exercise, the only variables that will remain are the price variables, for which variations will be considered. The system is log-linearized, and the only prices that are allowed to vary are those of maize (w, y), beans (b) and poultry (p).

$$\log(S_i) = \alpha_i^s + \sum_j \xi_i^j \log(p_j) \;;\; i, j = w, y, b, p \qquad (1')$$

$$\log(D_y) = \alpha_y + \xi_y^p \log(p_p) + \xi_y^{yc} \log(p_y^c) \qquad (2)$$

where S_i is the supply of commodity i; D_y is the derived input demand for yellow maize, p_j is the producer price of j, ξ_i^j are elasticities of supply (or derived-demand) of i with respect to p_j; and p_y^c is the price poultry producers pay for yellow maize.

4.2 Consumption

The consumer demands for each good are assumed to derive from the maximization of a utility function with the usual properties. These demands depend on the prices of all consumption goods and household income.

$$D_i = d(p, Y) \qquad (3)$$

where D_i is the consumer demand for commodity i, and Y stands for disposable income. The demand system is also log-linearized as follows

$$\log(D_i) = \alpha_i + \sum_j \eta_i^j \log(p_j^c) + \eta_i^y \log(Y) \;;\; i, j = w, b, p \qquad (3')$$

where η_i^j are elasticities of demand for i with respect to the consumer price p_j^c, and η_i^y is the income elasticity of good i.

4.3 Income

National disposable income Y is the sum of agricultural and non-agricultural income, which is not only the result of supplying non-agricultural goods, but also exogenously determined income such as transfers and remittances. Non-agricultural income is assumed not to vary with the policy under consideration.

$$Y = \Pi(p, z) + RNA = \sum_i p_i S_i - p_y^c D_y + RNA \;;\; i = w, y, b, p \qquad (4)$$

where $\Pi(p, z)$ are maximum profits in the agricultural sector and RNA is the non-agricultural income. The log-linearized form of (4) is, thus

$$\log(Y) = \sum_i \frac{p_i S_i}{Y} \log(p_i) - \frac{p_y^c D_y}{Y} \log(p_y^c) \qquad (4')$$

4.4. Equilibrium conditions

To attain equilibrium in the economy, each of the product markets must clear. For the products considered, the sum of domestic supply and net imports is equal to total demand

$$S_i(p_i, p_y^c) + M_i = D_i(p_i^c, Y); \quad i = w,b,p$$

$$S_y(p_i, p_y^c) + M_y = D_y(p_w, p_p, p_p^c, p_y^c) \qquad (5)$$

In the case of white maize and beans, which are considered as non-tradable goods in this model, net imports are fixed at zero and an endogenous market price equilibrates the market. The two remaining commodities are treated as tradable; therefore the adjustment to market equilibrium will be through net imports.

4.5. Prices

Producer and consumer prices are assumed to differ by a fixed multiplicative margin, mrg_i. This makes the differentiation among them unnecessary when assessed in terms of rates of change.

$$p_i^c = p_i(1 + mrg_i) \qquad (6)$$

For tradable goods, the border price is the value in quetzals of the world price adjusted for transport costs. The consumer price is then determined by the border price and trade costs, which includes the markup due to rents when quotas are binding.

$$p_i^c = p_i^W \cdot e \cdot (1 + tr_i) \cdot (1 + tmg_i) \qquad (7)$$

In (7) p_i^W is the world price of good i, e is the exchange rate, tr_i are transport costs associated to the tradable product, and tmg_i is the markup associated to the trade policy stance. This is the only variable that is allowed to change as a result of the trade policy in this study.

Equations (1) to (5) result in a model of 13 equations in 13 endogenous variables (Sb, Sw, Sy, Sp, Db, Dw, Dy, Dp, pb, pw, My, Mp and Y) and 4 exogenous variables (p_y, p_p, p_y^c, p_p^c). Using (6) and (7) two prices remain exogenous (p_y^c, p_p^c), of which p_y^c will be used as the policy variable that represents the policy adopted, that is, the elimination of tmg_i.

By means of the log-linearization of all equations, this system is solved for the rates of change in the endogenous variables as a function of the rates of change in the exogenous variables that result from the policy under consideration; in this case, the liberalization of the yellow maize market.

