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Economic loss to the Brazilian regions due to the Doha Round failure: an investigation using bound tariffs

Matheus Wemerson Gomes Pereira[1]

Erly Cardoso Teixeira[2]

Ângelo Costa Gurgel[3]

Abstract: The objective of this paper is to determine the probable losses to the Brazilian regions due to the Doha round of negotiations failure. A model for the General Equilibrium Analysis Project for the Brazilian Economy (PAEG) is built following the GTAPinGAMS structure and syntax. The PAEG model is multiregional at a global level as well as at the Brazilian level. PAEG database is constructed using input-output matrix for 5 Brazilian regions connected to the GTAP database version 7. It is simulated the Doha Round requirement for agricultural production and exports subsidies reduction. Also, this scenario includes reduction on bound import tariffs. All regions considered in the current aggregation lose gains in economic growth and welfare due to the Doha Round failure. The Midwest is the Brazilian region that loses the most in terms of economic growth while the South region presents the highest welfare loss. While agriculture is highly competitive in all Brazilian regions, the manufacture sector is not. Thus the Doha Round failure allows an additional period of time to implement public policies and private management strategies to guarantee competitiveness to the manufacture sector in the case the new Doha Round agreement is signed.

JEL classification: R13; F13; F15; Q17.

Keywords: Brazilian regions, General equilibrium, Agribusiness, Trade liberalization, PAEG.

1. Introduction

The failure of the Doha Round in Hong Kong at the end of 2008 generated frustration among the countries involved, especially in developing countries that have their main source of income from agriculture, due to the expected decrease in agricultural subsidies by 2010. The new date for the agreement is 2013. This means that the high import tariffs and subsidies for agricultural production and export are still in place.

[1] Ph. D. student in Applied Economics at Federal University of Vicosa (UFV) – Brazil. Sponsored by CNPq-Brazil. E-mail: matheuswgp@yahoo.com.br.

[2] Ph. D.; Professor at Federal University of Vicosa (UFV) – Brazil. Corresponding author. UFV-DER, Luxuriant 36570-000, MG, Brazil; teixeira@ufv.br; FAX:+ 55 31 38992219.

[3] Ph. D.; Professor at University of São Paulo (FEA-RP/USP.) – Brazil. E-mail: angelocg@usp.br.

Agribusiness is very important in the formation of Brazil's GDP and the generation of surplus in trade balance, which makes the Doha Round failure to seems a loss to Brazil. Many papers have demonstrated high potential gains for the Brazilian economy with the implementation of the Doha Round (FERREIRA FILHO and HORRIDGE, 2006); (GURGEL, 2006); (POLASKI, 2006); and (PEREIRA, TEIXEIRA and SKORBIANSKY, 2008). It is important to emphasize that there are different degrees of development among the Brazilian regions such that some regions may face higher losses than others. Accordingly, it is of great importance to consider the costs of the Doha Round failure to each Brazilian region.

Buetre et alii. (2004) and Gurgel (2006) argue that negotiations in the WTO are based on bound Tariffs. Most studies seeking to measure the impacts of multilateral trade negotiations do not take into account the differences between bound and applied tariffs generating an imprecision in the estimates. The tariffs applied by many countries are currently below the consolidated level since unilateral tariff reductions have occurred. Thus, the work of Buetre et alii. (2004) seeks to correct the errors generated by the gap between applied and bound tariffs. However, because the lack of information on tariff quotas, Beutre et alii. (2004) ignore the presence of these distortions in many agricultural products and therefore their results on the removal of tariffs under-estimate the gains from trade liberalization on agricultural products.

The objective of this paper is to determine the probable losses to the Brazilian regions from the failure of the Doha Round of negotiations. It is investigated agricultural import bound tariff cuts via the "Girard method" or Swiss formula. Import tariff cuts for manufactured goods follow Non-Agricultural Market Access (NAMA) recommendations. Agricultural production and export subsidies are treated as suggested by the World Trade Organization (WTO). It is developed a general equilibrium analysis project for the Brazilian economy (PAEG) that includes a software, a database and a model for the five macro Brazilian regions. It is used PAEG database 2 connected to the GTAP data base 7 representing the economic environment of 2004.

The innovations presented in this paper are to model the interrelationships among the Brazilian regions and other international regions. The PAEG model disaggregates the Brazilian database matrix into five regions and plugs them to an aggregation from the GTAP database. This allows the Brazilian and other international regions to be treated as endogenous in the model.

2. The Model

PAEG is a static, multiregional and multi sector model built to analyze the Brazilian economy at a regional level. It represents the production and distribution of goods and services in

the world economy. Each region is represented by a final demand structure composed of public and private expenses in goods and services. The model is based on optimizer behavior in which the consumers look to maximize their well-being subject to budgetary restriction. The productive sectors combine intermediary inputs and primary factors of production to minimize costs, given the available technology. The database includes bilateral trade flows between countries and regions, as well as the costs of transport, import tariffs and taxes (or subsidies) on exports. Table 1 describes the data sets represented in the model.

