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The Effects of DR-CAFTA in Nicaragua: a CGE-Microsimulation Model for Poverty and Inequality Analysis

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Abstract

In this paper, we build a CGE-microsimulation model for the economy of Nicaragua, following the Top-Down approach (see Bourguignon *et al.*, 2003), that is, the reform is simulated first at the macro level with the CGE model, and then it is passed onto the microsimulation model through a vector of changes in some chosen variables, such as prices, wage rates, and unemployment levels. The main reason for this choice is that with such an approach, one can develop the two models (CGE and microsimulation) separately, thus being able to make use of behavioural micro-econometric equations, which are instead of more difficult introduction into a fully integrated model. Moreover, the so called top-down approach appears to be particularly suited to the policy reform we are willing to simulate with the model: the Free Trade Agreement of Central America with the USA is mainly a macroeconomic reform, which on the other hand can have important effects on the distribution of income. With such a model we try to study the possible changes in the distribution of income deriving from the Free Trade Agreement with USA. Our analysis finds only small changes both in the main macroeconomic variables and in the distribution of income and poverty indices.

JEL classification: C68, C15, C35, D31

Keywords: CGE models, microsimulation, income distribution.

CONTENTS

1. Introduction

In the literature that studies income inequality and poverty, we can observe a recent development of models that link together a macroeconomic model (usually a CGE model) and a microsimulation model. The reason for this lays in the fact that poverty and inequality are typically microeconomic issues, while the policy reforms or the shocks that are commonly simulated have often a strong macroeconomic impact on the economy under study. Indeed, the main advantage of linking these two models is that one is able to take into account full agents' heterogeneity and the complexity of income distribution, while being able at the same time to consider the macroeconomic effects of the policy reforms.

In this paper, we build a CGE-microsimulation model for the economy of Nicaragua, following the Top-Down approach (see Bourguignon *et al.*, 2003), that is, the reform is simulated first at the macro level with the CGE model, and then it is passed onto the microsimulation model through a vector of changes in some chosen variables, such as prices, wage rates, and unemployment levels. The main reason for this choice is that with such an approach, one can develop the two models (CGE and microsimulation) separately, thus being able to make use of behavioural micro-econometric equations, which are instead of more difficult introduction into a fully integrated model (see for instance Cockburn, 2001, and Cororaton and Cockburn, 2005).

Moreover, the so called top-down approach appears to be particularly suited to the policy reform we are willing to simulate with the model: the Free Trade

Agreement of Central America with the USA is mainly a macroeconomic reform, which on the other hand can have important effects on the distribution of income.

The Free Trade Agreement (CAFTA) between the countries of the American isthmus and the United States was signed in May 2004 (in August the Dominican Republic joined the Treaty, known from that moment on under the name DR-CAFTA). The Nicaraguan Congress ratified the Agreement in October 2005, and it came into force the 1st April 2006.

United States are a very important trade partner for Nicaragua. According to Sánchez and Vos (2005), in 2000 42% of Nicaraguan exports were directed to the US market, while 22% of Nicaraguan imports came from the USA. The majority of commercial exchanges between the two countries concerns agricultural products. The Trade Agreement provides for a gradual reduction of tariff rates on imports from USA, to be carried on in the first ten years that follow the introduction of the Treaty. Anyway, for most products the biggest reduction will be in the first year. On the other side, Nicaraguan exports toward USA will benefit of gradual increases in the quotas of entry into the US market[1].

The introduction of DR-CAFTA in Nicaragua was controversial. The promoters of the Agreement claimed an improvement in competitiveness and efficiency in production, and also new investment in advanced technology by USA was

[1] For a more detailed description of the new trade regulation enforced with the DR-CAFTA, see Sánchez and Vos (2006).

expected[2]. On the other side, the opposers of the DR-CAFTA are afraid that it will bring about a high number of losers, especially among those working in the traditional sectors, such as the agricultural sector and the small enterprises, which will not be able to compete with the US producers.

As our model is only a one-country study, we are not going to model the changes in the regime adopted in USA with respect to goods and commodities coming from Nicaragua, as well as we will not take into consideration the quotas imposed on imports from USA, but only the changes in the tariff rates raised on the imported goods from USA. With such a model we try to study the possible changes in the distribution of income deriving from the Free Trade Agreement with the USA. The core of the microsimulation model follows the discrete choice labour supply approach, and it is based on a multinomial logit specification, while the CGE model is basically a standard one.

The rest of the paper is organized as follows. Section two describes the model in detail, for each of its modules: the microsimulation and the CGE models, and how the two models are linked together. The third section deals with the results of the simulation, and section four concludes.

[2] The largest US investments in Nicaragua are in the energy, communications, manufacturing, fisheries, and shrimp farming sectors.

Nicaraguan Economy

Nicaragua is one of the poorest countries in the Latin America and the Caribbean region. Almost half of Nicaraguan population lives under the poverty line, while more than 25% of people in the rural areas are extremely poor[3]. The distribution of income shows a Gini index which is estimated to be 43.1 (World Bank, 2006) when computed on consumption, and 57.9 (ECLAC estimate, 2006) when computed on income.

Agriculture employs about 30% of the workforce and accounts for about one fifth of the gross domestic product. The main commercial crops are coffee, cotton, and sugarcane; these, together with meat, are the largest exports.

During the 80's Nicaragua's economy underwent a strong recession, due both to the civil war, which caused the destruction of much of the country's infrastructure, and to the economic blockade staged by the USA from 1985 onwards.

At the beginning of the 1990s began a significant process toward macroeconomic stabilization. Pacification, international aid, continued foreign investment and the re-establishing of trading relationships with US have contributed to the stabilization process. Moreover, important trade reforms were carried over in

[3] Around 46% of the population lives below the poverty line established by the 2001 Living Standards Measurement Survey and 15% of the population lives in extreme poverty (The World Bank, 2003). These indicators are even higher according to other estimates, such as those contained in the Statistical Yearbook published by the Economic Commission for Latin America and the Caribbean (ECLAC, 2006). The differences in the estimates come from different levels of the poverty line, and from the different reference variable adopted (consumption or income).

those years: most of the quantitative restrictions to imports and exports were removed, and there was a net reduction of tariffs on imports, together with a liberalization of the financial sector.

At the end of the 1990s the economy suffered a slowdown, due to the financing of the reconstruction after the damage caused by Hurricane Mitch in the fall of 1998, and to a simultaneous fall in the price of coffee and an increase in the price of oil. Nicaragua continues to be dependent on international aid and debt relief under the Heavily Indebted Poor Countries (HIPC) initiative.

2. The Model

2.1. The Microsimulation Model

The main role of the microsimulation module in the linked framework is to provide a detailed computation of net incomes at the household level, through a detailed description of the tax-benefit system of the economy, and to estimate individual behavioural responses to the policy change.

The data source for the building and estimation of the microsimulation model is the “Encuesta Nacional de Hogares sobre Medición de Nivel de Vida” (EMNV) of 2001, supplied by the Instituto Nacional de Estadísticas y Censos and The World Bank (Poverty and Human Resources Development Research Group, LSMS Data).

The survey includes information regarding income and expenditures of 4191 families, in which live 22810 individuals. Of these individuals, 12645 are at working age (15-65). Moreover, we have information on 2079 non agricultural activities and 1547 farm activities.

