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TRADE AGREEMENTS AND THEIR IMPACTS ON THE FAMILIAR AGRICULTURE IN BRAZIL[♣]

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Abstract

The concept of Familiar Agriculture has been used in Brazil to guide the agriculture policy towards farmers who use the labor available at the household more intensively and also were historically less privileged by the agriculture policy. This paper evaluates the impacts of trade agreements scenarios on the Brazilian economy, industries and families, considering the differences between rural and urban households and familiar and commercial farmers.

We use the GTAPinGAMS computable general equilibrium model in its last version with the most recent available GTAP data. The model is modified to account for different households in Brazil, with a more detailed focus in several categories of familiar farmers. We simulate multilateral, regional and multi-regional agreements to measure the differentiated impacts of trade polices on groups of familiar farmers, commercial farmers and rural employees.

Our results show that the familiar farmers gain with the agreements and the income differential between rural and urban households decreases in Brazil. However, the income distribution among rural households is deteriorated, since the commercial farmers, relatively richer in land and capital, present higher gains than familiar farmers, and the rural employees, usually without land and education, suffer losses.

Key-words: Familiar agriculture, income distribution, trade policy, general equilibrium
JEL classification: F15, F13, Q12, C68

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1. INTRODUCTION

The last decades we world has experienced an intense process of wide spreading of trade regional agreements and deepening of trade relations among countries and blocks. Under the scope of the World Trade Organization (WTO), an intense search for trade integration among countries and continents followed the multilateral agreements from the Uruguay Round.

Several studies have discussed and measured the potential impacts of alternative trade agreements on Brazilian economy and its trade partners. Such studies have focused on the impacts of scenarios as the Free Trade Agreement of Americas (FTAA), a free trade area between Mercosul and European Union (EU), multilateral trade agreements discussed under the WTO, trade agreements with some specific countries, as USA and Mexico, or with blocks, as the Andean Community, or also unilateral tariff cuts in Brazil. Examples of those studies are Carvalho *et alii*. (1999), Mensbrugghe e Guerrero (2000), Hinojosa-Ojeda e Robinson (2000), Batista (2000, 2001), Figueiredo *et al.* (2001), Pereira (2001), Diao *et al.* (2001), Decreux e Guérin (2001), Roland-Holst e Van der Mensbrugghe (2001), Haddad *et al.* (2001, 2002), Gurgel *et al.* (2002), Gurgel e Campos (2003, 2006), Monteagudo e Watanuki (2003), Harrison *et al.* (2003), Hertel *et al.* (2003), Ferreira Filho e Horridge (2004, 2005), Anderson *et al.* (2005), Antimiani *et al.* (2005), Bussolo *et al.* (2005) e Gurgel (2006).

The debates about higher liberalization on agriculture products are particularly important for Brazil. Jank e Jales (2003) argue that the discussions about agriculture are one of the most controversial topic in all kind of negotiation table, multilateral, hemispheric, bi-regional, sub-regional and bilateral. They affirm that the greatest obstacles in the Doha Round, in the FTAA and in the Mercosul-UE agreement are directly connected to the agriculture theme.

Following Cline (2003), the reduction of trade barriers on agriculture markets tends to increase domestic prices on developing exporter countries, what should bring benefits to rural producers and contributes to the reduction of income inequality in the world. Hertel et al. (2003) affirm that the potential impacts from agriculture policies taken by developed countries on low income families, particularly the rural ones, on

developing countries has occupied a central role in the multilateral negotiations. Those authors discuss the possibilities of poverty reduction among farmers at developing countries as a consequence of lower trade barriers. Following the same idea, Buetre *et al.* (2004) affirm that the trade liberalization on agriculture markets should reduce poverty since there is a higher concentration of poor people in rural areas than in urban areas in the developing world.

In the case of Brazil, Harrison *et al*. (2003) measured the effects of trade policy options on the rural and urban poverty. They found an improvement in the income distribution, meanly among rural households, due to increases in the exports of agriculture and in the salaries of unskilled labor. At same time, Barreto *et al*. (2003) affirm that the income distribution impacts from lower trade barriers are related to the sectoral distribution of the labor by its qualification. They conclude that export promotion of industrial goods in Brazil will tend to affect negatively the income distribution.

Hertel et al. (2003) have estimated changes in the income distribution in Brazil from multilateral free trade. They conclude that poverty should reduce due to increase in the income of households who receive most of their income from agriculture activities. Following the same idea, Ferreira Filho and Horridge (2004, 2005) estimated a reduction in poverty in Brazil from scenarios of trade agreements in the Americas and multilateral agreements at Doha Round. They explain their results as resultant of a decrease in unemployment among less skilled labor, hired mostly by agriculture sector.

Azzoni et al. (2005) simulated a decrease in agriculture subsidies and measure the impacts on income distribution and poverty in Brazil. They verified an improvement in the average income of agriculture families and people employed in agriculture. Bussolo et al. (2005) have studied the same issue and have concluded that a Doha Round agreement brings modest impacts on income distribution, but a multilateral liberalization can produce substantial gains to poorest families in Brazil, mostly to those linked to agriculture.

In general, the studies about trade and income distribution in Brazil show agriculture families as gainers from trade agreements, what contributes to alleviation of poverty and improve income distribution. Those studies consider some level of dis-aggregation of households by income and rural and urban. However, excepting in the

case of Azzoni et al. (2005), those studies do not consider the characterization of the familiar agriculture in Brazil.

There is an enormous income inequality in agriculture and heterogeneity among households groups. Also, it is persistent some believe about a dichotomy between modern export-oriented agriculture and less productive agriculture producing for domestic markets. From these facts we can arise some important questions about the results of the papers discussed before. There is some consensus that agriculture families specialized in producing export goods should benefit from trade liberalization, since those goods are highly protected in international markets. However, the studies cited before do not capture the differences between families producing export goods and those producing for domestic markets.

As cited above, Azzoni et al. (2005) are the only to differentiate familiar agriculture and commercial agriculture[1] in Brazil. However, those authors just simulate multilateral reductions on agriculture subsidies, and do not allow conclusions about impacts from reduction of other trade barriers.

It is important to consider the differences between familiar agriculture and commercial agriculture to address questions not considered by other studies, as: trade agreements bring gains to all agriculture families, or just to commercial farmers? Does the familiar agriculture lose from trade integration? Which group among familiar farmers should be more benefited from trade agreements? The agriculture workers without land and capital can gain from trade? Urban families can benefit more than rural families?

The goal of this paper is to estimate the impacts of trade agreements under discussion on the Brazilian economy and households, considering the division between rural and urban families and between familiar and commercial farmers. Compared with previous studies, we advance in capturing the universe of the familiar agriculture and agriculture employees under a broad set of free trade scenarios.

Three reasons have motivated this alternative way to consider households in Brazil. First, it allows to present results of trade agreements on families relying on agriculture. Second, to explore the controversial dichotomy of the Brazilian agriculture sector, where business farmers using modern technology and targeting

[1] We use the terms “commercial agriculture” and “business agriculture” in opposition to familiar agriculture. The next section will define better what is officially considered as “familiar agriculture” in Brazil.

export markets coexist with familiar proprieties, supposedly more intensives in labor and oriented to domestic markets and subsistence products. Finally, this approach allows us to guide the public policy towards better alternatives to the familiar farmers, group considered in the last years the mean focus of the agriculture policy .

Compared with some of the previous papers about the theme, we are not concerned with changes in the poverty on income classes, but we just want to compare the changes in income distribution and welfare among household types covering familiar farmers, commercial farmers and agriculture employees.

The next section presents the characterization of familiar agriculture used here. The third section we describe the model and the treatment to add multiple households. We also present some of the benchmark data and scenarios simulated. The conclusions are drawn in the last section.

2. FAMILIAR AGRICULTURE IN BRAZIL

The study conducted by INCRA/FAO (2000) uses data from the Brazilian agriculture census (Censo Agropecuário) from IBGE about 1995/96 in order to characterize the familiar farmers. Such characterization is based on the social and production relations, instead of following the common approach of a maximum limit of land or value of production to separate familiar agriculture from commercial agriculture. The familiar agriculture is defined by the proprieties where the agriculture production is under direction of the farmer and the use of labor from his family (parents and relatives) is bigger than from hired labors. Also, some limit of area regionally established is considered.

The results from the study by INCRA/FAO show that 85% of the properties in Brazil were familiar agriculture in 1995/96. They occupied 30% of the total cultivate area and produced around 38% of the agriculture production (Table 1). The average area of familiar properties varies by region, being 26 ha in the country and ranging from 17 ha in the Northeast region and 84 ha in the Middle-west. The average annual monetary income of them was R$1,783[2] in 1995/96, while the same income was around R$16,400 in the case of the commercial farmers (INCRA/FAO, 2000).

[2] The nominal exchange rate in 1996 in Brazil was around 1R$ = 1U$.

Table 1 – Selected indicators about the agriculture families in Brazil – 1995/96

	Familiar Agriculture	Commercial Agriculture	Others*	Total
Number of properties	4,139,369	554,501	165,994	4,859,864
% of properties from the total	85%	11%	4%	100%
Total Area (1000 hectares)	107,768	240,042	5,801	353,611
Share in the total of agriculture areas	30%	68%	2%	100%
Average area / properties	26 ha	433 ha	-	-
Average monetary income	R$1,783	R$16,400		

Source: INCRA/FAO (2000).
*Public and religious institutions, non identified institutions.

Table 2 shows the participation of familiar agriculture in the Brazilian agriculture production. It suggests an expressive contribution from familiar agriculture in 1995/96, as 97% for tobacco, 84% for cassava, 67% for beans, 58% for pork, and 52% for dairy. The familiar agriculture also contributes to some considerable share of others goods, as corn, grapes, poultry, cotton, soybean and rice. It suggests that the universe of familiar agriculture goes beyond the dichotomy between the small farms producing to subsistence and domestic markets and big plantations producing export goods.

Table 2 – Share of production from familiar farms in the total value of production of selected products, Brazil, 1995/96.

Livestock	Dairy	Pork	Poultry	Rice	Banana	Coffee
24%	52%	58%	40%	31%	58%	25%
Beans	Tobacco	Orange	Cassava	Corn	Soybean	Grapes
67%	97%	27%	84%	49%	32%	47%

Source: INCRA/FAO (2000).

The INCRA/FAO (2000) study divided the familiar agriculture in sub-groups based on the average income of the farmers. They have used the value of the state average payment received by an agriculture worker to estimate an index called unity of hired labor (UHL). This index was used to compare the income received from agriculture production to the cost of opportunity (CO) of the familiar labor. This cost of opportunity was established as the daily payment given to a worker in agriculture.