4.6.Welfare effects

Changes in real income y obtained from the model depicted above are given by

$$d\log y = d\log Y - d\log P \qquad (8)$$

where $d\log P = \sum_i \theta_i \left(d\log p_i\right)$ is the percentage change in a consumer price index given by the sum of changes in product prices weighted by the shares θ_i of these products' consumption in total expenditure. This is a general measure of the overall effect of the policy.

Some distributional effects can be observed using a measure of welfare that includes the diverse responses of different agents to the changes induced by the policy. A second-order welfare measure that reflects long term changes is used

$$\left(\frac{dW}{Y}\right)_h = \sum_i \phi_{hi}\left(d\log p_i\right) + \frac{1}{2}\left[\sum_i \phi_{hi}\,\xi_i\left(d\log p_i\right)^2 + \sum_i\sum_j \phi_{hi}\,\xi_i^j\left(d\log p_i\right)\left(d\log p_j\right)\right] - \qquad (9)$$
$$- \sum_i \theta_{hi}\left(d\log p_i\right) - \frac{1}{2}\left[\sum_i \theta_{hi}\,\eta_i\left(d\log p_i\right)^2 + \sum_i\sum_j \theta_{hi}\,\eta_i^j\left(d\log p_i\right)\left(d\log p_j\right)\right]$$

where W is a measure of welfare, and θ_{hi} and ϕ_{hi} are respectively the household h's shares of consumption and production of good i in total household income (proxied by total household expenditure in this study). In (9), the change in welfare for household h as a percentage of household income is approximated by the change in producer surplus as a proportion of household expenditure -the first two terms- minus the change in consumer surplus as a proportion of household expenditure -the second two terms-. If the elasticities of supply and demand are zero, the measure collapses to (8).

5. DATA, CALIBRATION AND SIMULATED POLICY

A base scenario for the sectors under study is shown in Table (2). The data for the variables in the model correspond to the year 2000. This base year was chosen to calibrate the particular starting point since it is a fairly ordinary year, but also since several data were obtained from the ENCOVI survey, which was conducted in 2000. This is the only household survey that contains relevant disaggregated information for Guatemala. It covers more than seven thousand rural and urban households over the whole country, and contains a wide range of information on socioeconomic variables. Unfortunately, the survey is only available for this particular year.

A differentiation among rural and urban population is made in the survey, as well as a division of the country in 8 regions (see Tables 1 and 4). Using the survey's data on per capita expenditure and a poverty line based on caloric intakes defined by the National Statistics Agency (INE), the population is divided into three groups: they are characterized as extreme poor if their yearly total expenditure is less than 1,912 Quetzals (USD 246), as poor if the amount is less than 4319 Quetzals (USD 556), and as non poor otherwise.

Information on produced, consumed and traded quantities are from the Ministry of Agriculture of Guatemala (MAGA). Data on producer and consumer prices are from FAO (2001) and were checked for compatibility with the unit values from the ENCOVI survey. International prices and transport costs

are from IMF statistics. The international price for tradables was converted to Quetzals using the official average exchange rate for 2000 from BANGUAT.

Due to paucity of data and the existence of only one survey, which hinders the estimation of elasticities; the study draws on previous researches that identify own and cross demand and supply elasticities among the relevant markets. Elasticities of supply come from Sadoulet and De Janvry (1995), whereas the study of elasticities in Nicita (2004) is the source of the income and price elasticities for the demand module. The fact that this is a study for a neighbor country, Mexico, makes it particularly suitable. Nevertheless, when using these elasticities, the symmetry constraints from profit function theory and Slutsky substitution effects are imposed[2].

The policy analyzed is the elimination of trade barriers for yellow maize. In 2000, the in-quota tariff for yellow maize was 5%, whereas out of quota imports had a 35% tariff. As stated in the previous section, and as it is evident from Table (2), the barrier between the border price and the internal price (tmg_i) is rather high due to the existence of a binding quota. The simulation thus corresponds to what would be expected to happen when the end-of-protection-period set in CAFTA is reached.

The high reduction in the price of yellow maize implied by the policy (48%) somehow weakens the suitability of the model to assess such a price change, given that the nature of the model is adequate to evaluate changes in the neighborhood of the original equilibrium. A sensibility analysis is used to address this issue, in which generous bounds are placed in the parameters represented in different alternative scenarios. Five of these alternative scenarios will be employed in section 4 below. Scenarios I and II assume half and double values for supply elasticities respectively. Scenarios III and IV do the same with demand elasticities. Finally, scenario V represents a situation in which the population does consume yellow maize as a substitute of white maize[3].