Table 1 – Data set description

Legend	Description
i, j	Sectors and firms
r, s	Countries and regions
$f \in m$	Factors of production of free mobility inside a given region: qualified work, non-qualified work and capital
$f \in s$	Fixed production factors: land and other natural resources

Figure 1 presents the general structure of the PAEG model. The presented symbols correspond to the variables of the economic model. Y_{ir} represents the production of goods i in the r region. C_r, I_r and G_r represent the private consumption, the investment and the public consumption respectively. M_{ir} represents the imports of goods i for the region r. HH_r indicates the consumer representative agent, and $GOVT_r$ represents the public sector or government. FT_{sr} represents an activity through which specific factors of production are allocated to particular sectors.

In Figure 1, the flows in the markets of factors and goods are represented by solid lines or dotted lines in an irregular form, while the payments of taxes are presented by the dotted regular line. Domestic and imported goods markets are presented in vertical lines on the right side of the figure. The domestic production (vom_{ir}) is distributed between exports ($vxmd_{irs}$), international transport services (vst_{ir}), intermediary demand ($vdfm_{ijr}$), private consumption ($vdpm_{ir}$), investment ($vdim_{ir}$) and government consumption ($vdgm_{ir}$). The accounting identity in the database, represented by the social accounting matrixes, referring to the domestic production is presented by equation 1.

$$vom_{ir} = \sum_{s} vxmd_{irs} + vst_{ir} + \sum_{j} vdfm_{ijr} + vdpm_{ir} + vdgm_{ir} + v\dim_{ir}. \qquad (1)$$

Imported goods, additionally represented by vim_{ir}, are used in intermediary consumption ($vifm_{jir}$), in private consumption ($vipm_{ir}$) and in government consumption ($vigm_{ir}$). Equation 2 presents the accounting identity of these flows.

$$vim_{ir} = \sum_{j} vifm_{ijr} + vipm_{ir} + vigm_{ir} . \quad (2)$$

The inputs to the production of Y_{ir} include intermediary inputs (domestic and imported), mobile production factors (vfm_{fir}, $f \in m$) and the consumption of the public agent ($vigm_{ir}$). The income from production factors services is distributed to the representative agent. The equilibrium in the factors market is given by an identity that relates the factors service payment to the income generated by them (equation 3).

$$\sum_{i} vfm_{fir} = evom_{fr} . \quad (3)$$

The equilibrium conditions in the international markets require that the exports of goods i for region r (vxm_{ir}) are equal the imports of the same goods for all commercial partners ($vxmd_{irs}$), as represented in equation 4.

$$vxm_{ir} = \sum_{s} vxmd_{irs} . \quad (4)$$

Likewise, equilibrium conditions are also applied to the international transportation services. The supply added from the transport service j, vt_j, is equated to the value of the export transport services (equation 5).

$$vt_j = \sum_{r} vst_{jr} . \quad (5)$$

The equilibrium in the transport services market equates the supply of these services to the sum of the bilateral flows of transport services acquired through imports ($vtwr_{jisr}$), as in equation 6.

$$vt_j = \sum_{r} vtwr_{jisr} . \quad (6)$$

The taxes revenue and transfers, indicated by the dotted line, are represented by R. The tax flows consist of indirect taxes on production and exports (R_{ir}^{Y}), on consumption (R_r^{C}), on government demand (R_r^{G}) and on imports (R_{ir}^{M}). The government income also includes direct taxes to a representative agent, represented by R_r^{HH}, as well as transfers from abroad, vb_r. The government budgetary restriction can be represented by equation 7.

$$vgm_r = \sum_{i} R_{ir}^{Y} + R_r^{C} + R_r^{G} + \sum_{i} R_{ir}^{M} + R_r^{HH} + vb_r . \quad (7)$$