The microsimulation model follows the discrete choice labour supply approach, and it is estimated through a multinomial logit specification (see Bourguignon *et al.*, 2003 and Bussolo and Lay, 2003). Each agent can choose among three labour market alternatives: being inactive, being a wage worker or being self-employed. The equations of the model are the following:

Regression model for log-wage earnings:
$$Log(YL_{mi}) = a_{l(mi)} + b_{l(mi)} \cdot X_{mi} + c_{l(mi)} \cdot \lambda_{mi} + v_{mi} \qquad (1)$$

Choice of labour market status:
$$LM_{mi} = \alpha_{g(mi)} + \beta_{g(mi)} \cdot Z_{mi} + \varepsilon_{mi} \qquad (2)$$

Household *m*'s income generation model:
$$Y_m = \sum_{i=1}^{NC_m} YL_{mi} \cdot W_{mi} + YE_m - taxes_m \qquad (3)$$

Household specific consumer price index:
$$PCI_m = \sum_{s=1}^{10} \eta_{ms} \cdot P_{ms} \qquad (4)$$

Households' real income:
$$Y_m = \frac{Y_m}{PCI_m} \qquad (5)$$

The *first equation* of the model computes the logarithm of labour income of member *i* of household *m* as a linear function of his/her personal characteristics (vector X_{mi}) and of λ_{mi}, which represents the inverse Mills ratio estimated for the selection model. The residual term v_{mi} describes the effects of unobserved components on wage earnings. The equation is estimated separately for eight

different labour market segments, differentiated according to occupation (wage worker or self-employed), gender and skill level. The index function $l(mi)$ assigns individual i of household m to a specific labour market segment[4].

The *second equation* represents the choice of labour status made by household members. Each individual at working age has to choose among three alternatives: being a wage worker, being self-employed or being inactive. We estimate the selection model using a multinomial logit specification, which assigns each individual to the alternative with the highest associated probability. In our model we have arbitrarily set to zero the utility of being inactive. Vector Z_{mi} of explanatory variables includes some personal characteristics of individual i of household m. The equation is defined only for individuals at working age, and it is estimated separately for different demographic groups, defined for household heads, spouses and other members. The index function $g(mi)$ assigns each individual to a specific demographic group.

The *third equation* is an accounting identity that defines total household net income, Y_m, as the sum of the labour income of its members YL_{mi} (NC_m is the number of members at working age in household m) and of the exogenous income YE_m, net of taxes. The variable W_{mi} is a dummy variable taking value one if

[4] In the original model implemented in Bourguignon *et al.* (2003) there is a specific equation which estimates family income deriving from self-employment activity on the base of household's characteristics. In the present work we have instead the income declared by self-employed as labour income, and we do not need an additional equation to compute the income deriving from self-employment activity.

individual *i* of household *m* is a wage worker, and zero otherwise. Taxes on income are computed according to "Ley de equidad fiscal", which was introduced in 2003.

Real net income in equation *(5)* is computed dividing nominal household income by a household specific consumer price index, as computed in equation *(4)*, where η_{ms} are consumption shares for different goods and P_s is the price of good *s*.

We have grouped the various commodities into 10 consumption goods.

Estimation

The aim of the first equation in the model is to obtain efficient estimates for labour incomes and incomes deriving from self-employment activity, but only for those individuals that are observed to be inactive in the survey. These estimates are used in the case that, after a policy reform, one or more of them will change their labour market status and become wage workers or go into self-employment activity. In this case, using these estimates, we will be able to assign a wage or a labour income to individuals that have changed their labour market status after the simulation run.

For all the other individuals that are observed to receive a wage or to earn a positive income from their activity, we use instead the observed wage and income levels and not the estimated ones.

Equation (1) is estimated separately for each labour market segment, which is defined according to occupation, gender and skill level. An individual is considered high-skilled when his/her education attainment is more than primary

school, and unskilled otherwise. We estimated the equation using a Heckman two-step procedure to correct for the selection bias[5]. Vector X_{mi} includes some regional dummies, the logarithm of age, and the number of school years attended. In the selection equation we used a dummy indicating the presence or not of children under six, a dummy variable indicating the racial group (distinguished in white and non-white), and the number of adults living in the household to correct for the selection bias. The estimation results for the labour market segments low-skilled wage workers, women, and high-skilled self-employed, men, are reported in Appendix, Tables 1A and 2A.

Equation (2) represents the choice of the labour status made by individuals. Each individual can choose among three alternatives: being inactive, being a wage worker or being self-employed. The utility of being inactive is arbitrarily set to zero. Parameters of this equation were obtained through the estimation of a multinomial logit model, assuming that the residual terms ε_i are distributed according to the Extreme Value Distribution – Type I[6]. The estimation was

[5] Inactive people are divided only according to gender and skill level.

[6] The Extreme Value distribution (Type I) is also known as Gumbel (from the name of the statistician who first studied it) or double exponential distribution, and it is a special case of the Fisher-Tippett distribution. It can take two forms: one is based on the smallest extreme and the other on the largest. We will focus on the latter, which is the one of interest for us. The standard Gumbel distribution function (maximum) has the following probability and cumulative density functions, respectively:

pdf: $f(x) = \exp\left(-x - e^{-x}\right)$

CDF: $F(x) = \exp\left(-e^{-x}\right)$.

conducted on sub-samples of individuals at working age, differentiated according to their demographic group (household heads, spouses, and other members). The explanatory variables include some regional dummies, sex, logarithm of age, skill level, illiteracy and racial group, the number of household members and that of children under six. For spouses and other members we also used labour market status, skill level and illiteracy of the household head. The model is estimated by Maximum Likelihood. The estimation results are reported in Appendix, Tables 3A to 5A.

Following the procedure described in Duncan and Weeks (1998), we drew a set of error terms ε_i for each individual from the extreme value distribution, in order to obtain for each individual an estimate that is consistent with his/her observed activity or inactivity choice. From these drawn values, we selected 100 error terms for each individual, in such a way that, when adding it to the deterministic part of the model, it perfectly predicts the activity status that is observed in the survey.

After a policy change, only the deterministic part of the model is recomputed. Then, by adding the random error terms previously drawn to the recomputed deterministic component, a probability distribution over the three alternatives (being a wage worker, being self-employed or being inactive) is generated for each individual. This implies that the model does not assign every individual from the sample to one particular choice, but it gives the individual probabilities of being in one condition rather than in the other. This way, the model does not

identify a particular choice for each individual after the policy change, but generates a probability distribution over the different alternatives[7].

2.2. The CGE Model

The main characteristics of the CGE model are the following.

There are two representative households, divided according to their residence in urban or rural areas. Both maximize utility according to a Linear Expenditure System (LES) system. They obtain income from their supply of labour and capital, and they also receive transfers from the government and remittances from abroad.

Domestic production is carried on by 38 production sectors, which are producing 38 commodities following a Leontief technology in the aggregation of value added (capital and aggregate labour) and the intermediate aggregate. The aggregation of intermediate inputs is done according to a Leontief technology, while capital and labour are aggregated into value added according to a Constant Elasticity of Substitution (CES) function.

Labour demand is divided into eight different labour types, distinguished according to sex, qualification level and occupation (wage workers or self-employed) of the workers. These labour types are then aggregated to form a

[7] This procedure is also described in Creedy and Kalb (2005). See also Creedy *et al.* (2002b).

"labour aggregate" according to a CES function. The price of each labour type is set at the level of its marginal productivity.

Investments in the economy are savings-driven.

The public sector consumes goods, saves, and raises taxes on households' income, on firms' output and sells, on consumption of certain goods and tariffs on imports. It also pays subsidies to exports, and transfers to firms and households. The equilibrium of public budget constraint is reached through the change in public savings.

For the foreign sector the Armington assumption holds, and domestic production and imports are aggregated through a CES function. Domestic production is divided into supply of exports and supply of domestically produced good for the internal market following a Constant Elasticity of Transformation (CET) function. A stylized scheme of the production structure and of the foreign sector design is reported in Appendix B.

Calibration

The calibration of the model is done on the Social Accounting Matrix (SAM) for Nicaragua for the year 2000 (see Sánchez and Vos, 2005 for details).