6. RESULTS

In this section the results of the policy simulation are examined first, and they are next included in an evaluation of changes in household welfare.

6. 1. Multimarket results

The changes in endogenous variables under the different scenarios can be seen in Table (3). The functioning of the model does not appear especially sensitive to the rather large change in elasticities assumed in each one of the different scenarios. The particular linkages between markets prove to determine to a large extent the outcome of the policy exercise.

With the exception of the last scenario, the direction of change is the same regardless of the different assumptions about elasticities. Because of the decrease in the relative price of yellow maize, this crop is substituted for white maize and, in a smaller proportion, beans. Producers of poultry meat demand more of the input whose price has decreased, and the supply of poultry meat also increases. Imports of yellow maize evidence rather large increases due to the combination of these effects. The prices of

[2] For cross supply elasticities, the constraint is $\xi_i^j = (\phi_i/\phi_j)\xi_j^i$, whereas in the case of demand elasticities the constraint is $\eta_i^j = (\theta_i/\theta_j)\eta_j^i + \theta_j(\eta_i^Y - \eta_j^Y)$. Due to the fact that this is not a complete system the symmetry constraints do not apply.

[3] This scenario is included thanks to a comment from a Guatemalan specialist; who considers that since yellow maize was consumed in the past as a substitute of white maize, it is likely to occur that the consumers choose again for this good when faced with a big enough difference in relative prices of both varieties.

white maize and beans also decrease to adjust the markets of these non tradable goods. Since prices of poultry meat are assumed to remain fixed, the demand and imports for poultry decreases.
The percentage increases in nominal and real income –which according to the model are made up exclusively of changes in agricultural income- are substantial, considering the reduced set of goods included in the model.
In the scenario where both maize varieties are substitutes in consumption (Scenario V), the links at work in the multimarket model exacerbate most of the changes observed in the previous scenarios, while the directions of change are only reversed for the supply and demand of beans and white maize as a result of a large decrease in their prices. Recall that this is an extreme scenario that assumes behavioral changes in the patterns of consumption of the population. Nominal income is reduced in this case, but the larger reduction in the cost of living index more than compensates this reduction and the final result is an increase in real national income.

6.2. Distributional effects

In the previous computation of income effects it is assumed that all households in the economy share the same production and consumption pattern. Since sources of income and consumption shares differ across households as can be see in Table (1), changes in prices as a result of a policy will affect the diverse income groups differently. To determine the distributional impacts on the people or households linked to the markets that were affected by the reform, a disaggregation among poor and non poor households in the different regions was considered in a second stage.
The changes in prices and quantities obtained through the model can be transmitted to the household level via the associated change in their consumption or income, which enables a richer assessment of income effects. Thus, household data was used in a microsimulation to obtain a measure of (9) for each of the households in the survey. In computing this measure, household responses to price changes are included and their consumption and production patterns are allowed to vary. The ENCOVI survey contains data on household production and consumption for maize, beans, and poultry meat. Since maize is not broken up by variety, it is assumed that the household data replicates the aggregate pattern. Also, and more relevant, goods produced and consumed at home are valued at producer prices and included in the computation of consumption. Own consumption of the crops included in the model represents a large part of total expenditure for some households, and thus it should be considered in the analysis[4].
Two further simplifying assumptions were made when assessing the change in welfare among households. First, it was assumed that the parameters of the nationwide model are the same for the whole country. Since these parameters were obtained from other studies, at this stage of the research a differentiation among different types of households would add an even greater deal of arbitrariness. Second, even if the regional markets are not integrated, regional prices are assumed to differ by a margin that is not affected by the trade policy itself, therefore percentage changes in the price of each good obtained from the multimarket model are the same across regions.
The average change in the welfare measure across households in the different regions and with different poverty status is reported in Table (4). Changes in welfare are positive in most cases and under most of the different scenarios of behavioral parameters. Clearly, the effect of the reduction in prices on the households as consumers outweighs the effects they face as producers.

[4] Previous research on the effects of CAFTA (Pörtner, 2003) excludes this component from the measures of consumption.

