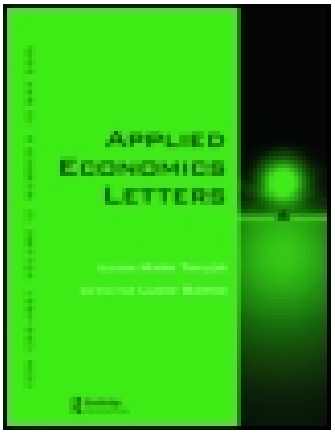

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Assessing the impacts of trade on poverty and inequality

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This paper uses a computable general equilibrium model to simulate different trade liberalization policy scenarios and counterfactual microsimulations to assess the impacts of greater trade openness on household income distribution and poverty ratios. Our conclusion is that trade liberalization alone may not be sufficient to significantly reduce poverty and inequality.

I. INTRODUCTION

In a large number of countries, trade liberalization reforms introduced during the 1990s were very ambitious and took place at a very rapid pace. The expectation was that after increasing exposure to international trade developing countries would engage in a fast-growth track with improvements in productivity and income and positive spillovers on inequality and poverty indicators. There is, however, some controversy about the effectiveness of such reforms (Ganuza *et al*., 2002).

In this paper we use computable general equilibrium simulations and counterfactual scenarios to assess the effects of trade liberalization on employment, poverty and inequality indicators for the case of Brazil. The case of Brazil is of interest as the country adopted an ambitious trade liberalization program in the 1990s that has effectively increased productivity and the returns to schooling for the most skilled workers but that has not generated any substantial change in growth patterns (Carneiro and Arbache, 2003). Analysis of the poverty and inequality effects of greater trade exposure in this context may thus offer important lessons for other developing countries.

The paper is organized as follows. After this Introduction, Section II makes use of a computable general equilibrium (CGE) model for Brazil to simulate the impacts of greater openness on major labour market indicators. Section III applies the elasticities obtained with the CGE model strategy to assess the impact of different policy scenarios on poverty and inequality indicators. Section IV concludes, pointing to the limited scope of trade liberalization to significantly affect poverty and inequality in Brazil.

II. COUNTERFACTUAL CGE MODEL SIMULATIONS

Model description

The model solves endogenously for quantities and prices, and for the income of institutions and disaggregates the production factors and institutions as an attempt to capture the distributive impacts of economic changes.[1] Labour is divided into eight categories reflecting the different types of labour force – given by their status of labour contract – and schooling (see Appendix for details). Families are divided into nine categories according to income, degree of urbanization and status of the household head.

There are 841 equations and endogenous variables.[2] The price equations are presented first, followed by equations that describe production and value-added generation. Next are equations that describe the mapping of value

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[1] The income flow in a CGE model is represented by a Social Accounting Matrix (SAM). The different accounts in the SAM delineate the boundaries of an economy wide model. Thus, the specification of a complete model requires that the market, behavioral and system relationships embodied in each account in the SAM be described in the model (Robinson *et al*., 1999).

[2] The model we use has been adapted to the Brazilian case by Barros *et al*. (2001).

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added into institutional income. The circular flow is then completed by equations showing the balance between supply and demand for goods by the various agents. Finally, there are a number of system constraints that the model economy must satisfy. These include both market clearing conditions and the choice of macro closure for the model.[3]

The general equilibrium block. The production function employs three factors (labour, capital and intermediate inputs) and is specified in three stages. In the first stage, the different types of labour (F_l) are aggregated in a Cobb–Douglas labour demand function (L) for each sector (i):

$$L_i = \prod_i F_{il}\beta^{li}$$

In the second stage, aggregate labour factors and capital (K) are linked through a CES function to obtain the value added for each sector (X_i):

$$X_i = \alpha_i^D[\alpha_i L_i^{\rho ip} + (1-\alpha_i)K_i^{\rho ip}]^{1/\rho ip}$$

Finally, in the third stage, value added is associated to intermediate inputs through a Leontief function of the following form:

$$INT_i = \sum_j \alpha_{ij} X_j$$

The firm maximizes profits and the prices of inputs, production factors and output are fixed. Profit maximization is carried out with the technological constraints specified in the production function. As a result of the maximization, wages equal the marginal productivity of labour.

The producer takes the decision as to where to sell his output based on the comparison of the domestic and international prices, besides considering a restriction related to the capacity of redirecting this output to different markets. Consumers, on the other hand, choose amongst domestic or imported goods that are considered as perfect substitutes (see Armington, 1970).