Some parameter values were taken from the existing literature. Sánchez and Vos (2005) is the source for the values of the substitution elasticities in the production function, in the Armington function (aggregation of the composite good sold on the internal market), and in the CET function (aggregation of internal production

intended to the internal market and exports)[8]. Sánchez and Vos (2005) also estimated the values of income elasticity of consumption demand using the data of the EMNV 2001. The values for the Frisch parameter were taken from Lluch, Powell and Williams (1977).

For what concerns the elasticity of substitution among the eight different labour types, we implemented a sensitivity analysis, using different values of elasticity. We report the results of the simulation for the different values considered in this sensitivity analysis (see Appendix C).

2.3. Linking The Two Models

The basic difficulty of the Top-Down approach is to ensure consistency between the micro and macro levels of analysis. Thus, it is necessary to introduce a system of equations to ensure the achievement of consistency between the two models[9]. In practice, this consists in imposing the macro results obtained with the CGE model onto the microeconomic level of analysis. In particular, the changes in the commodity prices, P_q, must be equal to those resulting from the CGE model; the changes in average earnings with respect to the benchmark in the micro-

[8] Sánchez and Vos (2005) used the values estimated in Sánchez (2004) for a similar model for Costa Rica, carrying on a sensitivity analysis for some parameter values.

[9] This way, what happens in the MS module can be made consistent with the CGE modelling by adjusting parameters in the MS model, but, from a theoretical point of view, it would be more satisfying to obtain consistency by modelling behaviour identically in the two models.

simulation module must be equal to the changes in the wage rate obtained with the CGE model, as well as the change in the return to capital in the micro-simulation module must be equal to the one observed after the simulation run in the CGE model. In addition, the changes in the number of wage workers in the micro-simulation model must match those observed in the CGE model.
In our model, these consistency conditions translate into the following set of constraints, which can be called "linking" equations:

Household specific consumer price index:
$$PCI_m = \sum_{s=1}^{NG} \eta_{ms} \cdot P_{ms} \cdot \left(1 + \Delta P_s^{CGE}\right) \qquad (L.1)$$

Logarithm of wage earnings:
$$Log\left(YL_{mi}\right) = Log\left[\hat{YL}_{mi} \cdot \left(1 + \Delta PL^{CGE}\right)\right] \qquad (L.2)$$

Capital income:
$$YK_m = KS_m \cdot \left(1 + \Delta PK^{CGE}\right) \qquad (L.3)$$

Employment level:
$$\Delta EMP_l^{MS} = \Delta EMP_l^{CGE} \qquad (L.4)$$

The variables with no superscripts are those coming from the microsimulation module; those with the ^ notation correspond to the ones that have been estimated: in particular, $Log(\hat{YL}_{mi})$ is the wage level resulting from the regression model for individual *i*, member of household *m*, while $\hat{W}_{mi}$ is the labour market status of individual *i* of household *m* deriving from the estimation of the binomial choice model.

ΔP_s^{CGE}, ΔPL^{CGE} and ΔPK^{CGE} indicate, respectively, the change in the prices of goods, the change in the wage rate and in the return to capital deriving from the simulation run of the CGE model, while ΔEMP_l^{CGE} and ΔEMP_l^{MS} are the

employment level percentage changes for the CGE model and the microsimulation model for labour type *l*.

From equation *(L.4)*, the number of newly employed (or inactive) of labour type *l* resulting from the MS model must be equal to the change in the employment level of labour type *l* observed after the CGE run. This implies that the CGE model determines the employment level of the economy after the simulation, and that the MS model selects which individuals among the inactive persons have the highest probability of becoming employed (if the employment level is increased from the CGE simulation result), or either who, among the wage workers or self-employed, has the lowest probability of being employed after the policy change (if the employment level is decreased)[10].

One possible way of imposing the equality between the two sets of parameters of system of equations *(L)* is through a change in the parameters of the selection and regression models. Following Bourguignon *et al.* (2003b), we restrict this change in the parameters to a change in the intercepts of functions *(1)* and *(2)*. The justification for this choice is that it implies a *neutrality* of the changes, that is, changing the intercepts a of equation *(1)* just shifts proportionally the estimated labour income of all individuals, without causing any change in the ranking between one individual and the other. The same applies for the labour market status selection equation: we choose to change the intercept α of equation *(2)*, and this will shift proportionally all the individual probabilities of each alternative,

[10] And, in this case, his/her new wage level will be determined by the regression model of wage earnings.

without changing their relative positions in the probability distribution, only to let some more individuals become employed (or some less if the employment rate of the CGE model is decreased), irrespectively of their personal characteristics. This change in the intercept will be of the amount that is necessary to reach the number of wage workers or self-employed resulting from the CGE model. Thus, this choice preserves the ranking of individuals according to their *ex-ante* probability of being employed, which was previously determined by the estimation of the multinomial model. For this reason the change in the intercept parameter satisfies this neutrality property.

3. Simulation

The simulation of the introduction of DR-CAFTA into the Nicaraguan economy consists of a reduction of tariff rates on imports from the US.

As we are working with a static model, we cannot model the scheduled gradual change in the tariff rates, which is planned to be distributed along the ten years following the introduction of the Trade Agreement. As our model does not have any dynamic characteristic, it will be able capture the effects of the Treaty in the short-medium run, say about five years. Thus, the simulation we implemented will take into account the reduction in the tariff rates which is intended to take place after the first five years of effectiveness of the Treaty. This choice is expected to have no big influence on the results of the model, as the main tariff

reduction for most of the commodities will take place in the first year after the introduction of the Agreement.

As our model is only a one-country study, we are not going to model the changes in the regime adopted in USA with respect to goods and commodities imported from Nicaragua. So, for instance, we are not going to take into account the access quotas imposed on these imports from Nicaragua to USA. These quotas are represented by limits to the importable quantities of some goods (in particular, beef, peanuts, cheese and sugar), but they are planned to reach an unlimited amount for beef and peanuts after the fifteenth year of enforcement of the Treaty, while for cheese they will be more than doubled after sixteen years. The unique quota which is expected to remain quite low is the one imposed on sugar, which will reach an amount 30% superior than the one imposed in the first year of enforcement of the Agreement.

The general reduction in the first five years after the introduction of the Treaty is about thirty percent of the previously adopted tariffs. The reductions adopted for the specific commodities and services are reported in Table 1C.

As the supporters of the agreement with US expected an increase in the capital investments from USA in Nicaragua, we also considered an exogenous change in the initial capital endowment of different amounts (2, 5 and 10 %, respectively). The percentage changes resulting from the simulation for a selected set of variables are reported in Appendix C, Tables 2C-10C.

A sensitivity analysis was also conducted to take into account different possible values for the elasticity of substitution of labour demand at the stage of

aggregation of the eight different types of labour, which are divided according to sex, qualification level and occupation (wage workers or self-employed) of the workers, as explained in the description of the CGE model.

The results show a very little answer of the economy to the tariff change. This outcome is not completely surprising, because the tariff levels which were in force previous the introduction of the DR-CAFTA were already quite low. Moreover, other studies found not only for Nicaragua but also for other countries in the region the same small answer to trade liberalization[11].

The sole reduction of tariffs on imports will cause a very small increase in total domestic production which in the best hypothesis will be of 0.2 %. However, if we consider a small value for the elasticity of substitution among different labour inputs (elasticity fixed at 0.3), the change in domestic output is even negative. The negative response of output in this case is alleviated when considering a positive shock in the initial capital endowment, but this shock has to be of significant amount to cause a positive change in output (10% change in capital endowment).

The reduction of the tariff rates on imports does not generate significant losses for the government, as tax revenues do not decrease of high amounts. When the elasticity of substitution for labour is considered at the same level of the one used

[11] See for instance Sánchez (2005), Vos *et al.* (2004), and the book edited by Ganuza et al. (2004), which contains sixteen country-studies on different countries in Latin and Central America on the consequences of the trade liberalization carried on during the last decades in this region.

for value added aggregation, tax revenues even increase, due to the higher production and consumption levels in the economy. This increase becomes even bigger when we introduce a positive shock to capital endowment.