Based on this comparison the INCRA/FAO study have defined four categories of familiar farmers:

- Type A - total income three times greater than the CO;
- Type B - total income between one to three times the CO;
- Type C - total income between half and one time the CO;
- Type D - total income equal or lower than half the CO;

We use those same categories to define the sub-groups for the familiar agriculture in the present paper. From this classification, 8.4% of the farmers were classified as type A, 20.4% as B, 16.9% as C and finally, 39.4% as D (INCRA/FAO, 2000). Table 3 presents some statistics about the categories of familiar farmers.

Table 3 – Selected statistics about familiar farmer's categories – 1995/96

	Types				
Statistics	A	B	C	D	Total
Number of properties	406,291	993,751	823,547	1,915,780	4,139,369
% of total	8.4	20.4	16.9	39.4	85.1
Area (ha)	24,141,455	33,809,622	18,218,318	31,599,055	107,768,450
% of total	6.8	9.6	5.2	8.9	30.5
Gross Value of Production	9,156,373	5,311,377	1,707,136	1,942,838	18,117,725
% of total	19.2	11.1	3.6	4.1	37.9

Source: INCRA/FAO (2000).

Some other important statistics to characterize the categories of familiar agriculture form the INCRA/FAO (2000) study have to do with the average income. The average income by property was R$ 15,986 for type A, R$ 3,491 for type B, R$ 1,330 for type C and R$ 98 for type D. The average area was 59 ha for type A, 34 ha for type B, 22 ha for type C and 16 ha for type D. Calculating the income per unity of land, type A generates R$ 269/ha, type B generates R$ 103/h and type C, R$ 60/ha. These numbers are greater then the average generated by commercial farmers, which is around R$ 40/ha.

Table 4 presents the share of the Brazilian value of production coming from familiar agriculture categories.

Table 4 – Percent share of production from Familiar farmer's categories in the Brazilian gross value of production, selected products, Brazil 1995/96.

Types	% Area	Livestock	Dairy	Pork	Poultry	Rice	Beans	Cassava	Corn
A	6.8	12.7	22.3	32.5	22.2	13.4	17.1	30.6	19.5
B	9.6	6.7	19.0	14.7	8.9	8.4	22.6	32.6	15.5
C	5.2	2.2	5.6	4.2	3.0	4.4	12.2	11.5	6.0
D	8.9	2.1	5.1	7.0	5.8	4.7	15.3	9.1	7.7

Source: INCRA/FAO (2000).

As discussed above, we follow the characterization of the familiar farmers in the INCRA/FAO (2003) study to define the multiple households in Brazil. We also include more categories in the multiple types of households: a group of commercial farmers, a group of agriculture workers (without any land possection) and four groups of urban households classified by income levels.

3. THE MODEL

To estimate the impacts from trade agreements on the income of rural families we need a methodology able to represent the intersectorial relations in the economy, trade flows and trade barriers, as also shocks in trade policy parameters. We have chosen to use the computable general equilibrium approach. More details about this technique can be found in Sadoulet e De Janvry (1995) e Shoven e Whalley (1998).

We departure from the *Global Trade Analysis Project* – GTAP Model (Hertel, 1997; GTAP, 2001). It was created in 1992 as a research program to provide a database and tool to develop quantitative analysis on international trade, reducing the costs of entry in developing general equilibrium models of global scale. This model allowed the establishment of a global research net for trade issues.

We choose specifically the *GTAPinGAMS* model (Rutherford and Paltsev, 2000; Rutherford, 2005) developed from the original GTAP model. The GTAPinGAMS model uses the database from GTAP, however, it is built as a mixed complementarity problem in the *General Algebraic Modeling System* (GAMS programming language (Brooke *et al.*, 1998). We use the most recent version of GTAPinGAMS, version 6, built on the GTAP database 6.

The *GTAPinGAMS* becomes suitable to accomplish the goals of the present research since it allows changes in its original structure. The model considers only one representative agent in each region, which is responsible for the consumption of goods and supply of primary factor of production. We change this formulation to include multiple agents in Brazil. In this way, we become able to capture the distributive impacts from trade policies on different household types.

The GTAPinGAMS[3] model is static, multiregional and multi-sectorial. The sectoral activities minimize costs subject to the technological constraints. It assumes a

[3] We reduce here the description of the model, since it is well documented and available at http://www.mpsge.org/gtap6/ . More details and a complete representation of equations can be found in Rutherford (2005).

CES production function combining, in the top level, intermediate inputs and a value-added composite in a Leontief function, and primary factors in a CES in the next level. Each intermediate input j is a CES aggregation of domestic and imported goods.

Each imported good is a CES aggregation of bilateral imports from different regions, combined following the Armington assumption, where one good is an imperfect substitute of the same good coming from different regions. Transport services are added to the bilateral imports as a proportional fraction to the value of imports, reflecting the differences in transportation margins among regions. Bilateral imports are subject to subsidies (or taxes) to exports and import tariffs. The government of the exporter region pays the subsidies (or receive the tax) to exports, while the tariffs are collected by the government of the importing region.

The representative consumer minimizes the cost of a basket of goods and services, assuming a Cobb-Douglas function in the substitution among composites goods and services. Each composite is formed by a CES function aggregating domestic and imported commodities. The consumption of government is a Leontief function of domestic and imported composite goods. Composites can not be substituted by each other, but domestic and imported components can substitute each other.

The model has three types of conditions to assure consistence of the database: market clearance in all markets of commodities and factors, zero profits in all sectors and income balance for representative agent and government. The equilibrium conditions determine relative prices and activity levels. The elasticities governing all CES functions are the same used in the original GTAP model.

The description of the model above represents the original set up of the GTAPinGAMS model. We modify this structure in order to substitute the representative agent in one region, Brazil, by several household types. We keep in general the same demand structure used in the original single representative agent, i.e., a CES function among composite of goods and services and composites as a CES aggregation of imported and domestic goods. More details about the database and procedure to dis-aggregation of households further in this paper can be found in the next sections and in Appendix I.

GTAPinGAMS uses the syntax of MPSGE (*Modeling Programming System for General Equilibrium*) algorithm, developed by Rutherford (1999). It builds the algebraic equations characterizing zero profit conditions and market clearance for the

sectors and income balance for consumers. It uses the mixed complementarity problem – MCP approach (Rutherford, 1995).

GTAP Aggregation and Benchmark data

GTAP6 accounts for 89 regions and 59 sectors/*commodities*. We aggregate those in 13 regions and 26 sectors (Table 6). Table 7 presents the benchmark macroeconomic data. Brazil represents a considerable share of Latin America, but it is a relatively small economy compared with most of the regions represented here.

Table 6 – GTAP aggregation

Regions	Sectors/Commodities	
1. Brazil	1. (pdr) paddy rice	14. (omt) other meat
2. Argentina	2. (wht) wheat	15. (vol) vegetable oils and fat
3. Uruguay	3. (gro) corn and cereals	16. (mil) dairy
4. Chile	4. (v_f) vegetable and fruits	17. (pcr) processed rice
5. Mexico	5. (osd) oil seeds	18. (sgr) sugar
6. Rest of Latin America (RAL)	6. (c_b) sugar cane and sugar beet	19. (ofd) other food
7. US	7. (pfb) plant-based fibers	20. (b_t) beverages and tobacco
8. Canada	8. (ocr) other agriculture products	21. (tex) textiles and apparel
9. European Union (EU)	9. (ctl) bovines, sheep and horses	22. (crp) chemicals, plastic, rubber
10. Rest of Europe (REU)	10. (oap) swine, poultry and other an.	23. (omf) other manufactured products
11. Japan	11. (rmk) raw milk	24. (trd) trade
12. China	12. (omn) mining, oil and gas	25. (otp) transport
13. Rest of World (ROW)	13. (cmt) meat of bovine, sheep, horses	26. (ser) services

Table 7 – Macroeconomic regional data (US$ millions 2001)

	Private consump.	Investment	Govern. Expens.	Exports (FOB)	Imports (CIF)	GDP
Brazil	302	105	100	74	79	503
Argentina	198	38	28	31	27	269
Uruguay	14	3	3	3	4	19
Chile	42	13	8	24	20	66
Mexico	412	122	68	166	150	618
Rest of Latin America	413	120	74	146	162	590
US	6,956	1,991	1,529	907	1,301	10,082
Canada	406	145	136	271	243	715
European Union	4,657	1,614	1,625	2,604	2,571	7,930
Rest of Europe	541	192	151	392	389	887
Japan	2,334	1,060	718	478	413	4,178
China	495	409	148	388	281	1,159
Rest of World	3,098	1,353	773	2,075	1,810	5,490

Source: GTAP 6.

Table 8 presents the sectoral data about output, imports and exports for Brazil. The Brazilian production is concentrated on services and other manufactured

products. However, we can see that agriculture exports have an important participation in the total of exports. Imports are concentrated in industrial sectors.

Table 8 – Output, exports and imports – Brazil (1,000 US$ of 2001)

	Output	% of total production	Export (FOB)	% of total exports	Imports (CIF)	% of total imports
Pdr	1,151	0.13	3	0.00	90	0.11
Wht	238	0.03	1	0.00	1,034	1.30
Gro	2,401	0.28	1,444	1.94	94	0.12
v_f	1,827	0.21	475	0.64	424	0.53
Osd	6,217	0.73	3,750	5.04	153	0.19
c_b	3,189	0.37	0	0.00	0	0.00
pfb	764	0.09	185	0.25	108	0.14
ocr	7,795	0.91	2,903	3.90	366	0.46
ctl	5,563	0.65	6	0.01	10	0.01
oap	6,565	0.77	256	0.34	99	0.12
rmk	2,719	0.32	1	0.00	1	0.00
omn	15,761	1.85	4,373	5.88	4,197	5.27
cmt	9,384	1.10	1,909	2.57	82	0.10
omt	4,666	0.55	2,050	2.75	39	0.05
Vol	6,708	0.79	700	0.94	155	0.20
mil	6,881	0.81	42	0.06	215	0.27
pcr	1,316	0.15	9	0.01	76	0.10
sgr	4,847	0.57	1,866	2.51	17	0.02
ofd	28,140	3.30	4,583	6.16	914	1.15
b_t	6,560	0.77	84	0.11	223	0.28
tex	18,229	2.13	1,278	1.72	1,495	1.88
crp	42,658	5.00	4,498	6.04	12,604	15.82
omf	179,357	21.00	35,332	47.48	41,420	52.00
trd	67,936	7.96	714	0.96	1,209	1.52
otp	27,021	3.16	1,635	2.20	3,645	4.58
ser	396,033	46.38	6,322	8.50	10,988	13.79
Total	853,925	100.00	74,419	100.00	79,658	100.00

Source: GTAP 6.