The labour market behaviour. The adjustment rule incorporates a feature that ensures the existence of involuntary unemployment in equilibrium. As in Barros *et al*. (2001) we considered two alternatives for that purpose. The first is based on the hypothesis of wage rigidity that establishes that nominal wages are fixed exogenously with the adjustment in the labour market being reached via changes in employment levels. In the model, four out of eight labour markets operate according to this rule: formal rural, low skill urban formal, low skill public workers and high skill public worker. The second alternative represents a negative relationship between the unemployment rate and the wage level, such as in the wage curve literature.[4] We consider that middle and high skill workers in the formal urban sector, as well as the low and high skill workers in the informal sector, have their wages fixed according to this rule.

The block of income transfer. In the second block of the model, the formation of the income flows appropriated by families, firms, government and rest of the world are considered. The income distribution is generated by attributing the remuneration of capital to firms and the remuneration of labour to families. The distribution of earnings of the eight types of labour among the nine types of families is made according to the composition of these families. The government acts in this process by promoting the redistribution of the income generated in the production process through tax collections from firms and families, tariffs levied on imported goods and social security contributions. After collecting this revenue the government then redistributes it among the families by means of retirement pensions and other government transfers. Transfers to firms are made by means of interest payments on public bonds and consumption of goods.

Empirical implementation strategy

The Social Accounting Matrix (SAM) uses data from the Brazilian Institute of Geography and Statistics (IBGE) for 1996. The empirical implementation of the model follows two stages. In the first stage, the model is solved for the base year without the imposition of any changes in the parameters or exogenous variables. Thus, the optimal solution must replicate the original values of the variables for the base year. In the second stage, a set of exogenous variables and/or parameters is modified to mimic a given policy, in our case a trade-liberalization-oriented policy. The model is then solved to find the solution compatible with the modifications in the base model. The rationale of our simulations is explained below.

Simulation 1. The first simulation imposes a 20% increase in the exports of the sectors that use more skilled labour in their production processes. The choice of these sectors was based on the comparison of each sector's average years of schooling with the overall average; the sectors which were above the overall average (6.64 years) were considered the most dynamic and, therefore, had their exports raised by 20% in the simulation.

[3] The model is not presented in full to save space. A complete description can be found in Robinson *et al*. (1999).
[4] See Blanchflower and Oswald (1998) for the theoretical foundations of the wage curve. The actual parameters used in the model have been estimated by Barros and Mendonça (1995).

Simulation 2. The second simulation assesses the effects of an across-the-board 50% cut in import tariffs. At this point, the idea is to investigate whether an overall and significant tariff reduction would contribute to greater output, higher salaries and more employment.

Simulation 3. The third simulation is an attempt to assess the impacts of a Free Trade Agreement of the Americas (FTAA) in which import tariffs are reduced and international prices of exports and imports change simultaneously. The tariff reductions and the international price changes under the FTAA have been estimated by the IFPRI team using predictions derived from their world model (Löfgren *et al*., 2002).

Simulation 4. As in the case of the previous exercise, the fourth simulation is an attempt to assess the effects of a broader World Trade Organization (WTO) agreement in which import tariff rates are lowered to zero and international prices of exports and imports change according to the predictions of the IFPRI's world model.

Analyzing the simulation results

Summary results appear in Table 1 for some selected aggregate variables. In most of the counterfactual scenarios, unemployment rates tend to go down and average real household incomes tend to increase. In the simulations in which we altered the level of import tariff rates, that is an across-the-board 50% import tariff cut, an FTAA scenario and a WTO agreement, the results converged to lower unemployment rates and higher household incomes for all types of labour and families. The absolute magnitudes of these changes, however, were very small. This could be indicative that greater openness may have a limited impact on poverty and inequality indicators in Brazil, which is in accordance with previous results (Green *et al*., 2001).

In the experiment that corresponded to an increment of 20% in the exports of the skilled labour-intensive sectors, there was an overall rise in the real average income of all families and distinct effects in terms of unemployment. The increase in average incomes, however, was differentiated by type of family. The largest increases were observed for middle- to high-income families in both the rural and the urban sectors. As for the behaviour of unemployment, while low skill informal workers and high skill formal sector workers had their unemployment rates reduced, those with low to middle skills in the formal sector and the skilled workers in the informal sectors experienced increases in their unemployment rates.