Taking into consideration the positive shock to capital endowment, the changes considered are in general of a higher amount, but anyway in the best hypothesis of a 10% change in the capital stock, the resulting change in domestic production will be around 1.5%.

In the first scenario (reduction of tariff rates on imports only), the change in labour demand apparently favours unskilled workers, and women in particular, except for the case with a low elasticity of substitution, where a small increase in the demand for qualified workers is experienced. The change in the employment levels of wage workers and self-employed depends similarly on the adopted value of the elasticity of substitution. Anyway, all the changes occurring in the employment levels of the different labour inputs are very small.

When the elasticity of substitution is sufficiently high (higher than 0.3), real wage is observed to increase, as well as real income does, thus increasing consumption levels for both rural and urban households.

For what concerns the microeconomic results, that is the changes in income distribution and poverty, we can observe in general very small changes in the underlying indices.

Taking into account only the reduction in tariffs on imports, poverty rates at a national level decrease in all the counterfactuals. On the contrary, income

inequality is rising, especially when we consider separated indices for urban and rural areas. Poverty seems to decrease more in urban than in rural areas.
This result of an increasing income inequality in both urban and rural areas confirms what was already found by Vos *et al.* (2004) for most of Latin and Central American countries.
When we take into account also the positive shock on capital, then income inequality does not increase so much as before, and it slightly decreases in some cases. Anyway, the changes resulting in both income inequality and poverty indices remain very small, especially in rural areas, where poverty is observed to have its greatest incidence.

4. Conclusion

The small positive results deriving from our analysis show that after the introduction of the Free Trade Agreement with US in Nicaragua cannot be seen as the unique solution to the high poverty rates and the unequal income distribution of the country. In the best hypothesis the consequent increment in production would be of around 1.5%. This result is not surprising, as the tariff levels in force before the introduction of the DR-CAFTA were already quite low, after the process of trade liberalization carried on during the 1990s in all Central and Latin America's countries.
The main impact of the Treaty is to be found in the increase of exports, which, according to the supporters of the Agreement, are expected to be the leading

engine of future development and economic growth in the country. Anyway, this increment in the amount of exported good is able to increase domestic production of only 1.5 percentage points in the best scenario.

It is true however that in our model we did not take into account the possible improvement in productivity generated by the new investments in advanced technology coming from the US, which could have given a major boost to the economy. Anyway, the dynamic model developed by Sánchez and Vos (2006), which includes also a positive shock on factor productivity, finds again small responses of the economy to trade liberalization, and to the Trade Agreement with the USA in particular.

The DR-CAFTA alone seems to be unable to bring about big changes in the structure of the economy, and especially for what concerns poverty and inequality reduction. It should at least be accompanied by other policies supporting lower incomes, especially in rural areas. One possible future implementation of the model presented here could be the design and the analysis of such a policy.

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Appendix A – Estimation Results

Table 1A - Estimation results, Heckman selection model for labour income (low-skilled wage workers, women)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs = 3126
Censored obs = 2396
Uncensored obs = 730

Wald chi2(10) = 151.74
Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lty						
lage	.2210825	.1690677	1.31	0.191	-.1102841	.552449
arur	-.9978383	.44287	-2.25	0.024	-1.865848	-.1298289
r1	-.1468691	.2538034	-0.58	0.563	-.6443145	.3505764
r2	-.8507314	.2710743	-3.14	0.002	-1.382027	-.3194355
r3	-.8852242	.3774232	-2.35	0.019	-1.62496	-.1454883
_cons	6.120207	1.318075	4.64	0.000	3.536827	8.703586
select						
lage	-.0491581	.0605332	-0.81	0.417	-.167801	.0694849
arur	-.4525106	.0540818	-8.37	0.000	-.558509	-.3465122
r1	.1448655	.0925955	1.56	0.118	-.0366183	.3263493
r2	-.1463364	.0947095	-1.55	0.122	-.3319636	.0392908
r3	-.2925868	.1034305	-2.83	0.005	-.4953068	-.0898667
gr12	.0851561	.129487	0.66	0.511	-.1686337	.3389459
ch6_12	-.012388	.0542111	-0.23	0.819	-.1186398	.0938638
nad	-.0365392	.0134625	-2.71	0.007	-.0629251	-.0101532
_cons	-.1723666	.2697849	-0.64	0.523	-.7011353	.3564022
mills						
lambda	1.939433	1.187985	1.63	0.103	-.3889746	4.267841
rho	0.87894					
sigma	2.2065578					
lambda	1.9394331	1.187985				

lage=logarithm of age; arur=urban/rural area (0=urban, 1=rural); r1, r2, r3=regional dummies for the four regions: Managua, Pacific, Central and Atlantic regions (reference region: Managua); gr12=racial group (0=white, 1=non-white); ch6_12=presence or not of children under 6 (0=no children under 6, 1=one or more children under 6); nad=number of adults living in the household; lambda=inverse mills ratio.

Table 2A - Estimation results, Heckman selection model for labour income (high-skilled self-employed, men)

```
------------------------------------------------------------------------------
Heckman selection model -- two-step estimates   Number of obs      =       958
(regression model with sample selection)        Censored obs       =       488
                                                Uncensored obs     =       470

                                                Wald chi2(12)      =    270.65
                                                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lty          |
        lage |   .4970857   .5662874     0.88   0.380    -.6128172    1.606989
        arur |  -.3199981   .2471247    -1.29   0.195    -.8043536    .1643574
          r1 |  -.4281195   .2428315    -1.76   0.078    -.9040604    .0478214
          r2 |  -.4064177   .2625873    -1.55   0.122    -.9210793    .1082439
          r3 |  -.1487554   .3285819    -0.45   0.651    -.7927641    .4952532
      annist |   .1340232   .0627497     2.14   0.033     .0110361    .2570103
       _cons |   8.314737   2.186083     3.80   0.000     4.030093    12.59938
-------------+----------------------------------------------------------------
select       |
        lage |   2.016758   .1282089    15.73   0.000     1.765473    2.268043
        arur |   .0078036   .1328345     0.06   0.953    -.2525472    .2681544
          r1 |   .0429545   .1260169     0.34   0.733    -.2040341    .2899431
          r2 |   .1740407   .1379282     1.26   0.207    -.0962937    .4443751
          r3 |   .2301884   .1756594     1.31   0.190    -.1140976    .5744744
        gr12 |  -.2246951   .2298711    -0.98   0.328    -.6752342     .225844
      annist |  -.0445373   .0334132    -1.33   0.183     -.110026    .0209513
      ch6_12 |   .3841464   .0971689     3.95   0.000     .1936988     .574594
         nad |  -.1266104   .0246628    -5.13   0.000    -.1749486   -.0782723
       _cons |  -5.800225   .4880658   -11.88   0.000    -6.756817   -4.843634
-------------+----------------------------------------------------------------
mills        |
      lambda |  -1.695824   .4715574    -3.60   0.000    -2.620059   -.7715885
-------------+----------------------------------------------------------------
         rho |   -0.81581
       sigma |  2.0786962
      lambda |  -1.695824   .4715574
------------------------------------------------------------------------------
```

lage=logarithm of age; arur=urban/rural area (0=urban, 1=rural); r1, r2, r3=regional dummies for the four regions: Managua, Pacific, Central and Atlantic regions (reference region: Managua); annist=years of schooling; gr12=racial group (0=white, 1=non-white); ch6_12=presence or not of children under 6 (0=no children under 6, 1=one or more children under 6); nad=number of adults living in the household; lambda=inverse mills ratio.