Table 9 presents the data about income for the different household types in Brazil. The household groups are: familiar agriculture (AF1 to AF4), commercial agriculture (ABu), agriculture employees (AEm), and urban households (Ur1 to Ur4). The definition of different household types follows the study of Azzoni *et al.* (2005).[4] The groups with lower numbers represent the poorest households of that group.

Table 10 shows the income shares for each household. It gives an idea about the importance of each primary factor in the composition of household income. As example, the poorest type of familiar agriculture receives most of its income from unskilled labor. The familiar farmers with higher average income have a diversified

[4] We present more information about the household data and how it was included and balanced to the GTAP data in the Appendix I. The data used to perform the multiple household approach were gently supplied by Prof. Joaquim Guilhoto from FEA-USP.

composition of sources of income. The agriculture employees, or rural workers, present the highest degree of dependency on only one primary factor, the unskilled labor, what makes their mobility to other income groups more difficult. The commercial agriculture (or business agriculture) and the richest urban households receive more than half of their income from capital.

Table 9 – Household income from sources – Brazil (US$ million)

Households	Source of income						**Total Income**
	Capital	Unskilled labor	Skilled labor	Land	Natural resources	Govern. transfers	
AF1	0.26	2.28	0.11	0.21	0.00	0.40	**3.26**
AF2	0.23	1.85	0.17	0.22	0.00	0.78	**3.26**
AF3	1.01	3.03	0.64	0.62	0.01	2.42	**7.73**
AF4	1.61	4.12	1.26	1.01	0.02	2.57	**10.58**
ABu	4.22	-	1.89	1.26	0.05	0.72	**8.14**
AEm	0.44	7.95	0.34	-	0.02	1.03	**9.77**
Ur1	3.29	8.90	0.89	-	0.08	1.91	**15.06**
Ur2	10.55	16.10	4.24	-	0.14	5.19	**36.23**
Ur3	19.92	26.34	11.79	-	0.26	10.06	**68.39**
Ur4	137.80	52.86	49.65	-	1.81	2.54	**244.66**
Total	179.33	123.43	70.97	3.32	2.41	27.63	**407.09**

Source: Azzoni *et al*. (2005), GTAP 6 and results from research.

Table 10 – Household income shares from sources – Brazil (%)

Households	Source of income						Total
	Capital	Unskilled labor	Skilled labor	Land	Natural resources	Govern. transfers	
AF1	7.87	69.91	3.30	6.36	0.14	12.41	100
AF2	7.08	56.77	5.30	6.88	0.13	23.83	100
AF3	13.06	39.13	8.31	8.03	0.17	31.30	100
AF4	15.19	38.91	11.86	9.52	0.20	24.32	100
ABu	51.83	-	23.21	15.47	0.65	8.84	100
AEm	4.47	81.34	3.46	-	0.18	10.55	100
Ur1	21.82	59.08	5.90	-	0.50	12.70	100
Ur2	29.13	44.45	11.69	-	0.40	14.34	100
Ur3	29.13	38.52	17.25	-	0.38	14.72	100
Ur4	56.32	21.61	20.29	-	0.74	1.04	100
Total	44.05	30.32	17.43	0.82	0.59	6.79	100

Source: Azzoni *et al*. (2005), GTAP 6 and results from research.

Table 11 shows how Brazilian households distribute their income between consumption and savings. We can notice the higher propensity to save for richer families (commercial farmers and urban 4).

We show household consumption shares with goods and services on Table 12. Services and manufactured products account for bigger shares in the expenditure of

Brazilian households. The expenses with food are a bigger share of total expenses for poorer households.

Table 11 – Household expenses with consumption and savings - Brazil

Households	Use of income				**Total income**
	Consumption		Savings		
	(US$ million)	%	(US$ million)	%	
AF1	3.08	94.47	0.18	5.53	**3.26**
AF2	2.98	91.65	0.27	8.35	**3.26**
AF3	6.90	89.21	0.83	10.79	**7.73**
AF4	8.57	81.01	2.01	18.99	**10.58**
ABu	5.85	71.88	2.29	28.12	**8.14**
AEm	9.02	92.34	0.75	7.66	**9.77**
Ur1	14.38	95.48	0.68	4.52	**15.06**
Ur2	34.39	94.93	1.84	5.07	**36.23**
Ur3	60.22	88.05	8.17	11.95	**68.39**
Ur4	156.40	63.93	88.26	36.07	**244.66**
Total	301.80	74.14	105.28	25.86	**407.09**

Source: Azzoni *et al*. (2005), GTAP 6 and results from research.

The information about trade barriers is crucial to the evaluation of impacts of trade agreements. We present the data about benchmark tariffs, export subsidies and domestic support on Tables A6, A7 E A8 of Appendix II. They reflect the tariff cuts agreed at the end of Uruguay Round, as also several regional agreements, as NAFTA and Mercosul. We can affirm from those data that Brazil and its Mercosul partners (Argentina and Uruguay) have relatively lower tariffs in agriculture products in comparison with other regions, except in the case of US and Canada. These two countries have very low tariffs in primary agriculture commodities. However, they apply higher tariffs in food products, as sugar and dairy, and other processed agriculture commodities, the same happening with Japan and EU.

Export subsidies are higher in EU, mostly in the exports of meat, sugar, processed rice, cereals and dairy products. Rest of Europe, US and some countries of Latin America also apply export subsidies in some agriculture products.

Regarding the domestic support, the four developed countries/regions in the database give some support to their farmers. At the EU, oil seeds and fiber plants (mostly cotton) receive more support. In US, paddy rice and oil seeds are the most benefited by domestic support. Subsidies in the use of land and capital in agriculture production are common in EU, US and Japan. In Canada, many agriculture products receive subsidies in the use of land.

Table 12 – Household consumption shares – Brazil (%)

	AF1	AF2	AF3	AF4	ABu	AEm	Ur1	Ur2	Ur3	Ur4
pdr	0.0	0.0	0.0	0.0	-	-	-	-	-	-
wht	0.2	0.2	0.1	0.1	-	-	-	-	-	-
gro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
v_f	1.0	0.9	0.7	0.3	0.3	0.5	0.5	0.4	0.3	0.2
osd	0.4	0.4	0.2	0.1	-	-	-	-	-	-
c_b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pfb	1.8	1.8	0.8	0.6	-	-	-	-	-	-
ocr	2.4	2.3	1.8	0.7	0.7	1.3	1.4	1.1	0.8	0.4
ctl	0.8	0.8	0.4	0.3	-	-	-	-	-	-
oap	1.6	1.3	1.1	0.4	0.7	0.6	0.6	0.4	0.3	0.2
rmk	0.5	0.6	0.5	0.3	0.3	0.5	0.4	0.3	0.3	0.1
omn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cmt	6.3	5.6	5.5	2.7	2.6	5.1	4.1	3.7	2.7	1.1
omt	4.0	3.4	3.0	1.2	1.6	2.3	2.2	1.5	1.0	0.5
vol	2.9	2.7	2.3	0.8	0.8	2.3	1.7	1.3	0.8	0.3
mil	3.6	4.4	4.4	2.5	2.4	4.0	3.3	2.8	2.2	1.0
pcr	2.5	2.2	1.8	0.5	0.5	1.2	1.2	0.8	0.4	0.1
sgr	1.9	2.1	1.5	0.5	0.6	1.5	1.3	0.9	0.5	0.2
ofd	17.5	16.6	14.2	7.4	6.5	12.2	12.6	10.5	7.7	3.7
b_t	3.5	3.3	3.3	2.0	1.9	3.4	2.8	2.7	2.3	1.1
tex	2.9	3.6	4.1	3.8	4.3	4.0	3.6	4.0	4.0	3.1
crp	1.2	1.2	1.5	3.7	3.3	2.3	2.7	3.1	3.7	5.1
omf	13.7	17.0	19.6	18.2	20.6	19.1	17.3	19.1	19.1	14.6
trd	4.1	4.2	5.1	12.6	11.1	7.8	9.1	10.5	12.4	17.1
otp	1.2	1.2	1.5	3.7	3.3	2.3	2.7	3.1	3.7	5.0
ser	26.2	24.4	26.9	37.6	38.5	29.7	32.6	33.9	37.7	46.1
Total	100	100	100	100	100	100	100	100	100	100

Source: Azzoni *et al*. (2005), GTAP 6 and results from research.

The data about trade protection show that agriculture markets in developed countries still very protected by different trade barriers. We should expect positive impacts on production of developing agriculture exporter's countries if trade agreements become able to reduce some of those barriers.

Scenarios

We implement several policy scenarios in discussion, as Doha Round, FTAA and trade agreement between EU and Mercosul. We consider cuts in different trade barriers for some scenarios, as also exceptions to the liberalization of some agriculture markets in others. The scenarios investigated are:

1) Tariff liberalization (lib_tar.): removal of all import tariffs for all regions;

2) Export subsidies liberalization (exp_sub): removal of all export subsides in all regions;

3) Elimination of subsidies to domestic production (dom_sup): removal of all subsidies given to domestic agriculture production (direct subsidies and subsidies to the use of primary factors) at developed countries (USA, EU, Japan and Canada);

4) Multilateral liberalization at Doha - Harbison (doha_har): cuts in tariffs, removal of export subsidies and cuts on domestic subsidies to agriculture production following the Harbinson proposal for Doha[5]: developed countries: - cuts of 75% in agriculture *ad valorem* tariffs[6] higher than 95%, - cuts of 70% in agriculture *ad valorem* tariffs between 15% and 95%, - cuts of 45% in agriculture *ad valorem* tariffs smaller than 15%, - cuts of 50% in non agriculture tariffs, - cuts of 28% for US and 16% for EU in domestic support, - elimination of export subsidies; developing countries: - cuts of 60% in agriculture *ad valorem* tariffs bigger than 120%, - cuts of 50% in agriculture *ad valorem* tariffs between 60% and 120%, - cuts of 40% in agriculture *ad valorem* tariffs between 20% and 60%, - cuts of 35% in agriculture *ad valorem* tariffs smaller than 20%, - cuts of 33% in non agriculture tariffs;

5) FTAA (ftaa): creation of the Free Trade Area of Americas (FTAA), implemented through the removal of import tariffs among all regions and commodities in the Americas;

6) FTAA with exceptions to the liberalization of some commodities (ftaa_exc): creation of FTAA as in the previous scenario, excluding the liberalization of dairy and sugar products, since they are highly protected at US markets;

7) FTAA with the removal of domestic support in US (ftaa_dsu): creation of FTAA as in scenario 5 and elimination of domestic support given to US farmers;

8) FTAA without Brazil (ftaa_sbr): creation of FTAA as in scenario 5, excluding Brazil from the agreement;

9) Trade agreement Mercosul-EU (meeu): creation of a free trade area between Mercosul and EU through the elimination of all import tariffs for all goods among countries from those regions;

10) Trade agreement Mercosul-UE with exceptions to the liberalization of some commodities (meeu_exc): creation of a free trade area between Mercosul an EU as in

[5] The cuts in tariffs and subsidies implemented here under the Harbinson scenario are an approximation of the Harbinson proposal, with some adaptation. Stuart Harbinson was responsible for negotiating the agriculture liberalization at WTO, and have proposed a decrease in the trade barriers for agriculture products that could be considerate an average between the EU position (linear cuts in tariffs and subsidies as in the Uruguay Round) and the US position (cuts in tariff peaks by the Swiss formula) (WTO, 2003).