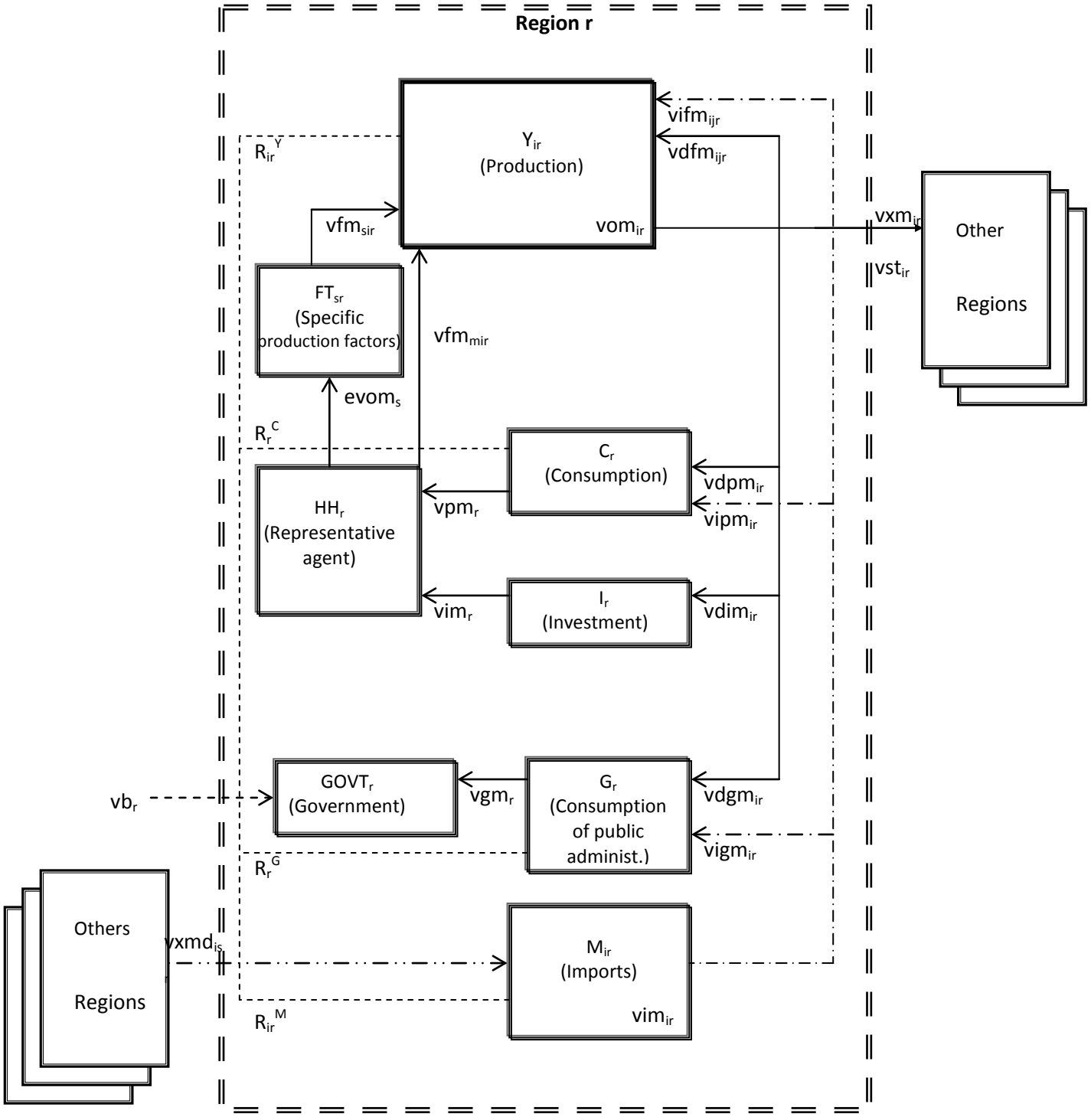


Figure 1 – Flows in PAEG`s open economy

The budgetary restriction of the representative agent relates the income of the production factors when they were deducted from the tax payments to the consumption and private investment expenses, as in equation 8.

$$\sum_{f} evom_{fr} - R_{r}^{HH} = vpm_{r} + vim_{r} . \qquad (8)$$

From the previous equations, it is possible to visualize two condition types for the consistency of the database contained in the input-output and social accounting matrices: the market equilibrium (supply is equal to demand for all goods and production factors), and the income equilibrium (net income is equal to net expenses). A third set of identities is concerned with the operational net profits in the economic sectors. The PAEG model, like the GTAP, takes into account perfect competition and constant returns to scale in such a way that costs with intermediary inputs and primary factors are equated to the production value, and profits are equated to zero. Such a condition is applied to each one of the productive sectors and activities, according to equations 9 through 15 as follows.

Y_{ir}: $$\sum_{f} vfm_{fir} + \sum_{j} \left(vifm_{jir} + vifm_{jir} \right) + R_{ir}^{Y} = vom_{ir} \qquad (9)$$

M_{ir}: $$\sum_{s} \left(vxmd_{isr} + \sum_{j} vtwr_{jisr} \right) + R_{ir}^{M} = vim_{ir} \qquad (10)$$

C_{r}: $$\sum_{i} \left(vdpm_{ir} + vipm_{ir} \right) + R_{ir}^{C} = vpm_{r} \qquad (11)$$

G_{r}: $$\sum_{i} \left(vdgm_{ir} + vigm_{ir} \right) + R_{ir}^{G} = vgm_{r} \qquad (12)$$

I_{r}: $$\sum_{i} v\dim_{ir} = vim_{r} . \qquad (13)$$

FT_{fr}: $$evom_{fr} = \sum_{i} vfm_{fir} \qquad f \in s \qquad (14)$$

YT_{j}: $$\sum_{r} vst_{jr} = vt_{j} = \sum_{irs} vtwr_{jirs} . \qquad (15)$$

The benchmark identities, 9 to 15, presented above indicate market clearance, zero profit and income balance conditions as the model microeconomic closures. The agents behavior in the model, however need to be described. It is considered the standard economic assumption of optimizing agents in the competitive equilibrium setting for both producers and consumers. A representative firm maximizes profit in each sector assuming constant returns to scale technology.