What is noticeable is the fact that the average improvements are the highest for the extreme poor and relatively low for the non poor. Therefore, there is evidence of an improvement in the distribution of income.
Also, rural household welfare improves more than that of their urban counterparts. Since in each region the poor and extreme poor are to be found among the rural households -who are mostly producers of the goods that are being studied-, these results seem to indicate that the policy favors these households even when the price they receive as producers suffer absolute decreases.
Regarding regional distribution of income, there is no clear evidence of a differential change among the more poor northern regions and the rest of the country. However, the poor and non poor households in the Peten region, one of the poorest of the country, suffer a reduction in welfare in all scenarios. In Table (1) it is shown that the importance of the production of the considered crops as a percentage of total household income in this region is much higher than in the rest of the country. This might be a sign that the average gains in the rest of the regions hide some losses among the producers of maize and beans. More detailed data and analyses are required to inquire further on this issue.

6.2.1 Disaggregating the impact on rural households

Most of the empirical literature on trade and poverty make a distinction among the effects of the policy upon the welfare of urban and rural households or regions, as in the previous section. However, the characterization of a homogeneous group of rural households falls short of the reality for rural Guatemala. Guatemala is the most rural country in Latin America, with more than 5 million inhabitants in this sector, 2/3 of which are from diverse native ethnic groups, 75 percent are poor, and more than 40 percent are extremely poor. Additionally, a wide array of households can be found according to land tenure, education, sources of income and patterns of expenditure, among many other characteristics.
The impact on different rural households is based on a characterization of rural Guatemala that considers some of the dimensions in the set of differentiating characteristics: land tenure, skill level, and market participation. Accordingly, six rural household typologies were considered to asses how the policy under study affects them (see Table 5). Noticeably, almost half of the rural population is not engaged in commercial activities, namely they use their production for self-consumption. Another important fact is that many rural households who are not land owners are also unskilled workers[5].
Changes in welfare for each of the rural household typologies is related with their production and consumption behaviour (Table 5). Therefore, whereas those without land benefit fully from the reduction in prices of the goods their consume and are not harmed in the production side since they are not producers, those who do produce the goods under consideration (wether they are sellers to the market or not) obtain smaller improvements in their money metric utility measure. Moreover, for the medium and large rural sellers there are even reductions in welfare due to the fact that they obtain a larger percentage of their income from basic grains and poultry, whilst these goods represent a smaller share in their total expenditure.

[5] Nonskilled population is defined as those who received less than six years of formal education.

7. SUMMARY AND CONCLUSIONS

Despite Guatemala being already a fairly open economy, the CAFTA agreement presents opportunities and perils to the economy. In this study the focus is in the liberalization of the yellow maize market and the possible impacts upon the main related products, which has been identified as one of the key challenges posed by CAFTA.

The exercise was conducted in a multimarket partial equilibrium setting. This model permits to evaluate specific policies directed towards a given economic sector or group of sectors; and enables a more complete analysis of policies than single market partial equilibrium models. In addition, the separation among regions, rural and urban markets, and poverty status sheds more light upon the distributional effects of the policy.

The results indicate that the model predicts consistent variations even when changes in behavioral parameters are included. Specifically, yellow maize is substituted for the other crops in production -white maize and beans-. The prices of these two goods also fall, though in a relative small percentage. When these changes in prices are introduced into a microsimulation to assess changes in welfare, the policy appears to have stronger positive effects the poorer the households are. This improvement in the distribution of income is observed also when the measure of welfare is evaluated in the different regions of the country, with the exception of the Peten region where the improvements are relatively low for the extreme poor and there are decreases in welfare for the rest of the households. Since this is one of the poorest regions in the country, and most of the households in this region are strongly related to the products included in this analysis through both consumption and production, the results give a sense of the focus compensatory measures should have in case such a policy is implemented. Also, the results call for a more detailed analysis on the effects of the policy on different, better identified, types of households[6]. Here, we provided a hint of the detail needed by differentiating rural households according to land tenure, education, and market participation. When the impact is measured on each of the 6 typologies defined, we found evidence of the possibility of losses for the larger scale producers who sell their products in the market, whereas the rest are benefited by the policy according to their consumption and production bundle.

For all its simplicity, the merit of the study is to give an intuitive understanding of the possible effects of one of the trade measures included in CAFTA, and to facilitate an informed discussion of policy outcomes that attempts to go beyond the current argumentative debate.

There are other aspects to evaluate when assessing the possible impact of CAFTA on the Guatemalan economy outside the sphere of trade policy. This study is conceived as a first step towards a more complete understanding of the agreement that should include, for instance, the changes in non agricultural income, wages, and remittances; and also the role of complementary policies that member countries can implement.