III. MICROSIMULATIONS OF THE IMPACT OF TRADE ON POVERTY AND INEQUALITY

The parameters obtained with the CGE model are now used in a new round of microsimulations to investigate the likely impacts of export demand shocks, export promotion and trade liberalization on the degree of income

Table 1. *Percentage change from base year in macroeconomic variables per simulation*

Variables	Simulation 1	Simulation 2	Simulation 3	Simulation 4
Real GDP (RGDP)	0.531	−0.008	−0.009	−0.027
Household savings (HHSAV)	−0.080	0.288	0.184	0.392
Government savings (GOVSAV)	−0.680	6.340	5.406	12.616
Depreciation (DEPREC)	−0.334	−0.267	−0.278	−0.644
Total savings (SAVING)	−0.062	−0.706	−0.911	−2.132
Fixed investment (FXDINV)	−1.093	−0.735	−0.967	−2.270
Tariff revenue (TARIFF)	−0.336	−48.413	−42.315	−98.336
Indirect taxes (INDTAX)	−0.079	−0.008	0.029	0.045
Total revenue (GR)	−0.026	−1.103	0.961	−2.269
Avg. real household income – poor families	0.093	0.144	0.153	0.322
Avg. real household income – poor families headed by retired	0.052	0.079	0.081	0.174
Avg. real household income – middle income urban families	0.100	0.151	0.160	0.337
Avg. real household income – high income urban families	0.107	0.171	0.177	0.377
Avg. real household income – poor rural families	0.080	0.129	0.140	0.291
Avg. real household income – middle income rural families	0.095	0.151	0.158	0.334
Avg. real household income – middle–high income families	0.127	0.189	0.193	0.413
Avg. real household income – high income families	0.156	0.198	0.199	0.423
Unemployment – low skill informal workers	−0.146	−0.427	−0.909	−0.403
Unemployment – skilled informal workers	−0.053	−0.211	−0.468	−0.214
Unemployment – low skill formal workers	−0.054	−0.286	−0.614	−0.275
Unemployment – middle skill formal workers	0.056	−0.428	−0.930	−0.434
Unemployment – high skill formal workers	0.004	0.025	0.026	−0.003

Table 2. *Counterfactual microsimulations of the effects of greater openness on poverty and equality*

		Increase export of skilled-labour intensive sectors (20%)		Cut import tariff rates by 50%		Import tariff rates under FTAA		Import tariff rates under WTO agreement	
	Original	Simulated	% change	Simulated	% change	Simulated	% change	Simulated	% change
Change in unemployment									
1	3.66	3.65	−0.146	3.64	−0.427	3.650	−0.909	3.630	−0.403
2	6.29	6.29	−0.053	6.28	−0.211	6.280	−0.468	6.260	−0.214
3	4.63	4.62	−0.054	4.61	−0.286	4.620	−0.614	4.600	−0.275
4	4.10	4.10	0.056	4.08	−0.428	4.080	−0.930	4.060	−0.434
5	2.08	2.08	0.004	2.08	0.025	2.080	0.026	2.080	−0.003
6	1.61	1.61	0.000	1.61	0.000	1.614	0.000	1.610	0.000
7	1.09	1.09	0.000	1.09	0.000	1.088	0.000	1.090	0.000
Poverty	33.41	34.07		34.06		34.06		34.06	
Extreme poverty	14.89	15.61		15.61		15.61		15.6	
Inequality (Gini)	0.600	0.604		0.604		0.604		0.604	
Change in average real income									
1	38.61	38.65	0.093	38.67	0.144	38.670	0.153	38.740	0.322
2	27.47	27.48	0.052	27.49	0.079	27.490	0.081	27.520	0.174
3	123.48	123.60	0.100	123.67	0.151	123.680	0.160	123.890	0.337
4	342.95	343.32	0.107	343.54	0.171	343.560	0.177	344.240	0.377
5	31.10	31.12	0.080	31.14	0.129	31.140	0.140	31.190	0.291
6	151.49	151.49	0.095	151.72	0.151	151.730	0.158	152.000	0.334
7	904.57	905.72	0.127	906.28	0.189	906.350	0.193	908.310	0.413
8	2606.15	2610.22	0.156	2611.31	0.198	2611.340	0.199	2617.170	0.423
Poverty	33.41	33.02		32.99		33.00		32.95	
Extreme poverty	14.89	14.98		14.97		14.98		14.97	
Inequality (Gini)	0.600	0.599		0.599		0.598		0.599	
Combined change									
Poverty	33.41	33.02		33.00		33.00		32.95	
Extreme poverty	14.89	14.99		14.98		14.98		14.97	
Inequality (Gini)	0.600	0.599		0.599		0.598		0.599	

inequality at the household level and on poverty and extreme poverty ratios. The methodology for this analysis is discussed in detail in Vos (2002). The counterfactual simulations are carried out to obtain a new distribution of income in which one or several parameters of the labour market structure are changed. The relevant labour market parameters in our case are: (i) the unemployment rate for each type of worker; and (ii) the average level of remuneration for each type of family.