Production functions for each sector are described by a nested Leontief and a constant elasticity of substitution technology. Intermediate inputs are combined on a Leontief basis, but primary factors are subject to a greater than zero constant elasticity of substitution. Taxes are

applied on final sector output, on intermediate inputs and on factor demands on an ad-valorem basis. Intermediate inputs are a composite of domestically produced and imported inputs. The choice among imports from different trading partners is based on Armington's assumption of regionally differentiated products. The imports aggregated function is described by nested CES-Leontief functions, where transportation services enter on a proportional basis with imports from different countries, reflecting differences in unit transportation margins across different goods and trading partners.

Trade flows are subject to export subsidies and import tariffs. Final private consumption is represented by the maximization of utility subject to the budget constraint. Final demand is characterized by a Cobb-Douglas function which includes both domestic and imported inputs. A nested Cobb Douglas-CES function, where composite goods are substituted under the Cobb-Douglas nest is applied. Each composite good is a combination of domestic and imported goods combined under a CES elasticity. Land and natural resources are portrayed as sector-specific to agricultural production.

International transportation services come from an aggregation of transportation services exported throughout the world via a profit maximization function. We assume a Cobb-Douglas function which combines transport service from multiple regions.

Public consumption demand is represented by a Leontief function as an aggregation of domestic and imported goods. This formulation introduces substitution at the second level between domestic and imported inputs. All production activities in the model are represented by constant returns to scale technologies, and markets are assumed to operate competitively with free entry and exit. As a consequence, equilibrium profits are driven to zero and the price of output reflects the cost of inputs. Market clearance is obtained in each sector by supply and demand conditions. All CES elasticities are taken from the GTAP model.

The model uses the syntax from the Modeling Programming System for General Equilibrium (MPSGE) developed by RUTHERFORD (1999). The MPSGE represents a general equilibrium model through blocks of production functions, demand equations and specific restrictions. As soon as the blocks of the model are described, MPSGE transforms the information into algebraic equations that are processed in the GAMS software (RUTHERFORD, 1995).

2.1. Reconciling PAEG and GTAP database.

PAEG database version 2 is composed by 12 regions and 19 sectors and is compatible with the GTAP 7 database[4] (Table 2). Among the 12 regions 5 are Brazilian regions that substitute the data for Brazil in the aggregation obtaining from the GTAP 7 database.

Input-output matrices are constructed for 5 Brazilian regions. The construction of the regional Brazilian input-output matrices is described in details by TEIXEIRA et alii. (2008).

The GTAP database as well as the PAEG database is aggregated into regions and sectors. The Brazilian regional data matrices are calibrated in such a way that the Brazilian GDP is the sum of each region GDP. It is compatible in magnitude to the Brazilian GDP in the GTAP database. Also, the GTAP data on Brazilian imports are then distributed between the regions, using the regional Brazilian data matrix to define the relative participation of the imports of each region in total Brazilian imports. The same procedure is used to regionally distribute the Brazilian exports. For trade flows among the Brazilian regions and other regions, the database *Aliceweb* (MIDIC, 2010) is used. This procedure guarantees the consistency of the trade relationship between the Brazilian regions and the remaining regions and countries in the GTAP database.

Supply and demand in the Brazilian regional matrix lose equilibrium once their original exports and imports data were substituted by the Brazilian data from GTAP. To recompose equilibrium, the values of investments in the Brazilian regions are adjusted, as well as the capital flow. Once the PAEG model closure keeps the capital account fixed, as well as the balance of payment, the current account is also constant in benchmark equilibrium. The real exchange rate accommodates changes in trade flow.

After these adjustments, the Brazilian elasticities in the GTAP database are attributed to the Brazilian regions. Therefore, the Brazilian data matrix is removed from the aggregation obtained from GTAP, leaving only the adjusted regional Brazilian matrix data and the remaining international regions.

The data aggregation used in this paper is composed of 19 sectors and 12 regions (Table 2). The sectors aggregation include: paddy rice (pdr); corn and other grains (gro); Soybean (osd); sugar-cane and sugar-beet (sgr); meats and live animals (oap); raw milk (rmk); other agricultural goods (agr); and other processed food, beverages, and tobacco (foo). Also some manufactured goods are separated in the textile industry (tex); clothing and shoes (wap); paper goods, publishing (ppp); chemical, rubber, plastic goods (crp); and the remainder of the manufactured goods in a single sector (man). Last of all, the service sectors is separated into industrial services of public

[4] The GTAP database version 7.0 has data for 113 regions of the world, including Brazil, and 59 commodities/sectors. A complete discussion of the GTAP 7 database can be seen in NARAYANAN & WALMSLEY (2008).

usefulness (siu), construction (cns), commerce (trd), transport (otn) and public services and administration (ser).