[6] This is, precisely, the direction the research project will move on. Data on specific regions, such as Alta Verapaz in Guatemala and the "Cuenca lechera" in Nicaragua, will be included so as to have different typologies of producers and to better assess the effects of the policy, including not only agriculture income but also labor income and transfers.

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TABLES

Table 1. Structure of production and consumption (% of total expenditure)

REGION	PRODUCT	EXTREME POOR Average Consumption	POOR Average Consumption	NON POOR Average Consumption	EXTREME POOR Average Production	POOR Average Production	NON POOR Average Production
METROPOLITANA	Maize	33.24	5.31	1.16	.00	1.37	.05
	Bean	1.73	3.36	1.21	.00	.82	.07
	Poultry	5.05	4.04	3.20	.63	.16	1.10
NORTE	Maize	26.95	16.55	4.84	2.60	4.68	1.65
	Bean	6.34	5.22	2.92	.46	1.36	1.10
	Poultry	3.33	3.56	3.15	1.29	.54	.48
NORORIENTE	Maize	24.60	13.80	2.98	2.13	1.52	1.86
	Bean	7.93	5.29	2.14	1.79	1.93	.25
	Poultry	2.66	2.86	3.03	.47	.56	.14
SURORIENTE	Maize	32.61	17.11	5.00	9.23	3.43	3.55
	Bean	16.17	8.02	3.13	2.15	1.99	1.28
	Poultry	2.63	3.65	3.34	.84	.51	.89
CENTRAL	Maize	22.67	12.24	4.39	1.47	2.77	1.55
	Bean	6.70	4.34	2.12	.86	.53	.27
	Poultry	3.65	3.85	3.55	.43	.60	.38
SUROCCIDENTE	Maize	25.41	13.66	5.63	.89	2.18	1.58
	Bean	4.89	4.13	1.97	2.72	.58	.05
	Poultry	3.12	4.12	3.58	.14	.59	.28
NOROCCIDENTE	Maize	29.02	15.74	6.35	2.90	1.81	1.36
	Bean	8.62	5.54	3.01	.78	.68	.57
	Poultry	4.39	4.79	3.74	.45	.27	.08
PETEN	Maize	45.19	21.28	5.62	33.02	31.52	9.75
	Bean	17.85	9.20	2.82	14.72	13.53	4.92
	Poultry	1.89	4.01	3.16	1.53	.50	.16

Source: own calculations. Data from ENCOVI 2000.

Table 2. Base Scenario

Data on the agricultural sector

Commodities	Quantities (1000 MT)				Prices (qtz/Mton)			
	Supply	Derived demand	Final demand	Net Imports	Producer	User	Consumer	Border
Beans	91		91	0	4607		5730	4540
White Maize	978		978	0	1673		2043	787
Yell. Maize	105	405		300	1995	2091	2365	1222
Poultry meat	140		155	15	15986		18624	16286

Elasticities

Producer and user price elasticities					
Commodities	Beans	White Maize	Yell. Maize producer	Poultry meat	Yell. Maize user
Beans	0.20	0.10	-0.05	0.00	0.00
White Maize	0.03	0.20	-0.10	0.00	0.00
Yell. Maize supply	-0.10	-0.78	0.50	0.00	0.00
Poultry meat	0.00	0.00	0.00	0.10	-0.05
Yell. Maize demand	0.00	0.00	0.00	0.13	-0.10

Consumer price and income elasticities					
Commodities	Beans	White Maize	Yellow Maize	Poultry meat	Income
Beans	-0.16	-0.02	0.2	1.58	0.4
White Maize	-0.01	-0.74	1	1.25	0.4
Yellow Maize	0.11	2.09	-0.5	0.00	0.4
Poultry meat	0.29	0.88	0.00	-1.16	0.9

Exchange rate (qtz/usd)	7.76
Income (thousand qtz)	61709369

Table 3. Percentage change in the endogenous variables.