Table 3A - Estimation results, multinomial model, household heads (RRR)

```
------------------------------------------------------------------------------
Multinomial logistic regression                 Number of obs   =       3590
                                                LR chi2(22)     =     797.50
                                                Prob > chi2     =     0.0000
Log likelihood = -3217.2906                     Pseudo R2       =     0.1103
------------------------------------------------------------------------------
         lms |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1            |
        arur |   .8561071    .113767    -1.17   0.242     .6598011    1.110819
          r1 |   1.204847   .2030816     1.11   0.269     .8658815    1.676506
          r2 |   .9194698   .1637857    -0.47   0.637     .6485036    1.303655
          r3 |     1.1405   .2361092     0.64   0.525     .7601116    1.711249
         sex |   .1642134   .0196199   -15.12   0.000     .1299298    .2075432
        lage |   .1011155    .022915   -10.11   0.000      .064851    .1576591
        qual |   1.668111   .2418169     3.53   0.000     1.255541    2.216251
        alfa |   .9043098   .1256603    -0.72   0.469     .6887105    1.187402
        gr12 |   1.005275    .283091     0.02   0.985     .5788706    1.745773
         lnc |   .9991803    .125738    -0.01   0.995     .7807782    1.278675
        nch6 |   .8752728   .0594136    -1.96   0.050     .7662381     .999823
-------------+----------------------------------------------------------------
2            |
        arur |   1.365137   .1701919     2.50   0.013     1.069194    1.742993
          r1 |   1.287282   .2180664     1.49   0.136     .9235909    1.794187
          r2 |     1.5104    .264805     2.35   0.019      1.07117    2.129735
          r3 |   1.902738   .3845238     3.18   0.001     1.280442    2.827471
         sex |   .1848543   .0206106   -15.14   0.000     .1485675     .230004
        lage |   .3972877   .0874067    -4.20   0.000      .258127    .6114723
        qual |   .8802342   .1289723    -0.87   0.384     .6605105     1.17305
        alfa |   .9350666   .1190693    -0.53   0.598     .7285383    1.200142
        gr12 |   .7824629   .2069581    -0.93   0.354     .4659342    1.314023
         lnc |   1.191989   .1426843     1.47   0.142     .9427167    1.507174
        nch6 |   .8777799   .0555592    -2.06   0.039     .7753695    .9937165
------------------------------------------------------------------------------
(lms==0 is the base outcome)
```

arur=urban/rural area (0=urban, 1=rural); r1, r2, r3=regional dummies for the four regions: Managua, Pacific, Central and Atlantic regions (reference region: Managua); sex=gender dummy (0=man, 1=woman); lage=logarithm of age; qual=skill level (0=primary school or less, 1=more than primary school); alfa=dummy variable for literacy (0=literate, 1=illiterate or semi-literate); gr12=racial group (0=white, 1=non-white); lnc=logarithm of number of household members; nch6=number of children under 6.

Table 4A - Estimation results, multinomial model, spouses (RRR)

```
------------------------------------------------------------------------------
Multinomial logistic regression                 Number of obs   =       2572
                                                LR chi2(30)     =     631.36
                                                Prob > chi2     =     0.0000
Log likelihood =   -2161.52                     Pseudo R2       =     0.1274
------------------------------------------------------------------------------
         lms |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1            |
        arur |   .4358674   .0666385    -5.43   0.000     .3230105    .5881553
          r1 |   1.223036   .2255632     1.09   0.275     .8520266      1.7556
          r2 |   .9471159    .185596    -0.28   0.782     .6450634    1.390605
          r3 |   .8042683    .183824    -0.95   0.341      .513866    1.258787
         sex |   .0345528   .0116624    -9.97   0.000     .0178313    .0669553
        lage |   1.327584    .335074     1.12   0.262     .8095135    2.177209
        qual |   2.601077   .4143482     6.00   0.000     1.903522    3.554254
        alfa |   .7055243   .1330822    -1.85   0.064     .4874733    1.021111
        gr12 |   1.195158   .3769703     0.57   0.572     .6440862     2.21772
         lnc |    1.16033   .2078675     0.83   0.406     .8167566    1.648428
      ch6_12 |   .7477552   .1079255    -2.01   0.044     .5635121    .9922375
         sh1 |   .9673427    .211349    -0.15   0.879     .6303857    1.484412
         sh2 |    .672693   .1499654    -1.78   0.075     .4345663    1.041304
    qual_hhh |   1.094168   .1706227     0.58   0.564     .8060266    1.485317
    alfa_hhh |   .6367528   .1255317    -2.29   0.022     .4326752    .9370867
-------------+----------------------------------------------------------------
2            |
        arur |   .5572857   .0636597    -5.12   0.000     .4454959    .6971273
          r1 |   1.672449   .2910338     2.96   0.003     1.189131    2.352209
          r2 |   .9085255   .1661865    -0.52   0.600      .634799    1.300283
          r3 |   1.049831   .2100081     0.24   0.808     .7093252    1.553795
         sex |   .1213444   .0407452    -6.28   0.000      .062835    .2343352
        lage |   2.114567   .4180649     3.79   0.000     1.435267    3.115372
        qual |   .9232702   .1335782    -0.55   0.581     .6953084    1.225971
        alfa |   .6021397   .0776533    -3.93   0.000     .4676537    .7753006
        gr12 |   .7999386   .1801195    -0.99   0.322     .5145108    1.243709
         lnc |   1.280937   .1789178     1.77   0.076     .9741685    1.684307
      ch6_12 |   .8038738   .0951288    -1.84   0.065      .637468    1.013718
         sh1 |   .5111478   .0957976    -3.58   0.000     .3540113    .7380331
         sh2 |   1.030198   .1850972     0.17   0.868     .7244095    1.465067
    qual_hhh |   1.227156   .1720607     1.46   0.144     .9322918    1.615279
    alfa_hhh |   .8849606   .1147124    -0.94   0.346     .6864163    1.140933
------------------------------------------------------------------------------
(lms==0 is the base outcome)
```