Table 2 – Data aggregation

Regions	*Sectors**
1 – Northern region Brazil (NOR)	1 – Paddy rice (pdr)
2 – Northeast region Brazil (NDE)	2 - Corn and other grains (gro)
3 – Midwest region Brazil (COE)	3 – Soybean (osd)
4 - Southeast region Brazil (SDE)	4 - Sugar-cane and sugar-beet (c_b)
5 – South region Brazil (SUL)	5 - Meats and live animals (oap)
6 - Rest of the Mercosur (MER)	6 - Raw milk (rmk)
7 - United States (USA)	7- Other farming goods: wheat, fibers, fruits, vegetables (agr)
8 – Rest of NAFTA (NAF)	8 - Food goods: Other processed food , beverages and tobacco (foo)
9 - Rest of America (ROA)	9 - Textile Industry (tex)
10 - European Union 25 (EUR)	10 - Clothing and Shoes (wap)
11 - China (CHN)	11 - Wood goods (lum)
12 - Rest of the World (ROW)	12 - Paper goods, publishing (ppp)
	13 - Chemical, rubber, plastic goods (crp)
	14 - Manufactured: Non Metal Minerals, mechanical-metal, mining, diverse industries (man)
	15 - Useful Public Industrial services (siu)
	16 - Construction (cns)
	17 - Trade (trd)
	18 - Transport (otp)
	19 - Services and public administration (ser)

Note: * The nomenclature presented in parentheses will be used to make the presentation of the data easy.
Source: Prepared by the authors.

The 5 Brazilian regions in the PAEG 2 database are the Northern (NOR), Northeast (NDE), Midwest (COE), Southeast (SDE), and South (SUL). Also, the aggregation considers Argentina, Uruguay and Paraguay together as the Rest of Mercosur countries (MER), while the rest of the Latin American countries are joined in a single region called Rest of America (ROA). Due to its importance in the international scene, the USA will be treated as a single region outside of the rest of NAFTA (NAF)[5]. Others important regions are the European Union 25[6] (EUR) and China

[5] This will be composed of Canada and Mexico.

[6] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

(CHN). The remaining countries contained in the GTAP database are combined in the Rest of the World (ROW). A chart reconciling the GTAP sectors with the PAEG database is shown in appendix (Table A1).

2.2. Overview of Brazil's regions

Table 3 presents some statistics reflecting differences among the 5 Brazilian regions. The Southeast region presents more than half of the Brazilian Gross Domestic Product (GDP) and more than 40% of the population. In terms of *per capita* GDP, the South and Southeast regions presents twice that of the Northeast region and almost double of the Northern region.

Regional differences are more evident for the agribusiness sectors. In the south and southeast regions of Brazil more than 50 % of the farms are smaller than 100 ha, with highly diverse production systems in terms of job generation. In the Midwest region less than 3% of the farms are less than 100 ha, with most production concentrated in areas larger than 1,000 ha and it is highly capital-intensive agriculture. The northern region is highly extractive and agricultural production is concentrated mainly in the transition area between the Amazon forest and the cerrado. In the Northeast there are areas of cerrado holding the bulk of production in irrigated fields while most farmers produce only for self consumption (IBGE, 2009).

Table 3 - Brazilian regions statistics (2004).

Regions	GDP (R$ million)	GDP (%)	Population	Population (%)	GDP *per capita* (R$)
North	93,423	5.29	14,373,260	7.92	6,499.78
Northeast	248,445	14.06	50,427,274	27.77	4,926.80
Midwest	132,727	7.51	12,770,141	7.03	10,393.55
Southeast	970,245	54.92	77,374,720	42.61	12,539.55
South	321,781	18.21	26,635,629	14.67	12,080.85

Source: IBGE (2009).

Table 4 presents the production, exports and imports values for the five Brazilian regions in the benchmark. Figure 2 shows the political map of Brazil divided by regions.

The Northern Region (NOR) is the largest region in Brazil, with 42 % of the national territory. Also it is the region where most of the Amazon Forest is contained. However, it presents the smallest demographic density of all regions[7]. It is an important region in the production of other farming goods (agr), in particular Amazonian fruits such as acai, guarana and cupuaçu, fish, and extractives vegetable goods, such as the Brazilian nuts; and processed foods

[7] Demographic density of Brazil is 21.64 inhabitants / km ² compared to 3.31inhabitants/km ² in the Northern region (IBGE, 2009).

(foo). Also it relevant in the production of latex products, chemistry, pharmaceutical and plastic industries (crp); wood and furniture (lum); and manufactured goods (man) produced in the Free trade area of Manaus, which is the most important industrial center in the region. The services and public administration sector (ser) represents nearly 26% of the region gross production value in 2004.

Regarding the agribusiness production value in the Northeast Region (NDE) this region is important in the production of other farming goods (agr), especially in the production of cocoa, sugar and fruits; and food goods (foo). Also, it stands out in the textiles (tex); clothing and shoes (wap); and chemistry, pharmaceutical and plastics (crp) sectors. The services and public administration sector (ser) corresponds to 33 % of the region gross production value.

The Midwest Region of Brazil (CEO) stands out mainly in farming production, especially meat production (oap); soybean (osd); food goods (foo) and other farming goods (agr). This region is located predominantly in the cerrado area with large scale production and high capital-intensive technology. On the other hand, it is the least populous region of the country and has the second smallest population density, second only to the Northern Region.