Scenario	BASE	I	II	III	IV	V
% Change						
Sb	0.99	0.75	1.10	0.59	1.31	-6.42
Sw	3.74	2.11	6.14	3.09	3.15	-6.88
Sy	-19.91	-10.90	-34.57	-17.37	-17.61	-21.59
Sp	2.42	2.42	4.83	2.42	2.42	2.42
Dy	4.83	2.42	9.66	4.83	4.83	91.12
Db	0.99	0.75	1.10	0.59	1.31	-6.42
Dw	3.74	2.11	6.14	3.09	3.15	-6.88
Pb	-4.72	-3.32	-5.26	-5.11	-1.40	-15.95
Pw	-4.83	-2.60	-8.13	-8.04	-8.21	-56.52
Mp	-77.53	-52.36	-132.48	-65.01	-59.89	-594.91
My	13.49	7.08	25.14	12.60	12.69	130.56
Dp	-5.32	-2.89	-8.46	-4.11	-3.61	-55.39
Nominal y	0.34	0.41	0.25	0.25	0.27	-1.11
CPI	-0.20	-0.11	-0.31	-0.30	-0.28	-2.71
Real y	0.54	0.52	0.56	0.55	0.55	1.61

Source: solution of the system of equations in the model. Base Scenario corresponds to elasticities in Table (1). Scenarios I and II assume half- and double supply elasticities respectively. Scenarios III and IV do the same with demand elasticities. Scenario V incorporates yellow maize in the demand system.

Table 4. Average percentage change in welfare (% of total expenditure)

	REGION / Scenario	METROPOLI-TANA	NORTE	NOR ORIENTE	SUR ORIENTE	CENTRAL	SUROCCI-DENTE	NOROCI - DENTE	PETEN
URBAN	Base	.12	.50	.24	.49	.51	.61	.75	.25
	I	.09	.38	.18	.37	.39	.46	.57	.19
	II	.15	.65	.31	.63	.66	.79	.98	.30
	III	.15	.63	.30	.62	.64	.77	.96	.30
	IV	.11	.58	.25	.56	.58	.73	.91	.24
	V	.48	1.95	.94	1.83	1.91	2.44	2.95	.38
RURAL	Base	.76	1.66	.91	1.38	.88	1.20	1.79	-1.19
	I	.58	1.28	.69	1.05	.68	.92	1.37	-.87
	II	1.00	2.18	1.18	1.77	1.15	1.58	2.34	-1.64
	III	.98	2.14	1.16	1.75	1.13	1.55	2.29	-1.48
	IV	.94	2.07	1.10	1.59	1.06	1.51	2.17	-1.23
	V	2.90	6.17	3.34	4.71	3.11	4.56	6.97	-10.17
EXTREME POOR	Base	3.19	2.54	2.38	2.81	2.25	2.39	2.80	1.15
	I	2.46	1.95	1.82	2.14	1.72	1.84	2.14	.91
	II	4.27	3.35	3.13	3.61	2.96	3.19	3.68	1.42
	III	4.17	3.28	3.06	3.55	2.89	3.11	3.59	1.52
	IV	4.27	3.19	2.95	3.18	2.79	3.16	3.44	1.58
	V	13.29	10.05	9.47	9.84	9.04	9.83	11.03	-.93
POOR	Base	.48	1.27	1.30	1.55	1.05	1.23	1.53	-1.29
	I	.37	.98	1.00	1.18	.80	.94	1.16	-.95
	II	.62	1.66	1.71	2.01	1.37	1.61	1.99	-1.78
	III	.61	1.63	1.67	1.97	1.34	1.58	1.95	-1.61
	IV	.54	1.57	1.61	1.83	1.26	1.51	1.85	-1.39
	V	1.73	4.43	5.13	5.77	3.83	4.69	5.96	-10.72
NON POOR	Base	.16	.38	.19	.21	.35	.46	.58	-.52
	I	.12	.29	.14	.16	.26	.35	.44	-.39
	II	.20	.48	.22	.25	.44	.60	.75	-.71
	III	.19	.48	.23	.26	.44	.59	.73	-.65
	IV	.16	.43	.17	.21	.39	.54	.67	-.56
	V	.63	1.26	.41	.22	1.14	1.61	2.13	-3.82

Data from ENCOVI 2000 and Table (3) . Average of welfare changes from equation (9). Base Scenario corresponds to elasticities in Table (1). Scenarios I and II assume half- and double supply elasticities respectively. Scenarios III and IV do the same with demand elasticities. Scenario V incorporates yellow maize in the demand system.

Table 5. Rural Households Typologies.