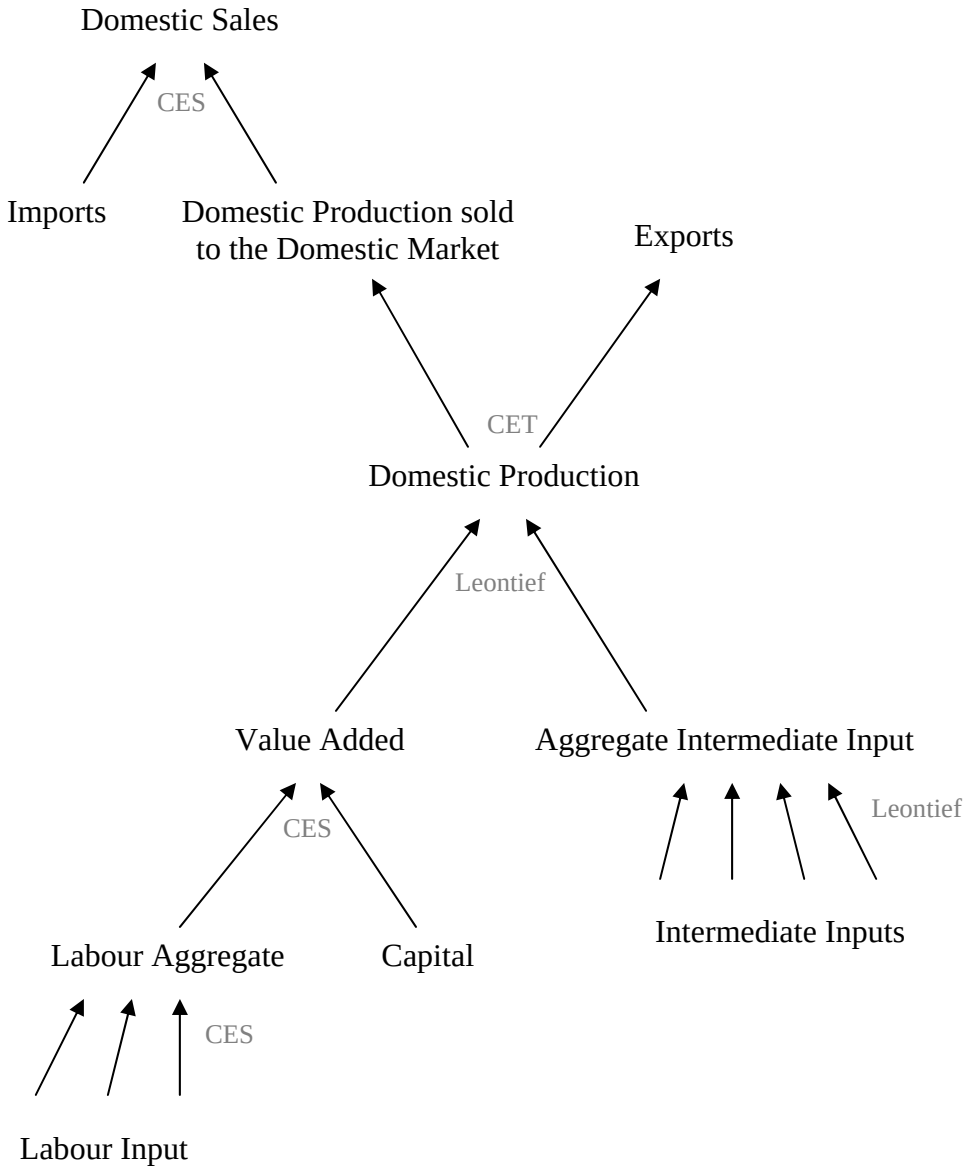
arur=urban/rural area (0=urban, 1=rural); r1, r2, r3=regional dummies for the four regions: Managua, Pacific, Central and Atlantic regions (reference region: Managua); sex=gender dummy (0=man, 1=woman); lage=logarithm of age; qual=skill level (0=primary school or less, 1=more than primary school); alfa=dummy variable for literacy (0=literate, 1=illiterate or semi-literate); gr12=racial group (0=white, 1=non-white); lnc=logarithm of number of household members; ch6_12=presence or not of children under 6 (0=no children under 6, 1=one or more children under 6); sh1,sh2=dummy variables for the occupational status of the household head: inactive, wage worker or self-employed (reference category: inactivity); alfa_hhh=dummy variable for literacy of the household head (0=literate, 1=illiterate or semi-literate).

Table 5A - Estimation results, multinomial model, other members (RRR)

```
------------------------------------------------------------------------------
Multinomial logistic regression                 Number of obs   =       4992
                                                LR chi2(32)     =    1721.62
                                                Prob > chi2     =     0.0000
Log likelihood = -4408.0407                     Pseudo R2       =     0.1634
------------------------------------------------------------------------------
         lms |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1            |
        arur |   .8244439   .0727119    -2.19   0.029     .6935685    .9800154
          r1 |    .979827   .1079306    -0.19   0.853     .7895638    1.215938
          r2 |   .9185511   .1077731    -0.72   0.469     .7298477    1.156044
          r3 |   .7114212    .097806    -2.48   0.013     .5433803     .931429
         sex |   .2040953   .0154282   -21.02   0.000       .17599     .236689
        lage |   6.759236   .8813768    14.65   0.000     5.234852     8.72752
        qual |    .957752   .0847464    -0.49   0.626     .8052576    1.139125
        alfa |   .6994105   .0801423    -3.12   0.002     .5587233    .8755228
        gr12 |   .8804213   .1702805    -0.66   0.510     .6026448    1.286233
         lnc |    .887087   .1008944    -1.05   0.292     .7098282    1.108611
        ch12 |   1.205024   .1483014     1.52   0.130     .9467583    1.533743
      ch6_12 |   1.430704   .1305793     3.92   0.000     1.196358    1.710953
         sh1 |   .9774192   .0966605    -0.23   0.817     .8051976    1.186477
         sh2 |   .7871059    .074041    -2.54   0.011     .6545802    .9464626
    qual_hhh |   .7249137   .0737278    -3.16   0.002     .5939014    .8848268
    alfa_hhh |   1.385381   .1231207     3.67   0.000     1.163916    1.648984
-------------+----------------------------------------------------------------
2            |
        arur |   1.276138   .1232602     2.52   0.012     1.056043    1.542105
          r1 |    1.34498   .2145616     1.86   0.063     .9838428     1.83868
          r2 |   2.176651   .3497891     4.84   0.000     1.588547    2.982479
          r3 |   1.921958   .3372869     3.72   0.000     1.362591    2.710955
         sex |   .1503253   .0131246   -21.70   0.000      .126682    .1783811
        lage |   2.516042   .3836938     6.05   0.000     1.865995    3.392542
        qual |   .7105529   .0727359    -3.34   0.001     .5813838    .8684202
        alfa |    .914365   .1044524    -0.78   0.433     .7309415    1.143817
        gr12 |   1.328942    .301983     1.25   0.211     .8512998    2.074576
         lnc |   1.100904   .1445853     0.73   0.464     .8510562      1.4241
        ch12 |   1.304911   .1839732     1.89   0.059     .9898608    1.720235
      ch6_12 |   .9476044   .0965729    -0.53   0.597     .7760306    1.157112
         sh1 |    .651611    .091971    -3.03   0.002     .4941359    .8592714
         sh2 |   2.897396   .3289583     9.37   0.000     2.319349     3.61951
    qual_hhh |   .7006015   .0903713    -2.76   0.006     .5440937    .9021284
    alfa_hhh |   1.030809   .0972319     0.32   0.748     .8568167    1.240134
------------------------------------------------------------------------------
(lms==0 is the base outcome)
```

arur=urban/rural area (0=urban, 1=rural); r1, r2, r3=regional dummies for the four regions: Managua, Pacific, Central and Atlantic regions (reference region: Managua); sex=gender dummy (0=man, 1=woman); lage=logarithm of age; qual=skill level (0=primary school or less, 1=more than primary school); alfa=dummy variable for literacy (0=literate, 1=illiterate or semi-literate); gr12=racial group (0=white, 1=non-white); lnc=logarithm of number of household members; ch12=dummy variable for presence of children (under 15) (0=no children, 1=one or more children); ch6_12=presence or not of children under 6 (0=no children under 6, 1=one or more children under 6); sh1,sh2=dummy variables for the occupational status of the household head: inactive, wage worker or self-employed (reference category: inactivity); alfa_hhh=dummy variable for literacy of the household head (0=literate, 1=illiterate or semi-literate).

Appendix B – The Structure of Production and Foreign Sector



Appendix C – Simulations

Table 1C - Tariff change in the first five years after the introduction of DR-CAFTA

Commodity or service group	Percentage change
Coffee	-0.536
Other agricultural products	-0.543
Animals and animal products	-0.667
Forestry and wood extraction	-0.308
Fish and other fishing products	-0.956
Mining	-
Meat and fish	-0.180
Sugar*	0.178
Milk products	-0.050
Other industrial food products	-0.407
Beverages and tobacco	-0.231
Textiles, clothes, shoes and leather products	-0.221
Textiles, clothes, shoes and leather products (Zona Franca)	-0.221
Wood products and furniture	-0.191
Pulp, paper and paper products, printing	-0.380
Refined petrol, chemical products, rubber and plastic products	-0.147
Glass and other non metallic products	-0.123
Common metals and their products	-0.320
Machinery and transport equipment	-0.129
Motor vehicles trade and repair	-0.846
Average reduction	-0,314

* The raise in the tariff of this good is due to the fact that the quota imposed on the quantity of sugar was transformed in tariff in the first year.