The Southeast region of Brazil (SDE) concentrates more than half the Brazilian GDP, 54.5%, in 2004. It includes the states of Sao Paulo, Minas Gerais, Espírito Santo, and Rio de Janeiro. In agribusiness, this region emphasizes the production of food goods (foo), especially coffee, sugar and ethanol; other farming goods (agr), especially orange juice production; meats (oap); dairy and raw milk (rmk); and corn and other grains (gro). The main manufacture industries of Brazil are in this region. The majority of the country population is in the Southeast region.

The Southern region, in spite of being the smallest Brazilian region, 6.75 % of the territory, is the main agribusiness producer and has the second largest GDP in 2004. Because of its mild climate, predominantly subtropical, other commodities can be cultivated, as is the case of wheat, among other farming goods (agr) and rice (pdr). The region main agricultural production is: meats (oap), soybean (osd), food goods (foo), and grains (gro). Also, it excels in clothing and shoes (wap), and textile (tex).

Regarding the trade flow for the Northern region (NOR), the exports of other farming goods (agr) is the most important, in particular Amazonian fruits. Furthermore, the wood and furniture (lum) exports and especially manufactured goods (man) with a main destination for other South American countries are also notable. The imports of the rubber, chemistry, pharmacist and plastics (crp), food sector (foo), and the manufactured goods sector (man), which receives imported raw material to be assembled in the Free-trade zone is also important.

Table 4 – Production, exports, and imports value in the Brazilian regions in 2004 (US$ million).

Regions	Sectors*																		
	pdr	gro	osd	c_b	oap	rmk	agr	foo	tex	wap	lum	ppp	crp	man	siu	cns	trd	otp	ser
	Production Value (US$ million)																		
NOR	36.16	174.25	50.67	60.55	622.83	79.69	3,522.40	1,840.65	907.82	146.56	2,098.56	1,160.73	2,164.44	10,568.46	2,130.34	11,395.22	3,606.70	902.49	14,451.34
NDE	488.51	835.93	1,403.20	3,105.98	2,254.53	254.22	5,139.26	9,604.21	2,398.98	1,728.26	745.60	683.45	14,335.91	8,617.45	5,332.11	22,826.39	14,020.73	4,103.02	50,066.03
COE	839.67	335.15	5,006.10	389.06	5,685.97	403.04	2,913.13	4,975.59	789.51	618.44	621.23	854.85	3,631.26	2,536.45	2,025.87	14,167.78	5,740.19	2,225.81	44,947.77
SDE	869.64	1,611.19	2,633.74	1,777.63	5,440.09	1,956.57	17,428.96	43,387.28	9,757.60	6,306.30	4,154.13	13,822.42	65,642.13	150,262.05	20,784.48	24,264.61	41,585.19	28,478.18	232,577.29
SUL	1,796.39	2,070.17	5,949.71	1,324.17	5,733.18	1,131.41	13,329.70	30,517.52	9,790.85	16,649.84	7,077.85	4,746.91	10,527.72	26,112.50	12,032.78	19,517.82	19,467.12	11,392.85	81,908.83
	Export Value (US$ million)																		
NOR	15.49	103.36	35.13	24.97	274.41	34.02	1,995.03	499.42	32.59	43.92	1,625.95	828.29	443.27	7,900.82	0.79	0.68	991.63	202.69	178.02
NDE	52.58	320.58	791.59	269.37	235.30	17.53	1,191.29	3,552.17	1,092.97	395.36	40.82	24.70	5,246.98	2,915.59	0.11	0.00	4,930.12	342.49	2,641.24
COE	427.87	107.79	3,398.00	130.68	2,573.64	194.19	1,758.84	1,880.28	123.73	156.57	186.59	195.06	591.28	952.00	315.92	502.57	757.40	311.17	4,624.55
SDE	31.49	279.93	746.81	48.73	282.83	80.66	2,575.97	11,981.01	2,328.10	2,007.50	1,203.37	3,247.87	16,444.01	63,018.77	386.95	1,760.22	1,238.26	2,072.26	20,507.24
SUL	596.00	753.59	3,193.05	482.61	1,845.70	231.68	4,817.65	16,295.38	2,286.57	11,588.37	3,715.57	981.90	1,969.59	10,930.55	1,439.17	1,187.40	2,415.66	2,247.69	24,407.88
	Import Value (US$ million)																		
NOR	8.73	11.18	16.04	13.41	36.74	6.58	179.69	1,026.01	327.02	729.06	204.38	195.55	1,656.81	7,263.64	620.55	19.19	222.05	284.52	2,986.64
NDE	69.32	65.65	126.06	51.68	262.14	50.84	744.16	3,719.23	1,198.41	1,871.29	485.15	346.26	5,885.48	7,702.63	227.05	37.78	559.51	792.46	2,629.94
COE	47.66	38.07	73.92	45.43	146.26	21.20	442.65	808.24	499.67	445.18	345.50	546.36	3,417.48	5,977.51	100.75	19.05	728.60	342.53	3,383.91
SDE	1,016.76	573.35	2,329.00	728.41	4,265.22	426.71	5,955.23	11,432.75	2,091.58	7,483.12	1,646.84	780.69	14,768.69	39,825.60	2,399.96	1,123.98	7,046.63	3,739.24	23,696.30
SUL	79.48	106.83	98.85	117.66	286.36	52.54	1,437.62	1,947.33	1,912.16	516.75	242.76	800.47	9,167.92	16,822.43	525.88	2,262.70	2,187.68	1,126.83	22,280.07