[6] WTO considers agriculture tariffs those applied on primary agriculture commodities as also food and other manufactured goods from agribusiness chains.

the previous scenario, excluding the liberalization of meat (bovine and other), corn and cereals, dairy, paddy and processed rice, sugar and fruit and vegetables, commodities more protected by tariffs in EU.

3. RESULTS

Table 13 presents the welfare impacts for the regions in the model. They are calculated by the Hickisian equivalent variation and can be interpreted, in a less formal way, as changes in aggregate consumption from the changes in income and prices of goods. Brazil gains in almost all scenarios, except on those where Brazil or its most important export products are partially or completely excluded from the regional agreements. The most expressive gains occur under trade liberalization, around 1.6% increase in welfare[7], what can be considered expressive in the applied general equilibrium literature[8]. However, the elimination of export subsidies and domestic support brings modest gains to Brazil, suggesting that the access to markets should be the mean goal to be pursued by Brazilian trade negotiators.

Table 13 – Welfare impacts of trade scenarios on different countries (welfare change as a percent of consumption)

	lib_tar	exp_sub	dom_sup	Doha_har	ftaa	ftaa_exc	ftaa_dsu	ftaa_sbr	meeu	meeu_exc
Brazil	**1.59**	**0.01**	**0.09**	**0.77**	**0.22**	**0.21**	**0.25**	**-0.15**	**1.41**	**-0.21**
Argentina	0.40	0.02	0.15	0.29	0.28	0.21	0.38	0.19	0.14	0.03
Uruguay	0.58	0.20	0.09	0.62	0.64	0.06	0.67	0.63	0.45	-0.14
Chile	1.44	0.00	-0.08	0.09	0.49	0.47	0.50	0.48	-0.22	-0.08
Mexico	-0.21	-0.01	-0.10	-0.03	0.02	0.02	-0.07	0.00	-0.03	0.00
RAL	0.35	-0.04	-0.08	0.20	0.09	0.08	0.05	0.13	-0.05	-0.01
USA	0.02	0.00	0.02	0.01	0.07	0.07	0.10	0.06	-0.01	-0.01
Canada	-0.04	-0.02	0.09	0.07	0.01	-0.01	0.05	0.02	0.01	0.00
EU	0.36	0.07	0.10	0.33	-0.04	-0.04	-0.05	-0.02	0.11	0.05
REU	0.53	-0.10	-0.02	0.31	-0.03	-0.03	-0.04	-0.02	-0.01	-0.02
Japan	1.38	-0.02	-0.03	0.70	-0.03	-0.03	-0.06	-0.02	0.00	0.00
China	2.89	-0.02	-0.15	1.06	-0.23	-0.22	-0.30	-0.19	-0.04	-0.01
ROW	0.94	-0.04	-0.07	0.54	-0.09	-0.09	-0.12	-0.07	-0.04	-0.02

Brazil is one of the most benefited countries on the Doha Round scenario, with welfare gains around 0.8%. Only China, among the countries here represented, would

[7] As the model is static, it doesn't show the trajectory of adjustments in the economy from the initial equilibrium until the complete adjustment. Also, it doesn't account for the length of this adjustment period. In this way, we don't discard the possibility of losses in some periods, meanly in the first periods after the shock due to more rigidity in the economy.

[8] As example of recent results, Ferreira Filho and Horridge (2005) estimated an increase of 0.65% in aggregate consumption in Brazil from a similar shock and Bussolo and Mensbrugghe (2005) found an increase of 1.06% in income.

gain more than Brazil. It suggests that the Harbinson scenario simulated is an ambitious one due to deep cuts on tariff peaks for developed countries.

Regional trade agreements (FTAA and Mercosul-EU) also represent opportunities to welfare gains in Brazil, much bigger in the case of the Mercosul-EU agreement if all tariffs could be removed, and comparable to overall world tariff liberalization. This confirms that the tariff barriers imposed by the European countries to Brazilian exports still high after the implementation of the cuts agreed on the Uruguay Round. However, if EU keeps protecting agriculture markets, the Mercosul-EU agreement leads to a welfare reduction in Brazil of the order of 0.2%.

The welfare gains for Brazil are modest in the case of the FTAA, even if the regional agreement includes those goods most protected in US. It happens since US protects agriculture markets mostly using non-tariff barriers, while the tariffs are relatively low. The gains from FTAA would improve just 0.03% if the domestic support given to American farmers was removed, in comparison with the basic FTAA case.

In general, the Brazilian trade partners and other regions experience better results in the scenario of overall multilateral tariff liberalization. China is the most benefited country in this case, since the welfare gains are about 2.9%. Canada and Mexico suffer welfare loss under the tariff liberalization, since they lose their privileged access to the North-American through the NAFTA. In other hand, the removal of subsidies doesn't mean big impacts in the regions. Uruguay is the most benefited from the removal of export subsidies and Argentina gets the most expressive gains in the scenario of removal of domestic support.

The Doha Round scenario benefits almost all regions, mostly China again, Japan and Uruguay also. Only Mexico suffers welfare loss, but pretty small. Such results suggest potential gains to the world economy from a positive trade liberalization agreement under the Doha Round.

Looking at the results from regional agreements on Brazilian Mercosul partners, we see that the FTAA is more beneficial to Argentina and Uruguay then to Brazil. However, Uruguay benefits only if US does not exclude from the agreement those commodities more protected today, since the gains drop from 0.64% to 0.06% in such case. Under the agreement between Mercosul and UE, Brazil is more benefited than Argentina and Uruguay if there are no exceptions. If some agriculture

products are excluded from the agreement, the Mercosul countries will loose or have very few gains.

Table 14 presents the changes in prices of primary factors. In general we observe considerable increases in the remuneration of land, since it is only used by agriculture sectors. However, the FTAA causes a decrease in the price of land. Those results are due to the positive effects on agriculture production from most of the scenarios. The world trade protection in agriculture is relatively higher than in Brazil and other sectors, as also Brazil is relatively abundant in land. As consequence, the trade liberalization promotes big changes in the price of land.

Table 14 – Percent changes in prices of primary factors in Brazil

	Lib_tar	exp_sub	dom_sup	doha_har	ftaa	ftaa_exc	ftaa_dsu	ftaa_sbr	meeu	meeu_exc
Capital	1.20	0.00	0.01	0.51	0.70	0.70	0.71	-0.11	0.66	0.42
Unskilled labor	0.53	-0.01	-0.07	0.16	0.78	0.78	0.74	-0.14	0.07	0.36
Skilled labor	0.49	-0.01	-0.10	0.14	0.63	0.63	0.60	-0.11	0.04	0.33
Land	143.04	0.90	12.72	56.52	-0.17	-0.82	4.45	1.49	130.31	6.73
Natural resources	-15.09	-0.49	-3.05	-10.60	-2.60	-2.19	-3.65	2.04	-17.99	3.71

Skilled and unskilled labor price changes are quite similar and much less expressive than changes in land prices. Capital prices, in other hand, increase more than labor prices in the tariff liberalization, Doha and Mercosul-UE scenarios. Those results are consequence of sectoral changes in production and demand for primary factors, with capital becoming relatively more expensive when the sectoral increase in production is more beneficial to capital intensive sectors. It happens in the case of Doha and Mercosul-UE agreements, since the agriculture exporter sectors are relatively more intensives in capital in the Brazilian economy. In the case of the FTAA, the increase in labor prices is related to improvements in the production of sectors relatively intensive in labor, as textiles and agriculture sectors intensive in labor.

The negative changes in prices of natural resources in almost all scenarios occur since this factor is used mostly in the energy and mining sectors, aggregated as omn here. It means that this sector should experience decreases in output in the scenarios, fact that will be confirmed later in the paper.

Table 15 presents the impacts on domestic prices in Brazil. Those impacts are important to analyze the effects on different household types. Sharp increases in food prices should affect negatively lower income families, while less expressive increase in relative prices of manufactures and services will be translated in less expressive impacts on consumption of richer families.