The results of the counterfactual microsimulations are reported in Table 2. The table lists the baseline scenario and then presents the results of each simulation in terms of percentage changes in the unemployment rate for the six different types of labour and percentage changes in the real average household income for the eight types of families considered in our CGE model.[5] At the bottom of each of these sets of results, we have first the estimated impact of the change in the unemployment rate (keeping average household income constant) resulting from the policy simulation obtained with the CGE model on poverty and inequality indices, and second the impact of changes in average household income (keeping unemployment rates constant) on poverty and inequality. Finally, estimates of the new poverty ratios and Gini coefficients are presented considering a simultaneous shift in both unemployment rates and average household income. Because of space limitations, in what follows we will only refer to this last set of results.

In the baseline context, i.e. considering household level data for 1996 – Brazil had a poverty ratio of 33.4%, an extreme poverty ratio of 14.8% and a Gini coefficient of 0.60. In most of the policy scenarios, poverty and inequality levels declined following a reduction in unemployment and increases in real average household income resulting from a simulation of greater economic openness.

[5] We exclude public workers from the labor category and high-income families from the family types.

The microsimulation results show that the potential to reduce poverty and inequality is very limited, as overall poverty ratios declined at most by 0.5 percentage points while inequality and absolute poverty remained virtually unchanged. In the cases of an exogenous increase of 20% in exports in the sectors that use skilled labour, an across-the-board 50% cut in import tariffs, a FTAA and a WTO scenarios, overall poverty ratios dropped to roughly 33% while absolute poverty remained around 14.98% and Gini coefficients stayed at 0.599.

IV. CONCLUSIONS

Increasing exposure to foreign trade has promoted neither larger improvements nor deterioration in inequality and poverty indicators. The situation of extreme inequality in educational terms, that in a sense is responsible for an important segmentation in Brazilian labour markets, appears to be the issue to be tackled. Policy reforms aimed at improving poverty and inequality indicators should, therefore, aim at the reduction of the disparity in the skill composition of the labour force so that the positive impacts of greater efficiency and the benefits of greater economic integration that might be generated with further trade liberalization can be appropriated in a more equitable form by Brazilian workers.

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APPENDIX

Factors and families categories used in the model

Factors: the factors are divided in 10 groups, from which two are for capital and eight for labour. The capital groups are: self-employed workers and small entrepreneurs (with income up to R$1000), and other capitalists.

Labour is divided as follows:

- Unskilled informal workers: labour force employed in all sectors with no contribution to social security and up to four years of schooling;
- Skilled informal workers: labour force employed in all sectors with no contribution to social security and with more than four years of schooling;
- Rural formal workers: livestock and agriculture workers that contribute to social security;
- Urban unskilled formal workers: all workers except in livestock and agriculture, that contribute to social security and with schooling up to four years;
- Urban semi-skilled formal workers: all workers except in livestock and agriculture, that contribute to social security and with schooling ranging from four years to twelve years;
- Urban skilled formal workers: all workers except in livestock and agriculture, that contribute to social security and with more than twelve years of schooling;
- Unskilled civil servant: workers with labour contract regime that hinders firing and with up to four years of schooling;
- Skilled civil servant: workers with labour contract regime that hinders firing and with more than four years of schooling.

Families are divided as follows:

- Poor urban families: monthly per capita income lower than R$50 and headed by woman with no partner;
- Inactive poor urban families: monthly per capita income lower than R$50 and headed by an inactive person (disabled or retired);
- Other poor urban families: all other families with monthly per capita income lower than R$50;

- Urban low-income families: monthly per capita income ranging from R$50 to R$150;
- Urban medium-income families: monthly per capita income ranging from between R$150 to R$400;
- Rural poor families: monthly per capita income lower than R$50;
- Rural medium-income families: monthly per capita income ranging from R$150 to R$400;
- Medium-to-high-income families: all families with monthly per capita income ranging from R$400 to R$1000;
- High-income families: monthly per capita income higher than R$1000.