* The sectors are: Paddy rice (pdr); corn and other grains (gro); Soybean (osd); sugar-cane and sugar-beet (c_b); meats (oap); raw milk (rmk); other agriculture goods (agr); other processed foods (foo); textiles (tex); clothing and shoes (wap); wood and furnishings (lum); paper goods, publishing (ppp); Chemical, rubber, plastic prods (crp); manufactured (man); Industrial Services of Public Usefulness (siu); civil construction (cns); trade (trd); transport (otp); services and public administration (ser).

Source: Research Data.

Source: PORTALBRASIL (2009).

Figure 2 – Political Map of Brazil divided by region.

In the Northeast (NDE), the exports of food goods (foo); and sugar-cane (sgr); and the imports of the chemical industry (crp), processed foods (foo) and manufactured goods (man) are relevant. The Midwest (COE) excels in the exportation of meats (oap), soybean (osd), food goods (foo) and other farming goods (agr). The main imports are from the chemical industry (crp), since the greater part of the fertilizers and agricultural chemicals used in production are imported. It also imports large amount of manufactured goods (man).

Regarding the trade flow of the southeast region (SDE), the most important exports are from the manufactured sectors (man), especially minerals, iron and steel, and vehicles; the rubber, chemistry; pharmacist and plastics (crp), cellulose and paper (ppp), food goods (foo) and other processed goods (agr). Regarding the imports: rice (pdr), corn (gro), and soybean (osd) are considerable. It also excels in the importation of food goods (foo) and other processed goods (agr).

The exports of the agribusiness goods from the Southern region are mainly: meats (oap), soybean (osd), other farming goods (agr), food goods (foo), corn (gro) and rice (pdr). The clothing and shoes (wap) and textile (tex) exports also excel. The main imports are manufactured goods (man) and from the rubber, chemistry, pharmacist and plastics (crp) industry. That happens because, like the COE Region, a large part of the fertilizers and agricultural chemicals used in production are imported.

3. Scenario

3.1 WTO proposal for agricultural production subsidies and export subsidies

Developed countries were not satisfied with the results from the Uruguay Round regarding the reduction of agricultural production and exports subsidies, and the reduction of imports tariffs. For this reason, the WTO proposed the Doha Round to specifically address this issue through a more detailed examination of agricultural subsidies. Production subsidies were subdivided into five categories: green box, search and development (S&D) box, red box, amber box, and blue box.

Provided that they comply with all relevant criteria, green box production subsidies are not prohibited and therefore unlimited. This green box encompasses resources destined for government programs directed toward research and extension, infrastructure, control of plagues and diseases, and emergency support for agricultural producers. According to the WTO (2006), this type of subsidy is justified due to the intrinsic characteristics of agricultural activities, such as the exposure to environmental risks that generally provoke large harvest losses. These subsidies are considered non distortionary in regards to international trade.

The S&D box encompasses production subsidies directed toward agricultural search and development and are also not prohibited. These subsidies are intended to give special assistance to agricultural activities in developing countries. This policy takes into account the countries development needs, including food security and rural development. The S&D Box may be a special safeguard mechanism for developing countries.

The production subsidies included in the red box are prohibited due to their strong capacity to distort commercial flow between countries. According to the WTO (2004), up until 2004 there were no records of countries using the red box category.

The production subsidies included in the blue and amber boxes distort international trade and must be reduced. Blue box subsidies such as deficiency payments are not in accord with multilateral agreements. According to the WTO (2005), this type of subsidy is present in Japan and countries belonging to the European Union (EU), such as Slovenia, Iceland, Slovakia, and Norway, which have until 2010 to eliminate them. Some countries insist that blue box subsidies are an important tool for supporting and reforming local agriculture and argue that they must be kept. Amber box subsidies are those designed to maintain a particular market price, i.e., policies to achieve a particular price level and include minimum price guarantee and direct payments to producers. Subsidies in the amber box that total less than 5% of the production value are exempt from WTO mandated cuts.

The WTO presented a proposal for the reduction of global agricultural subsidies that divided world economies into three groups, determined by the total amount of subsidies provided. Group 1 consists of countries that provide a total agriculture subsidy of up to US$ 10 billion, and the WTO proposed subsidy cuts ranging from 31% to 70%. Group 2 is made up of countries with subsidy expenditures ranging from US$ 10 billion to US$ 60 billion, with proposed cuts varying from 53% to 75%. Group 3 contains countries with subsidy expenditures superior to US$ 60 billion, and proposed subsidy cuts ranging from 70% to 80%. The groups and proposed production subsidy reductions are shown in Table 5. The subsidy reductions listed are the minimum proposed by the WTO for each group.