Table 15 – Percent change in domestic prices, Brazil

	Lib_tar	exp_sub	Dom_sup	doha_har	ftaa	Ftaa_exc	ftaa_dsu	ftaa_sbr	meeu	meeu_exc
Pdr	15.0	0.1	1.9	7.2	0.8	0.7	1.9	-0.6	14.5	0.4
Wht	10.4	0.2	2.0	5.5	0.8	0.6	1.9	-0.1	9.4	0.2
Gro	18.1	0.2	1.9	8.6	0.6	0.5	1.6	-0.6	14.5	0.0
v_f	12.6	0.1	1.6	6.1	0.6	0.5	1.5	-0.6	12.5	0.0
Osd	12.2	0.1	3.0	6.0	0.5	0.4	2.0	-0.6	10.4	-0.1
c_b	13.8	0.2	1.7	6.6	0.7	0.4	1.5	-0.7	15.0	-0.1
Pfb	12.4	0.1	1.8	6.2	0.7	0.6	1.6	-0.7	12.1	0.0
Ocr	13.2	0.1	1.5	6.2	1.0	0.9	1.7	-0.6	11.8	0.6
Ctl	28.9	0.2	2.0	12.7	0.7	0.6	1.6	-0.6	28.5	0.1
Oap	16.3	0.2	1.6	7.9	0.6	0.5	1.4	-0.6	16.3	0.0
Rmk	15.6	0.2	2.0	7.5	0.8	0.6	1.8	-0.6	14.9	0.1
Omn	-0.4	0.0	0.2	-0.1	0.1	0.2	0.5	-0.4	-0.5	-0.2
Cmt	16.2	0.1	1.4	7.5	0.7	0.6	1.4	-0.7	16.2	-0.2
Omt	14.4	0.1	1.4	6.9	0.7	0.6	1.4	-0.7	14.4	-0.2
Vol	7.3	0.1	1.9	4.0	0.6	0.5	1.5	-0.6	6.7	-0.4
Mil	7.3	0.1	1.1	4.0	0.8	0.7	1.4	-0.7	7.3	-0.3
Pcr	7.1	0.1	1.1	3.8	0.8	0.7	1.5	-0.7	7.0	-0.3
Sgr	6.4	0.1	1.0	3.5	0.5	0.4	1.1	-0.7	7.3	-0.6
Ofd	5.0	0.1	1.0	2.9	0.7	0.6	1.3	-0.6	5.1	-0.4
B_t	4.2	0.1	0.9	2.6	0.6	0.5	1.1	-0.7	4.5	-0.6
Tex	1.1	0.1	0.7	1.5	0.1	0.1	0.6	-0.7	2.9	-1.0
Crp	1.5	0.0	0.7	1.5	-0.2	-0.3	0.3	-0.7	2.8	-1.1
Omf	1.3	0.0	0.6	1.3	0.0	0.0	0.5	-0.7	2.2	-1.1
Trd	3.5	0.1	0.7	2.2	0.9	0.8	1.4	-0.8	3.8	-0.5
Otp	1.7	0.0	0.7	1.5	0.2	0.2	0.7	-0.7	2.5	-0.9
Ser	3.5	0.1	0.7	2.2	0.9	0.8	1.4	-0.8	3.8	-0.5

There is a generalized increase in prices in Brazil from the scenarios. Increases in prices are more pronounced under tariff liberalization, Doha round and agreement Mercosul-EU, with higher increases in the case of agriculture commodities. The increase in the international demand by Brazilian exports has an important role on this. The less expressive and generalized increase in prices of non agriculture goods come from increased domestic and international demand, as consequence of broad trade liberalization. In this way, the model does not confirm the idea of cheaper prices after trade liberalization for those goods suffering higher trade barriers before the opening, manufactured goods in the case o Brazil. In relative terms, however, the results are in agreement with the theoretical neoclassical structure of the model, where

those goods relatively less protected before the trade liberalization suffer higher increases in prices after that.

The impacts on sectorial output are presented in Table 16. The agriculture exporter sectors experience the most expressive percent increases in production under the scenarios of tariff cuts (tariff liberalization, Doha and Mercosul-EU). There are expressive gains in the production of corn and cereals, cattle and other animal products, meat and sugar. Also, we notice a decrease in production of almost all other products, including some products of well known competitiveness by Brazilian farmers, as oil seeds. There are two reasons for those results: first, the macroeconomic closure of the model imposes that the current account should not change, such that the surplus (or deficit) observed at the balance of payment should be constant. Then, the expansion of exports increases the demand by foreign currency, overvaluating the real exchange rate and promoting the increase in imports. As the agreements are favorable to some of, but not all, the most competitive Brazilian commodities, the strong expansion on exports are followed by increase in imports and decrease in production of several other goods. The second reason is that the increase in production in one sector requires an increase in the demand by primary factors, which should be pulled out from other sectors less benefited by the agreements. It is particularly important in the case of agriculture sectors, since they demand the specific primary factor land. In this way, when cattle production expands, they demand land that was used before by other agriculture sectors, as other crops.

Some other sectoral results are important to be pointed out, as the considerable reduction in production of other manufactures (between 4.6% and 8.6%) in scenarios of deeper liberalization, the increase in output of them in the FTAA, the strong expansion in oil seed output when domestic support is removed, the almost no difference in sectoral results at FTAA with and without exceptions, and finally the big difference in results from Mercosul-EU agreement with and without exceptions. All those results show that Brazil can have very expressive gains from agriculture liberalization in the case of some specific commodities. Also, they suggest some expressive changes in the sectoral income distribution, and these changes will be as bigger and deeper become the tariff cuts. However, a continental agreement in Americas does no change considerable the sectoral income distribution in Brazil.

Table 16 – Percent change in output, Brazil

	lib_tar	Exp_sub	dom_sup	doha_har	Ftaa	ftaa_exc	Ftaa_dsu	Ftaa_sbr	meeu	meeu_exc
Pdr	-1.3	0.0	0.0	-0.5	0.7	0.1	2.6	0.9	-1.6	3.7
Wht	-8.4	0.8	3.0	-2.2	1.4	0.5	4.3	4.9	-13.4	5.2
Gro	32.2	0.9	2.2	19.4	-0.9	-0.9	0.4	0.4	8.8	1.1
V_f	-9.3	-0.1	-2.3	-5.5	-1.0	-1.0	-1.4	0.2	-7.6	0.3
Osd	-4.3	-0.2	19.0	-1.5	-0.9	-0.9	7.2	1.0	-15.7	0.8
C_b	3.0	0.7	-0.5	1.8	0.5	-1.2	0.4	-0.3	14.8	0.2
Pfb	-12.5	0.2	0.4	-5.8	0.7	0.8	0.2	-0.4	-12.0	-0.3
Ocr	-11.4	-0.3	-3.1	-7.2	1.2	1.4	-0.2	0.3	-15.3	3.5
Ctl	91.8	0.6	1.4	49.1	-0.9	-0.8	-1.2	0.1	98.1	-0.1
Oap	13.7	0.5	-0.7	8.9	-1.4	-1.4	-1.8	0.2	16.1	0.2
Rmk	-2.8	0.3	0.2	-0.5	0.0	-0.4	0.1	0.1	-2.4	-0.4
Omn	-2.8	-0.1	-0.4	-1.8	-0.4	-0.4	-0.5	0.3	-3.3	0.4
Cmt	129.5	0.5	2.2	68.2	-0.5	-0.5	-0.9	0.1	137.4	-0.3
Omt	-9.5	1.3	-2.6	-0.7	-3.1	-2.9	-4.0	0.4	-5.0	0.3
Vol	-7.5	0.0	-0.4	-3.5	-0.7	-0.6	-0.6	0.0	-4.5	0.5
Mil	-3.5	0.5	-0.2	-0.5	0.3	-0.4	0.2	0.1	-2.6	-0.5
Pcr	-2.0	0.0	-0.1	-0.8	-0.3	-0.4	-0.4	0.0	-1.2	-0.5
Sgr	14.7	1.6	-0.9	7.7	2.4	-1.4	2.1	-0.2	39.0	1.2
Ofd	3.6	0.1	-0.2	1.4	-0.5	-0.5	-0.5	-0.2	3.1	5.7
B_t	-0.2	0.0	-0.1	0.0	-0.3	-0.3	-0.3	-0.1	0.0	-0.3
Tex	-6.7	0.1	-0.3	-2.3	2.5	2.4	2.4	-0.8	-2.9	-0.4
Crp	-8.4	-0.1	-0.2	-3.9	-1.3	-1.2	-1.2	-0.5	-7.2	-1.0
Omf	-7.9	-0.1	-0.6	-4.3	1.4	1.5	1.1	-0.1	-8.6	-0.7
Trd	0.3	0.0	0.0	0.2	-0.1	-0.1	-0.1	0.0	0.5	-0.2
Otp	1.2	0.0	0.2	0.4	0.0	0.0	0.0	0.1	0.4	0.4
Ser	-0.2	0.0	0.0	-0.1	-0.2	-0.2	-0.2	0.0	-0.2	-0.1

Table 17 presents impacts on exports in Brazil. In general, changes in exports follow changes in output, with some few exceptions. For paddy rice, as example, exports increase much more than output. As the initial export level is very small, around U$3,000 and less than 0.3% of initial value of production (Table 7), the increase of 1,000% in one of the FTAA scenarios means an increase in the share of exports to be around 4% of total production.

The commodities with higher trade protection in international markets are the most benefited in the scenarios. The meat industry is the most benefited, with export increases above 500% in some scenarios. It means that almost all production in Brazil will be exported to other countries, what can be confirmed by the strong increase in domestic prices in Brazil. Although it seems unreasonably to have one industry increasing its export share from around 20% in the benchmark to close to 100% in trade liberalization scenarios, those results reveal the competitive advantage Brazil has in producing such commodity and the enormous potential in supplying it to international markets. Also, it is clear the excess of tariff barriers in the markets of

meat today, particularly those imposed by EU (*ad valorem* tariffs higher than 100% in GTAP database). Unfortunately, not only tariff barriers are used today, but also many non-tariff barriers constraint the Brazilian exports of meat products.