Household typology	Percentage (of total rural population)	Consumption (goods in the model as a % of total expenditure)			Production (goods in the model as a % of total income)		% Change in welfare
		Maize	Beans	Poultry	Basic grains	Poultry	
Unskilled households without land	12.90%	5.06%	2.27%	7.04%	0.00%	0.00%	2.69%
Skilled households without land	2.40%	0.60%	0.68%	4.49%	0.00%	0.00%	2.47%
Non commercial households	53.30%	4.30%	2.00%	3.54%	3.94%	5.79%	0.76%
Small commercial households	23.90%	2.64%	1.50%	3.65%	3.66%	1.32%	0.51%
Medium commercial households	5.40%	1.39%	1.16%	3.55%	7.30%	20.69%	-0.16%
Large commercial households	2.10%	0.26%	0.35%	1.47%	5.61	17.6%	-0.30%

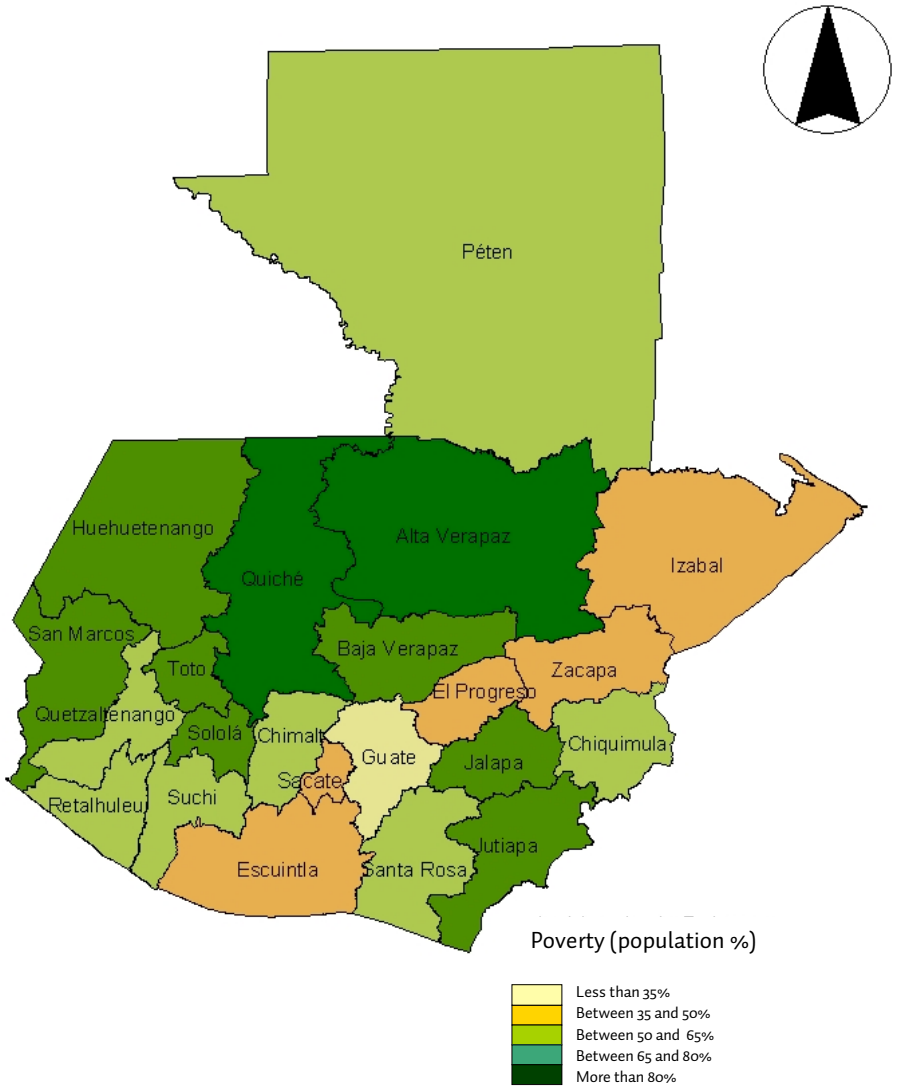
Source: National Life Conditions Survey of Guatemala, ENCOVI (2000).

FIGURES

Figure 1. Yellow Maize Production. Guatemala – 2003.

Source: IV Censo Agropecuario. INE. Guatemala.

Figure 2. Poverty Map. Guatemala – 2002.



Source: SEGEPLAN, INE, URL (2004)

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