Table 2C - Simulation results, macroeconomic variables, elasticity of substitution for labour inputs 0.3 (percentage deviations from benchmark values)

	Sim1	**Sim2**	**Sim3**	**Sim4**
Wage rate	-0.269	-0.211	-0.278	1.594
Real wage rate	-0.026	-0.018	0.054	2.126
Capital return	-0.211	-0.073	-0.346	-4.066
Consumer price index	-0.243	-0.193	-0.332	-0.521
Capital endowment	0.000	2.000	5.000	10.000
Public savings	-1.161	7.879	20.087	28.818
Tax revenues	-0.754	1.855	5.062	8.221
Public expenditure	-0.360	-0.160	-0.141	0.562
Aggregate employment	0.000	0.000	0.000	0.000
Imports	0.136	-0.532	-0.239	0.280
Exports	0.277	0.451	3.382	8.331
Sales on the domestic market	-0.232	-0.149	-0.247	1.015
Domestic production	-0.274	-0.212	-0.279	1.592
Investment	0.005	-0.021	-0.141	-2.159
High-skilled workers employment level	0.004	-0.046	-0.051	-0.027
Low-skilled workers employment level	-0.004	0.046	0.051	0.027
Male workers employment level	-0.005	-0.029	-0.029	0.049
Female workers employment level	0.005	0.029	0.029	-0.049
Wage workers employment level	0.157	0.038	-0.009	0.141
Self-employed workers employment level	-0.157	-0.038	0.009	-0.141

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 3C - Simulation results, employment and wage rate changes, household income and consumption levels, elasticity of substitution for labour inputs 0.3 (percentage deviations from benchmark values)

	Sim1		Sim2		Sim3		Sim4	
	Wage rate	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**
High-skilled wage workers, men	-1.049	0.784	-0.321	0.109	-0.070	-0.209	1.313	0.276
High-skilled wage workers, women	-0.414	0.141	-0.459	0.248	-0.546	0.269	1.586	0.006
High-skilled self-employed, men	1.007	-1.268	0.527	-0.735	0.029	-0.307	2.242	-0.636
High-skilled self-employed, women	1.628	-1.872	0.422	-0.632	-0.304	0.025	2.159	-0.554
Low-skilled wage workers, men	0.017	-0.290	-0.039	-0.173	-0.290	0.011	0.902	0.684
Low-skilled wage workers, women	-0.247	-0.027	-0.280	0.068	-0.311	0.032	1.954	-0.354
Low-skilled self-employed, men	-0.347	0.074	-0.497	0.286	-0.533	0.256	1.722	-0.128
Low-skilled self-employed, women	-0.517	0.245	-0.253	0.041	-0.171	-0.108	1.864	-0.267
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Households' nominal income	-0.209	-0.249	-0.125	-0.262	-0.231	-0.324	-0.076	1.420
Households' real income	0.036	-0.004	0.064	-0.049	0.096	0.032	0.485	1.825
Households' disposable income	-0.209	-0.249	-0.125	-0.262	-0.231	-0.324	-0.076	1.420
Households' consumption expenditure	-0.222	-0.249	-0.133	-0.262	-0.246	-0.324	-0.081	1.420
Households' savings	-0.209	-0.249	-0.125	-0.262	-0.231	-0.324	-0.076	1.420
Household specific price index	-0.245	-0.245	-0.189	-0.213	-0.327	-0.356	-0.558	-0.397
Households' consumption level	0.023	-0.011	0.058	-0.056	0.082	0.028	0.469	1.847
Households' utility level	0.023	-0.009	0.059	-0.059	0.084	0.032	0.483	1.989

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 4C - Simulation results. macroeconomic variables (elasticity of substitution for labour inputs 0.7) (percentage deviations from benchmark values)

	Sim1	**Sim2**	**Sim3**	**Sim4**
Wage rate	0.057	0.092	0.649	1.561
Real wage rate	0.070	0.497	0.818	2.936
Capital return	-0.042	-1.035	-1.301	-6.444
Consumer price index	-0.013	-0.403	-0.168	-1.335
Capital endowment	0.000	2.000	5.000	10.000
Public savings	0.432	6.386	23.009	44.283
Tax revenues	-0.003	1.807	6.374	11.644
Public expenditure	-0.093	0.113	0.298	0.075
Aggregate employment	0.000	0.000	0.000	0.000
Imports	0.134	0.806	-0.364	3.039
Exports	0.272	3.210	3.124	14.019
Sales on the domestic market	0.088	-0.073	0.346	1.189
Domestic production	0.048	0.090	0.647	1.537
Investment	0.078	-0.177	0.199	0.620
High-skilled workers employment level	-0.002	-0.157	-0.038	0.337
Low-skilled workers employment level	0.002	0.157	0.038	-0.337
Male workers employment level	-0.049	0.109	-0.154	0.318
Female workers employment level	0.049	-0.109	0.154	-0.318
Wage workers employment level	0.060	-0.066	-0.046	0.389
Self-employed workers employment level	-0.060	0.066	0.046	-0.389

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 5C - Simulation results, employment and wage rate changes, household income and consumption levels, elasticity of substitution for labour inputs 0.7 (percentage deviations from benchmark values)

	Sim1		Sim2		Sim3		Sim4	
	Wage rate	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**
High-skilled wage workers, men	-0.038	0.086	0.376	-0.285	0.911	-0.262	-0.296	1.838
High-skilled wage workers, women	-0.999	1.058	0.982	-0.884	0.430	0.216	3.272	-1.683
High-skilled self-employed, men	0.602	-0.551	-0.112	0.202	0.911	-0.262	0.705	0.826
High-skilled self-employed, women	5.535	-5.199	0.032	0.058	-0.833	1.492	-0.421	1.965
Low-skilled wage workers, men	0.870	-0.815	-0.730	0.825	0.662	-0.016	0.500	1.031
Low-skilled wage workers, women	-0.186	0.234	0.013	0.077	0.911	-0.262	0.512	1.019
Low-skilled self-employed, men	-0.462	0.513	-0.068	0.158	0.911	-0.262	3.166	-1.578
Low-skilled self-employed, women	0.178	-0.130	0.043	0.046	-0.660	1.315	3.725	-2.109
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Households' nominal income	0.035	-0.001	-0.164	-0.087	0.050	0.608	-0.796	1.843
Households' real income	0.045	0.024	0.234	0.332	0.229	0.749	0.625	2.999
Households' disposable income	0.035	-0.001	-0.164	-0.087	0.050	0.608	-0.796	1.843
Households' consumption expenditure	0.037	-0.001	-0.174	-0.087	0.054	0.608	-0.847	1.843
Households' savings	0.035	-0.001	-0.164	-0.087	0.050	0.608	-0.796	1.843
Household specific price index	-0.010	-0.025	-0.396	-0.417	-0.178	-0.141	-1.413	-1.122
Households' consumption level	0.050	0.013	0.226	0.337	0.230	0.744	0.542	3.043
Households' utility level	0.050	0.016	0.230	0.364	0.236	0.805	0.563	3.276

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 6C - Simulation results, macroeconomic variables, elasticity of substitution for labour inputs equal to value added aggregation sectoral elasticities (percentage deviations from benchmark values)

	Sim1	**Sim2**	**Sim3**	**Sim4**
Wage rate	0.197	0.172	0.399	0.813
Real wage rate	0.173	0.483	0.406	1.236
Capital return	-0.082	-0.900	-0.386	-2.106
Consumer price index	0.024	-0.309	-0.007	-0.417
Capital endowment	0.000	2.000	5.000	10.000
Public savings	0.759	9.952	23.589	30.675
Tax revenues	0.305	2.748	6.666	8.967
Public expenditure	0.085	0.122	0.410	0.771
Aggregate employment	0.000	0.000	0.000	0.000
Imports	0.288	1.313	0.728	0.068
Exports	0.591	4.254	5.376	7.894
Sales on the domestic market	0.223	0.047	0.357	0.597
Domestic production	0.188	0.169	0.390	0.797
Investment	0.081	0.277	0.157	-1.990
High-skilled workers employment level	-0.027	-0.146	-0.148	-0.354
Low-skilled workers employment level	0.027	0.146	0.148	0.354
Male workers employment level	-0.021	-0.115	-0.128	0.143
Female workers employment level	0.021	0.115	0.128	-0.143
Wage workers employment level	-0.072	-0.127	-0.179	-0.375
Self-employed workers employment level	0.072	0.127	0.179	0.375