Table 17 – Percent changes in exports - Brazil

	lib_tar	exp_sub	dom_sup	doha_har	ftaa	ftaa_exc	ftaa_dsu	ftaa_sbr	Meeu	meeu_exc
Pdr	210.4	-0.1	138.9	111.7	245.1	242.2	1228.1	-100.0	10.1	-3.6
Wht	-	-	-	-	-	-	-	-	-	-
Gro	60.1	2.4	6.5	38.4	-1.6	-1.5	2.8	0.9	-19.2	0.0
v_f	-21.9	-0.7	-8.1	-15.8	-1.7	-1.5	-2.7	0.1	-17.7	0.2
Osd	-3.8	-0.6	39.7	-0.9	-1.1	-1.1	15.6	1.9	-29.6	0.5
c_b	-	-	-	-	-	-	-	-	-	-
pfb	-32.8	0.5	2.5	-17.1	-0.5	-0.2	-2.3	-0.7	-41.8	0.4
ocr	-22.4	-0.9	-7.7	-16.6	4.8	5.3	1.0	0.9	-37.3	8.4
ctl	-58.1	0.1	26.2	-32.8	-2.9	-2.4	-5.6	2.5	-61.9	-0.1
oap	-39.6	-1.3	-5.4	-24.5	-2.6	-2.4	-4.5	0.1	-46.6	1.5
rmk	-	-	-	-	-	-	-	-	-	-
omn	6.4	0.0	-0.6	2.5	-1.8	-1.8	-1.7	0.1	5.5	2.0
cmt	994.2	3.4	19.0	517.5	-1.6	-1.3	-3.4	0.7	1048.4	2.1
omt	-11.3	3.3	-6.3	3.8	-7.1	-6.5	-9.2	1.2	-1.1	2.0
vol	-50.4	0.4	-1.4	-25.6	-1.5	-1.4	-0.2	0.9	-31.4	3.0
mil	1.5	28.9	-2.9	42.0	110.5	-4.8	111.3	-1.3	-5.7	3.0
pcr	-55.0	0.7	-0.2	-10.0	30.8	30.6	33.6	-7.6	-8.8	1.5
sgr	40.5	4.1	-2.1	20.8	7.2	-3.2	6.7	-0.4	105.3	2.4
ofd	20.1	0.3	-1.7	6.2	-0.3	0.0	-0.5	-0.6	13.2	37.5
b_t	-5.9	0.1	-1.3	-3.1	-1.1	-1.2	-1.4	-4.2	-4.9	5.7
tex	-7.1	0.1	-2.3	-6.5	37.6	37.9	36.8	-8.3	-13.9	11.5
crp	-6.0	-0.2	-2.7	-6.7	12.1	12.4	11.4	-5.8	-16.1	5.4
omf	4.8	-0.4	-1.9	-3.5	21.0	21.3	20.2	-1.4	-11.6	10.8
trd	-9.4	-0.3	-2.0	-6.6	-5.1	-4.9	-5.5	1.6	-13.0	2.4
otp	-4.5	-0.3	1.9	-3.9	-2.3	-2.1	-2.6	1.6	-8.7	3.9
Ser	-10.9	-0.3	-2.3	-7.4	-4.8	-4.6	-5.3	1.9	-13.2	2.4

Many other commodities suffer decrease in exports, including agriculture products which Brazil has recognized competitiveness. It happens because some few products, as meat, corn and cereals, sugar and other food, increase exports too much, and the closure of the current account imposes no changes in the initial balance.

It is important to verify that the exports of non agriculture manufactured commodities benefits from FTAA and from the agreement Mercosul-EU with excluded products. In the FTAA case, it reflects the size and diversity of the agreement, what allows Brazil to exploit comparative advantages in relation to other Latin American countries. In the case of Mercosul-EU with excluded products, the increase of exports of manufactured goods are related to the constraint of current account balance, since the exports of some agriculture products are not possible without the removal of import barriers in EU.

Table 18 shows percent changes in Brazilian imports. There is a generalized increase in imports in Brazil in most of the scenarios, except in the FTAA without Brazil. As expected, deeper tariff cuts (tariff liberalization, Doha and Mercosul-EU) cause bigger increases in imports. Many agriculture sectors experience considerable percent increases in imports, including those increasing exports. However, as the initial import values of those sectors are small (Table 7), the absolute changes in imports are relatively unexpressive.

Table 18 – Percent changes in imports - Brazil

	lib_tar	exp_sub	dom_sup	doha_har	ftaa	ftaa_exc	ftaa_dsu	ftaa_sbr	meeu	meeu_exc
Pdr	50.2	0.5	0.4	19.5	-9.7	-2.1	-12.0	-14.3	47.5	5.5
Wht	6.5	-0.1	-0.5	2.6	-0.8	-0.6	-1.3	-1.1	6.8	4.1
Gro	29.0	0.0	-0.1	13.3	-0.5	0.0	-0.8	-1.8	22.2	2.1
v_f	16.4	-0.3	0.6	7.1	3.0	3.4	2.8	-2.0	14.6	0.4
Osd	15.8	0.2	1.2	6.8	0.8	1.0	0.4	-1.7	23.4	0.6
c_b	49.8	0.2	6.0	20.6	17.4	15.8	24.6	-1.2	41.9	-1.0
Pfb	22.0	0.1	0.3	7.7	0.8	0.7	1.0	-0.9	15.7	2.2
Ocr	58.1	0.1	2.3	20.8	6.7	6.6	8.0	-1.3	28.9	4.2
Ctl	257.5	0.6	-1.1	101.5	-3.4	-0.3	-3.1	-5.5	271.0	0.3
Oap	108.4	0.5	3.1	48.6	3.3	3.4	4.5	-1.1	108.4	4.2
Rmk	98.2	-4.5	3.6	31.4	4.9	3.8	5.8	-0.5	83.5	0.1
Omn	-8.5	-0.1	-1.2	-4.7	3.8	3.9	3.5	-1.1	-9.6	-1.3
Cmt	94.5	-3.1	-1.1	27.8	-1.0	2.5	-1.2	-8.0	97.5	-1.5
Omt	158.3	-6.0	2.5	38.4	25.4	25.2	27.6	-2.4	108.1	-1.9
Vol	55.5	0.2	-2.4	18.2	3.1	3.4	2.0	-2.3	41.9	16.4
Mil	61.4	-11.1	0.0	-0.1	1.3	0.9	0.7	-8.2	47.9	-2.4
Pcr	16.8	0.5	-0.4	6.7	-0.7	1.4	-1.1	-4.2	12.8	-0.3
Sgr	77.1	-11.3	1.2	9.3	28.1	0.5	28.9	-2.1	57.3	-1.5
Ofd	32.6	-1.2	0.3	10.4	9.7	9.9	9.6	-1.3	18.8	6.3
b_t	26.2	-0.4	0.6	9.8	3.8	3.8	3.9	-0.6	22.1	16.8
Tex	75.9	-0.6	0.8	21.7	16.1	16.0	16.4	-1.8	28.4	13.6
crp	19.2	0.1	0.8	7.2	9.5	9.4	9.8	-1.1	10.2	4.6
omf	33.2	0.1	0.4	11.4	15.0	14.9	15.1	-1.2	19.2	12.0
trd	5.5	0.1	1.1	3.8	2.5	2.4	2.7	-0.9	7.8	-1.5
Otp	3.4	0.1	-0.9	2.1	1.1	1.0	1.2	-0.6	4.5	-1.1
Ser	5.6	0.2	1.1	3.7	2.1	2.0	2.3	-1.1	6.9	-1.2

The results suggest that the deepening of the multilateral or regional trade integration process of the Brazilian economy should produce a strong increase in trade flows, including imports, since tariff barriers imposed by Brazil still relatively high.

Finally, regarding changes in imports, it is important to discuss the results from scenarios of removal of export subsidies and domestic support by developed countries. Those scenarios decrease the imports of some commodities, as dairy products, meat and oil seeds, what means that the actual levels of those distortions are important to affect international prices and artificially increase imports of countries as

Brazil. However, the removal of those subsidies does not affect much the output or the aggregate income in Brazil.

The results previously shown in Table 13 indicated aggregated welfare gains in Brazil. However, they do not allow to analyze the impacts on different household types. Therefore, we turn here to the impacts on the multiple households in Brazil, in order to verify gainers and losers from the trade scenarios. Table 19 presents the impacts on welfare of the different households classified by income, rural or urban and type of agriculture production (familiar, commercial and agriculture labor). To understand the results, it is important to remember the impacts on price of primary factors presented in Table 14 and the changes in domestic prices at Table 15.

Results from Table 19 show gains to agriculture households in almost all scenarios. However, gains are usually bigger for richer rural households, what suggests some increase in the income concentration. Urban households, in other hand have negative impacts, generally small, except the group of highest income, gaining in almost all scenarios. The percent welfare loss is bigger for poorer urban families. These results are due mostly to the changes in prices of primary factors, since they determine the income of households. The increases in prices of consumer goods are also important to determine welfare changes for households. In this way, the commercial farmers are benefited since a considerable share of their income is generated from rents of land use, and this share if bigger than for other rural households. The familiar agriculture households also benefit, since a share of their income comes from land use.

Table 19 – Impacts of trade policy scenarios on Brazilian households (welfare change as percent of consumption)

	lib_tar	exp_sub	dom_sup	doha_har	ftaa	ftaa_exc	ftaa_dsu	ftaa_sbr	Meeu	meeu_exc
AF1	6.23	0.02	0.57	2.49	-0.28	-0.31	-0.09	-0.05	5.92	-0.33
AF2	7.30	0.03	0.64	2.81	-0.35	-0.37	-0.13	0.05	6.79	-0.13
AF3	9.76	0.04	0.86	3.74	-0.41	-0.44	-0.11	0.15	8.97	0.10
AF4	15.35	0.09	1.34	6.03	-0.25	-0.31	0.23	0.17	14.04	0.41
ABu	31.05	0.19	2.70	12.35	0.09	-0.04	1.08	0.20	28.15	1.22
AEm	-1.89	-0.02	-0.18	-0.68	-0.06	-0.05	-0.14	-0.16	-1.57	-0.60
Ur1	-1.92	-0.02	-0.17	-0.69	-0.21	-0.20	-0.28	-0.12	-1.54	-0.64
Ur2	-1.54	-0.02	-0.14	-0.53	-0.20	-0.19	-0.26	-0.11	-1.22	-0.58
Ur3	-1.03	-0.01	-0.10	-0.32	-0.11	-0.11	-0.16	-0.10	-0.82	-0.47
Ur4	1.39	0.01	0.03	0.77	0.57	0.56	0.59	-0.23	1.06	-0.06

Familiar farmers experience most expressive gains in the scenarios of tariff liberalization, Mercosul-UE agreement without excluded products, and Doha Round.

But those gains are not homogeneous, and vary from 2.5% and 15.3% among familiar household groups and scenarios. The gains in other scenarios are lower than 1% or negative. Losses occur under FTAA and under Mercosul-EU with excluded products.

The commercial farmers get the most benefits, what seems to be consistent with reality in Brazil, since they are more specialized in production of exported commodities, they use more technology and capital and are more competitive. In this way, when trade agreements bring gains to the agriculture production in Brazil, the agents who have and use more intensively those factors more important in the production of exports and are also more productive in the use of them should benefit the most. The case of sugar well illustrates this point. Most of the sugar production in Brazil is done by commercial firms, which control the sugar refinery production and the sugar-cane plantation. They use large extensions of land and employ modern technology and capital. In this sense, the expansion of sugar exports and production will be favorable to them, but not that good for familiar farmers.

The rural employees experience losses in all scenarios. It happens since the income of this group comes mostly from the use of unskilled labor and they don't have any land and almost no capital. As the prices of unskilled labor don't evaluate as much as the prices of land and capital, they do not benefit as much as other rural households. Also, food prices increase in the scenarios, what implies higher expenses for rural workers. Other studies, as those conducted by Ferreira Filho and Horridge (2004, 2005) and Harrison *et al*. (2003), as also the results generally found in the literature, suggest that positive income effects are bigger than the negative effects from higher consumer prices, and then, poor families can experience welfare increases from trade liberalization. The model we have used is similar to the one used by Harrison *et al.*(2003), what makes us believe that the characterization of households used in the present paper is the most important factor to explain the negative impacts obtained here. The other papers working with multiple households use the average income to define the types of households. In the case of rural families, it means that all household types will be assigned with some endowment of land. As the price of this factor increase much more than the prices of other factors in the economy, the positive income effects on rural families become bigger than the negative impacts on consumer prices. In the present paper, as rural workers just have unskilled labor as income source, the increase in the remuneration of this factor is not

enough to offset the negative impacts on consumption coming from higher prices on goods and services.

Among the urban households, only the richest gain, although the gains are lower than those observed for rural households. The positive impacts on rich urban households come from increases in the remuneration of capital, since this group has the biggest share of returns to capital in income. The other urban families suffer losses because they receive most of their income from unskilled labor, they do not have land and finally, there are increases in prices of important goods in their consumption basket, particularly in the prices of services, the most important item in their consumption.

It is important to point out that the model does not allow changes from income classes. It means that the losses suffered by rural workers and urban households could be lower if they had the opportunity to acquire resources (land, capital of even skills). Although the assumption of immobility among household types is a rigidity of the model, we believe this indicates better gainers and losers demanding specific polices, as education and re-orientation in the job market. Also, it avoids more complicated modeling exercises and representation of economic behavior not well explained theoretically and empirically about the mobility of labor among segmented labor markets. Finally, in the case of rural workers and some part of the familiar agriculture, the lack of mobility seems to be coherent with the observation of considerable income differentials among urban and rural areas but relatively low migration rate.

4. CONCLUSIONS

We have estimated the impacts of several trade agreements on Brazilian economy and agriculture, including rural families. Our contribution in relation to other papers was the way we characterize multiple households, here done in three broad types: familiar agriculture, which uses more labor from the family than hired outside, commercial agriculture and rural workers without land and capital. We believe this characterization allow us to better capture the technological differences among groups, the dichotomy among exporters and producers to domestic market, as also the groups more relevant in the discussions and formulation of agriculture policy in Brazil today.

Our results suggest that deeper multilateral or regional trade liberalization brings potential aggregate welfare gains to Brazil, as pointed out in other studies. Those gains come from increases in production and exports of agriculture commodities, what in turn increase the remuneration of primary factors and them, improve the income and consumption of rural families. In terms of strategy of negotiation in regional and multilateral forums, the access to markets (tariff cuts) is much more important them cuts in export subsidies or in domestic support in developed countries.

Among the agreements in discussion nowadays, a Mercosul-EU free trade area would be more beneficial to Brazil, but become welfare reducing if EU negates access to some agriculture markets. In this case, a multilateral agreement under the Doha Round framework and able to cut down tariff peaks, should be a better option for Brazil. The FTAA brings less aggregate welfare gains in comparison with others, but the gains do not change considerable if US decides to exclude agriculture products from the agreement nor to reduce domestic support to their farmers. In other hand, Brazil suffers loss if does not participate in FTAA.

The familiar agriculture usually has gains from the agreements, with gains bigger than the average gains to the economy. It indicates a better income distribution between rural and urban areas. However, we observe some worsening in the income distribution in rural and urban areas, since gains are higher for familiar households with higher average income, for richer households, and even higher for commercial farmers. Also, rural workers without land and capital always suffer losses, as also poor urban families in most of the scenarios.

The welfare impacts are due to changes in the remuneration of primary factors, since they determine the household income, as also due to changes in prices of final goods and services, consumed by households. The gains observed for rural households come from expressive increases in the remuneration of land. Average increases in capital returns are bigger than for labor wages, what explain the gains observed for richer urban households and commercial farmers. Rural farmers lose due to the lack of land, capital and skills endowments, as also due to increases in price of food. The increase in prices of services and other goods also helps to explain the losses in the case of poor urban households.

Finally, the results show that the familiar agriculture does not have to be afraid of trade liberalization, since it is not exclusively oriented to domestic markets. In this

way, we don't confirm the dichotomy in the Brazilian agriculture between familiar farmers producing goods to domestic markets and commercial farmers targeting export markets. As one could expect, the commercial farmers benefits most from the trade agreements, since they respond for more than 50% of production of commodities benefiting from liberalization, use technology and modern inputs more intensively and are more efficient in large scale production. However, the trade liberalization has losers, as expected by trade theories, and they are exactly those with low access to land, capital and skills. In this way, trade liberalization doesn't seem to contribute to reduce income inequality and poverty in Brazil. It them poses the necessity of complimentary policies in terms of access to land, capital and qualification in order to improve and distribute the benefits from trade integration.

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APPENDIX I

Household Characterization in Brazil

We brake-down the GTAP6 data about final consumption and income from primary factor in 10 household groups, based on the characterization of familiar agriculture, rural and urban households and average income. We used data from the social accounting matrix (SAM) in the study "Commodity Price Changes and their Impacts on Poverty in Developing Countries: the Brazilian Case", from Azzoni *et al.* (2005).[9]

This SAM refers to 1999 and has 80 commodities (17 primary agriculture products, 15 processed agriculture products, 3 agriculture inputs to industrial sectors, 2 industrial products and some service sectors (transportation, trade and other services). The definition of rural households was based on the Brazilian Census of Agriculture and in the Survey "Pesquisa de Padrões de Vida" (PPV) about 1996, both from IBGE. The Census was used to get information about technology and size of farms. The PPV was used to characterize households and consumption. The definition of agriculture households is based on the study of Ministry of Land Reform/INCRA and the Food and Agriculture Organization (FAO), discussed in section 2.

Based on the Census of Agriculture and in the PPV survey several sub-matrices were built, relating the income from factors (land, capital and labor) to the agents present in the matrix, originally classified as urban households, rural households, urban firms and rural firms.

The consumption and income expenditure in the SAM was built from the PPV and from the Survey "Pesquisa de Orçamento Familiares" (POF) from IBGE (IBGE, 1987 and 1996). The data from PPC were used to characterize the expenses of rural households, while the urban households' expenses were defined using data from POF.

Table A1 presents the original data in the SAM of Azzoni et al. (2005) about the income source. Tables A2 and A3 show the distribution of income from primary factors among different households.

Table A4 presents the data at Azzoni et al. (2005) SAM about the household expenses with goods and services as also with direct taxes and savings. The goods and services were aggregate to the same GTAP sectors used here.

[9] This SAM was gentle provided by Prof. Joaquim Guilhoto from University of Sao Paulo, through personal contact.

Table A1 – Household income (R$1.000.000) from primary factors and government transfers.

	Land	Capital	Labor	Govern. Transfers	Total
Ag. fam 1	826	647	4,092	789	6,355
Ag. fam 2	785	615	3,532	1,543	6,475
Ag. fam 3	2,336	1,830	6,421	4,823	15,410
Ag. fam 4	3,638	2,853	9,385	5,102	20,978
Business ag.	8,055	6,307	-	1,393	15,755
Ag. employees	-	-	16,865	1,989	18,854
Urb. 1	-	8,996	16,796	3,753	29,545
Urb. 2	-	18,978	42,289	10,253	71,520
Urb. 3	-	34,639	79,701	19,729	134,069
Urb. 4	-	201,642	204,151	75,577	481,370
Total	15,641	276,506	383,232	124,951	800,329

Source: Azzoni *et al.* (2005)

Table A2 – Distribution of income from primary factors and government transfers to households (%)

	Land	Capital	Labor	Govern. transfers
ag fam 1	5	0	1	1
ag fam 2	5	0	1	1
ag fam 3	15	1	2	4
ag fam 4	23	1	2	4
Business ag	52	2	-	1
ag employees	-	-	4	2
urb 1	-	3	4	3
urb 2	-	7	11	8
urb 3	-	13	21	16
urb 4	-	73	53	60
Total	100	100	100	100

Source: Azzoni *et al.* (2005).

Table A3 – Share of income from factors and government transfers in the total income of households (%)

	Land	Capital	Labor	Govern. transfers	Total
ag fam 1	13	10	64	12	100
ag fam 2	12	9	55	24	100
ag fam 3	15	12	42	31	100
ag fam 4	17	14	45	24	100
Business ag	51	40	-	9	100
ag employees	-	-	89	11	100
urb 1	-	30	57	13	100
urb 2	-	27	59	14	100
urb 3	-	26	59	15	100
urb 4	-	42	42	16	100

Source: Azzoni *et al.* (2005).

Table A4 – Household expenses (in R$1.000.000)

	ag fam 1	ag fam 2	ag fam 3	ag fam 4	Business ag	ag employees	urb 1	urb 2	urb 3	urb 4
pdr	-	-	-	-	-	-	-	-	-	-
wht	-	-	-	-	-	-	-	-	-	-
gro	3	3	6	3	2	5	8	15	19	31
v_f	60	57	103	51	35	89	151	274	354	566
osd	-	-	-	-	-	-	-	-	-	-
c_b	0	0	0	0	0	1	1	1	1	1
pfb	-	-	-	-	-	-	-	-	-	-
ocr	294	276	502	247	169	435	735	1,334	1,721	2,754
ctl	-	-	-	-	-	-	-	-	-	-
oap	745	604	1,188	556	597	810	1,334	1,918	2,726	4,351
rmk	31	37	85	59	39	93	124	243	333	497
omn	14	18	48	54	41	55	82	210	360	868
cmt	207	185	421	249	161	466	610	1,289	1,585	2,137
omt	578	491	990	464	427	909	1,416	2,196	2,676	3,880
vol	204	194	385	159	112	457	539	949	1,007	1,172
mil	184	223	510	356	236	556	746	1,459	1,999	2,987
pcr	162	139	267	84	63	212	341	523	511	511
sgr	71	76	127	53	40	155	223	346	358	372
ofd	889	845	1,670	1,053	629	1,708	2,876	5,566	7,018	10,550
b_t	144	135	316	226	153	384	516	1,183	1,670	2,622
tex	3	3	9	10	8	10	15	39	67	161
crp	11	12	33	98	59	60	114	308	621	2,695
omf	1,183	1,475	3,928	4,393	3,401	4,549	6,709	17,228	29,530	71,137
trd	92	94	264	789	475	481	914	2,476	4,990	21,666
otp	68	70	196	585	352	357	679	1,838	3,704	16,082
ser	740	757	2,129	6,361	3,828	3,880	7,376	19,973	40,250	174,777
cgds	-	-	-	-	-	-	-	-	-	-
Taxes	441	462	1,328	3,333	3,197	2,310	3,111	9,709	24,120	99,957
Savings	231	318	906	1,796	1,730	871	924	2,442	8,450	61,595
Total	6,355	6,475	15,410	20,978	15,755	18,854	29,545	71,520	134,069	481,370

Source: Azzoni *et al.* (2005).