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 7C - Simulation results, employment and wage rate changes, household income and consumption levels, elasticity of substitution for labour inputs equal to value added aggregation sectoral elasticities (percentage deviations from benchmark values)

	Sim1		Sim2		Sim3		Sim4	
	Wage rate	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**	**Wage rate**	**Empl. level**
High-skilled wage workers. men	0.052	0.136	0.983	-0.807	1.770	-1.356	2.223	-1.394
High-skilled wage workers. women	-0.328	0.518	-0.469	0.641	-0.668	1.065	1.117	-0.316
High-skilled self-employed. men	0.538	-0.349	0.598	-0.427	0.194	0.196	0.632	0.165
High-skilled self-employed. women	5.093	-4.667	-0.288	0.457	0.622	-0.231	1.510	-0.703
Low-skilled wage workers. men	1.627	-1.416	0.517	-0.347	0.753	-0.360	0.998	-0.199
Low-skilled wage workers. women	-0.289	0.478	-0.260	0.429	-0.445	0.839	0.502	0.294
Low-skilled self-employed. men	-0.650	0.843	-0.602	0.775	-0.543	0.938	-1.287	2.111
Low-skilled self-employed. women	0.039	0.148	0.159	0.010	0.996	-0.599	2.033	-1.211
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Households' nominal income	0.120	0.074	-0.075	-0.047	0.192	0.135	0.087	0.168
Households' real income	0.087	0.076	0.234	0.277	0.191	0.167	0.490	0.619
Households' disposable income	0.120	0.074	-0.075	-0.047	0.192	0.135	0.087	0.168
Households' consumption expenditure	0.127	0.074	-0.079	-0.047	0.204	0.135	0.093	0.168
Households' savings	0.120	0.074	-0.075	-0.047	0.192	0.135	0.087	0.168
Household specific price index	0.033	-0.002	-0.308	-0.324	0.001	-0.033	-0.401	-0.448
Households' consumption level	0.100	0.065	0.229	0.278	0.207	0.161	0.501	0.639
Households' utility level	0.100	0.071	0.236	0.299	0.211	0.173	0.513	0.683

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.

Table 8C - Microeconomic results, income distribution and poverty changes (elasticity of substitution for labour inputs 0.3)

		Benchmark	Sim1	Sim2	Sim3	Sim4
Gini index		0.607	0.12%	-0.24%	0.02%	0.13%
P0	General	58.18	-0.08%	0.04%	0.16%	-1.27%
	Extreme	35.35	0.14%	-0.40%	0.14%	-1.35%
P1	General	32.34	-0.06%	-0.28%	0.24%	-1.35%
	Extreme	18.23	-0.21%	-0.28%	0.22%	-1.35%
P2	General	22.62	-0.15%	-0.30%	0.25%	-1.34%
	Extreme	12.78	-0.39%	-0.31%	0.26%	-1.13%

		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Gini index		0.577	0.553	2.31%	1.68%	-0.34%	0.06%	0.05%	-0.03%	0.07%	0.13%
P0	General	43.45	77.00	-0.20%	0.00%	0.00%	0.07%	0.29%	0.07%	-2.15%	-0.63%
	Extreme	20.89	53.83	0.20%	0.10%	-1.22%	0.00%	0.41%	0.00%	-2.25%	-0.91%

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.
The Gini index is computed on per-capita gross income.
The poverty line for the general poverty rate is fixed at a level of 5157 $C per year, while the extreme poverty line is 2691 $C.
P0 is the “headcount ratio”: it measures the incidence of poverty as the proportion of total population lying below the poverty line.
P1 is the “poverty gap ratio”, which measures the intensity of poverty. as it reflects how far the poor are from the poverty line.
P2 is also called “severity of poverty index” as it gives an indication of the degree of inequality among the poor.

Table 9C - Microeconomic results, income distribution and poverty changes (elasticity of substitution for labour inputs 0.7)

		Benchmark	Sim1	Sim2	Sim3	Sim4
Gini index		0.607	-0.18%	0.14%	-0.07%	-0.07%
P0	General	58.18	-1.40%	1.46%	-0.33%	-1.11%
	Extreme	35.35	-2.36%	2.07%	-0.27%	-1.77%
P1	General	32.34	-2.07%	1.85%	-0.41%	-1.41%
	Extreme	18.23	-2.15%	1.88%	-0.80%	-1.05%
P2	General	22.62	-2.13%	1.86%	-0.60%	-1.24%
	Extreme	12.78	-1.88%	1.65%	-1.12%	-0.51%

		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Gini index		0.577	0.553	1.71%	1.73%	0.29%	0.07%	0.06%	-0.20%	-0.35%	0.14%
P0	General	43.45	77.00	-3.04%	-0.21%	3.03%	0.35%	-0.49%	-0.21%	-2.46%	-0.14%
	Extreme	20.89	53.83	-4.28%	-1.41%	2.77%	1.74%	1.04%	-0.91%	-3.69%	-0.81%

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.
The Gini index is computed on per-capita gross income.
The poverty line for the general poverty rate is fixed at a level of 5157 $C per year, while the extreme poverty line is 2691 $C.
P0 is the “headcount ratio”: it measures the incidence of poverty as the proportion of total population lying below the poverty line.
P1 is the “poverty gap ratio”, which measures the intensity of poverty. as it reflects how far the poor are from the poverty line.
P2 is also called “severity of poverty index” as it gives an indication of the degree of inequality among the poor.

Table 10C - Microeconomic results, income distribution and poverty changes (elasticity of substitution for labour inputs equal to value added aggregation sectoral elasticities)

		Benchmark	Sim1	Sim2	Sim3	Sim4
Gini index		0.607	0.05%	-0.19%	0.00%	0.00%
P0	General	58.18	-0.45%	0.12%	-0.08%	-0.37%
	Extreme	35.35	-0.47%	-0.27%	-0.07%	-0.27%
P1	General	32.34	-0.56%	-0.02%	-0.23%	-0.39%
	Extreme	18.23	-0.35%	-0.21%	-0.20%	-0.57%
P2	General	22.62	-0.49%	-0.13%	-0.23%	-0.44%
	Extreme	12.78	-0.36%	-0.14%	-0.12%	-0.66%

		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Gini index		0.577	0.553	-0.12%	0.17%	-0.23%	-0.15%	-0.02%	0.03%	-0.04%	-0.01%
P0	General	43.45	77.00	-1.08%	0.00%	0.10%	0.14%	-0.10%	-0.07%	-0.59%	-0.21%
	Extreme	20.89	53.83	-1.43%	0.00%	-0.83%	0.00%	-0.21%	0.00%	-0.84%	0.00%

Sim1: reduction of tariff rates on imports from USA (see Table 1C).
Sim2: reduction of tariff rates on imports from USA and 2% reduction of initial capital endowment.
Sim3: reduction of tariff rates on imports from USA and 5% reduction of initial capital endowment.
Sim4: reduction of tariff rates on imports from USA and 10% reduction of initial capital endowment.
The Gini index is computed on per-capita gross income.
The poverty line for the general poverty rate is fixed at a level of 5157 $C per year, while the extreme poverty line is 2691 $C.
P0 is the “headcount ratio”: it measures the incidence of poverty as the proportion of total population lying below the poverty line.
P1 is the “poverty gap ratio”, which measures the intensity of poverty. as it reflects how far the poor are from the poverty line.
P2 is also called “severity of poverty index” as it gives an indication of the degree of inequality among the poor.