Tables A1 to A4 represent just some of the sub-matrices of the study by Azzoni et al. (2005). We used only those data from their study. Based on those, we broke up the income and expenditure of the Brazilian representative agent in GTAP6 in the households groups used in the research. We keep the total income and expenditure in GTAP, using just the income and expenditure shares from Azzoni *et al.* to perform the break down of multiple households.

To ensure consistency between the GTAP data and the final numbers for the multiple households, we employ a formal "least square" minimization problem. The objective of the minimization problem was the deviation of the shares of income sources and expenditure patterns from the values observed at Azzoni et al. (2005) SAM. That is, we sought to find the new shares that would balance the data set but would be as close as possible to the originally shares at the Azzoni et al. SAM. In this way, the sum of income by household and sum of expenditure by household should be

equal to the total observed at GTAP. We used the software GAMS to perform this balancing.

Table A5 – Household expenditure shares with goods and services (%).

	Ag fam 1	ag fam 2	ag fam 3	ag fam 4	Business ag	ag employees	urb 1	urb 2	urb 3	urb 4
Pdr	-	-	-	-	-	-	-	-	-	-
Wht	-	-	-	-	-	-	-	-	-	-
Gro	0.05	0.05	0.04	0.01	0.01	0.03	0.03	0.02	0.01	0.01
v_f	0.95	0.87	0.67	0.24	0.22	0.47	0.51	0.38	0.26	0.12
Osd	-	-	-	-	-	-	-	-	-	-
c_b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pfb	-	-	-	-	-	-	-	-	-	-
Ocr	4.63	4.26	3.26	1.18	1.07	2.31	2.49	1.87	1.28	0.57
Ctl	-	-	-	-	-	-	-	-	-	-
Oap	11.73	9.34	7.71	2.65	3.79	4.29	4.52	2.68	2.03	0.90
Rmk	0.48	0.57	0.55	0.28	0.25	0.49	0.42	0.34	0.25	0.10
Omn	0.23	0.28	0.31	0.26	0.26	0.29	0.28	0.29	0.27	0.18
Cmt	3.26	2.86	2.73	1.19	1.02	2.47	2.06	1.80	1.18	0.44
Omt	9.09	7.58	6.42	2.21	2.71	4.82	4.79	3.07	2.00	0.81
Vol	3.21	2.99	2.50	0.76	0.71	2.43	1.83	1.33	0.75	0.24
Mil	2.89	3.45	3.31	1.70	1.50	2.95	2.52	2.04	1.49	0.62
Pcr	2.55	2.15	1.73	0.40	0.40	1.12	1.16	0.73	0.38	0.11
Sgr	1.12	1.18	0.82	0.25	0.25	0.82	0.76	0.48	0.27	0.08
Ofd	14.00	13.05	10.84	5.02	3.99	9.06	9.73	7.78	5.23	2.19
b_t	2.26	2.09	2.05	1.08	0.97	2.04	1.75	1.65	1.25	0.54
Tex	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.03
Crp	0.18	0.18	0.21	0.47	0.37	0.32	0.39	0.43	0.46	0.56
Omf	18.61	22.79	25.49	20.94	21.59	24.13	22.71	24.09	22.03	14.78
Trd	1.44	1.45	1.71	3.76	3.01	2.55	3.09	3.46	3.72	4.50
Otp	1.07	1.08	1.27	2.79	2.24	1.89	2.30	2.57	2.76	3.34
Ser	11.64	11.70	13.82	30.32	24.30	20.58	24.97	27.93	30.02	36.31
Taxes	6.93	7.13	8.62	15.89	20.29	12.25	10.53	13.57	17.99	20.77
Savings	3.64	4.92	5.88	8.56	10.98	4.62	3.13	3.41	6.30	12.80
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Azzoni *et al.* (2005).

Tables 7 and 8 in the text present the results from the minimization problem, in the case of income sources. Tables 9 and 10 present the results in the case of expenditure patterns. The data on table 7 and 9 were used in the present study to represent the income and expenses of different type of households.

APPENDIX II

Trade Protection Data

To understand the results from the model it is very important to know the trade protection levels before the implementation of scenarios. Table A6 below presents the average applied tariffs in the regions from GTAP6 database. Those reflect the tariff cuts after Uruguay Round, as also several regional agreements, as NAFTA and Mercosul. Table A7 shows the export subsidies. Table A8 presents the domestic support, as subsidies to production and subsidies to the use of primary factors.

Table A6 – Average tariffs (%) in the database

	BRA	ARG	URY	CHL	MEX	XLA	USA	CAN	EUR	XER	JPN	CHN	ROW
Pdr	2.3	0.2	9.2	5.9	1.1	14.4	3.6		53.5	7.9	758.6	0.4	22.2
Wht	5.5	0.7	5.8	7.0	1.5	8.1	2.3	2.0	0.9	47.8	183.1	1.0	7.7
Gro	5.1	1.2	4.9	7.0	32.9	11.3	0.0	0.0	17.9	25.1	38.5	87.9	79.4
v_f	11.0	10.5	8.5	6.8	11.4	11.5	0.7	0.9	17.1	17.1	14.1	24.7	14.5
Osd	0.1	2.2	5.6	7.0	0.4	4.4	2.8	-	-	26.5	0.4	101.1	68.0
c_b	9.5	-	-	-	-	13.8	0.2	-	9.9	34.4	-	9.1	6.8
Pfb	5.9	3.8	3.8	6.9	0.9	6.5	0.8	-	-	0.2	-	3.0	1.9
Ocr	9.2	5.6	6.5	6.9	10.5	8.3	2.0	0.8	2.6	12.1	1.8	16.7	15.5
Ctl	0.9	1.5	0.3	6.5	2.6	3.3	0.0	-	10.4	15.5	18.8	3.5	2.5
Oap	5.0	4.1	6.0	6.5	1.4	6.2	0.4	7.1	0.5	6.5	0.8	3.4	4.4
Omn	0.4	0.9	0.1	6.9	3.6	2.5	0.0	0.0	0.0	0.3	0.0	0.3	4.1
Cmt	5.0	6.3	9.8	7.0	3.0	8.9	4.2	6.5	46.7	79.4	43.5	15.9	14.2
Omt	12.7	11.3	12.1	6.7	17.9	14.3	1.5	51.0	18.8	48.1	50.8	14.2	15.5
Vol	10.4	10.1	0.7	6.9	4.2	9.4	1.0	1.3	11.8	17.4	2.3	12.9	27.3
Mil	18.3	15.0	14.2	6.9	38.7	15.9	18.5	110.3	37.8	29.7	53.1	19.6	10.1
Pcr	9.4	3.9	7.0	6.9	6.5	14.9	4.6	-	110.0	7.9	841.8	1.0	15.8
Sgr	14.7	13.1	9.2	6.9	13.1	10.4	25.0	0.8	110.6	26.1	245.5	18.8	22.0
Ofd	11.6	15.3	15.9	7.0	5.2	10.0	2.5	8.3	8.1	15.4	9.5	18.0	13.5
b_t	20.8	19.7	17.7	6.9	20.1	19.6	1.4	5.2	7.4	23.6	15.1	41.3	32.6
Tex	16.0	12.5	18.4	7.0	6.8	13.6	9.1	14.2	4.1	5.2	9.0	20.5	15.2
Crp	8.5	9.2	10.7	7.0	3.7	6.9	2.1	2.1	1.7	1.8	1.0	13.4	6.8
Omf	11.3	11.2	7.8	6.5	4.4	9.5	1.4	1.9	1.5	3.0	0.8	11.6	5.7
Ser	-	-	-	0.0	0.0	0.0	-	-	-	0.1	-	-	0.0

Source: GTAP 6 (author's calculation).

Table A7 – Export subsidies (%) in the database

	ARG	CHL	EUR	MEX	ROW	URY	USA	XER	XLA
wht			7.95						
gro			25.03					0.41	
v_f			2.26		0.44			11.98	
pfb					0.55				
ocr					0.11				
ctl								2.86	
oap			0.62		0.00				
rmk								5.79	0.03
omn	0.39				0.08			0.71	
cmt			45.84					2.64	
omt			5.37		0.02			2.03	
vol					0.94				
mil			23.53				7.26	14.60	
pcr			31.48						
Sgr			37.59		0.38			5.21	
Ofd			3.14		0.08			2.03	
b_t			0.92						
Tex					0.05	19.24			4.11
Crp						2.43			0.83
Omf		0.05		0.52		0.57		0.26	0.86

Source: GTAP 6.

Table A8 – Domestic support in the database in the form of direct subsidies to domestic production (%) and subsidies to the use of primary factors (%)

	Canada			European Union			Japan			US	
	Produc.	Capital	Land	Produc.	Capital	Land	Produc.	Capital	Land	Produc.	Land
pdr	-	-	39.4	-	7.6	9.4	5.6	10.7	-	85.7	14.6
wht	0.5	-	-	0.3	80.6	7.7	0.0	6.8	-	3.6	10.2
gro	5.6	-	52.7	0.2	11.0	91.8	1.5	11.7	34.5	6.7	61.2
v_f	0.5	-	21.4	0.4	3.0	11.0	0.1	-	14.4	4.3	13.8
osd	0.6	-	39.2	35.7	4.1	24.6	45.9	-	54.7	28.8	18.8
c_b	-	-	72.6	0.3	3.9	82.3	0.1	-	-	2.2	11.7
pfb	0.5	-	-	29.7	8.4	77.5	0.1	9.0	26.9	4.3	38.7
ocr	-	1.8	79.0	2.7	21.6	21.8	-	9.6	-	3.9	26.5
ctl	1.0	-	-	0.6	32.4	12.1	3.7	2.9	13.4	0.1	11.9
oap	-	-	47.9	0.8	4.3	9.1	-	3.1	33.3	0.0	24.8
rmk	0.7	-	67.7	0.2	11.5	92.2	3.5	11.6	-	2.7	77.0
omf	-	-	-	0.4	-	-	-	-	-	-	-
otp	-	-	-	2.8	-	-	-	-	-	-	-

Source: GTAP 6.