Table 5 - Proposal by the WTO for the reduction of the global agricultural subsidy expenditure

Group	*Expenditure in US$ billion*	*Reduction*
1	0 - 10	31 %
2	10 - 60	53 %
3	> 60	70 %

Source: WTO (2005).

The United States of America (USA) falls into Group 2, the EU falls into Group 3, and other countries providing agricultural subsidies fall into in Group 1 (WTO, 2006).

Currently, the Doha Round negotiations have put forward a ban on export subsidies. This proposal is more stringent than those made at the Uruguay Round, which advocated only a reduction in export subsidies.

3.2. Proposal for border tariffs reduction

The Girard approach or the Swiss method, used in this paper, has been suggested as a reasonable approach to tariff reduction. This method applies the Swiss formula and would result in steeper reductions in higher tariffs than in lower tariffs. The formula was put forward by the Chairman of the WTO Non-Agricultural Market Negotiating Group, Pierre-Louis Girard in an attempt to set targets for negotiation. According to the formula, all non-agricultural tariffs are to be reduced on a line-by-line basis using the following formula:

$$T_1 = \frac{t_a T_o}{t_a + T_o}, \qquad (16)$$

where, t_1 is the final rate, to be bound in *ad valorem* terms, t_a is the national average of the bound rates within each band, and T_0 is the initial rate. Table 6 contains stipulated WTO tariff reduction limits, clearly stating permitted divergence. The advantage this methodology has is that it harmonizes proposed reductions within each tariff grouping.

Table 6 - Proposal by the WTO for the agriculture tariff reduction (Girard or Swiss approach).

Group	*Current Tariffs*	*Reduction*
1	0 % – 20/30 %	20 %-65 %
2	20/30 % – 40/60 %	30 % - 75 %
3	40/60 % - 60/90 %	35 % - 85 %
4	> 60/90 %	42 % - 90 %

Source: WTO (2005)

To reflect Non-Agricultural Market Access (NAMA) negotiations, tariff reductions are shown in Table 7. It is hoped that by reducing both agricultural and non-agricultural tariffs, potential negotiating friction between developing and developed countries will be diminished.

Table 7 – Proposal for the tariff reduction of manufactured goods

Group	Current Tariff	Reduction
1	0 %-20 %	42.5 %
2	20 %-40 %	52. %
3	40 %-60 %	60 %
4	> 60 %	66 %

Source: WTO (2005)

3.3. Methodology to find the bound tariffs applied to PAEG (BD2).

Buetre et alii. (2004) estimated bound tariffs that will be used in this study. Gurgel (2006) organized those bound tariffs in a special aggregation that will be used in this paper. The sum of the consolidated tariffs for each product is later distributed to each country using the share of the applied tariffs in its sum obtained from the GTAP database. Next, the bound tariffs are compared with the applied tariffs and in cells in which the value of consolidated tariffs was lower than the applied tariffs; the applied tariff was reduced to match the consolidated tariff. From this new tariff array, the reductions were applied according to the Girard formula (Appendix B).

4. Results

4.1. Global results from the Implementation of the Doha Round

Table 8 presents the results for welfare gains and economic growth if the Doha Round of negotiation where implemented. The measure of welfare adopted is that of equivalent variation (EV) which is obtained through multiplication of the initial equilibrium expenditure, before the simulations, by the percentage variation in *per capita* utility. This indicator takes into consideration the size of the economies.

The implementation of the Doha Round would generate welfare gains to all regions. Because of the Doha Round failure the regions in this aggregation lose the opportunity to increase by this much the welfare gains. China is the single country with the highest welfare gains. All the Brazilian regions would present welfare gains. The Southern region (SUL) has a welfare gain of US$ 1.02 billion and the highest rate of welfare growth, 1.24 %.

Table 8 – Change in the welfare and GDP growth

Regions*	Change in EV		Δ % GDP
	US$ billion	%	
NOR	0.015	0.078	0.052
NDE	0.351	0.657	0.314
COE	0.354	1.204	0.33
SDE	1.093	0.44	0.243
SUL	1.017	1.244	0.212
RMS	0.418	0.382	0.094
USA	8.141	0.099	0.043
RNF	2.724	0.265	0.157
ROA	4.845	1.077	0.373
EUR	14.595	0.192	0.112
CHN	17.083	2.442	0.321
ROW	71.581	1.069	0.371

* NOR stands for the Brazilian North region; NDE, for the Northeast; COE, for the Midwest; SDE, for the Southeast; and SUL, for the Brazilian Southern region; RMS, for the rest of Mercosur; USA, for the U.S.; RNF, for the rest of NAFTA; ROA, for the rest of the Americas; EUR, for the E.U 25; CHN, for China; and ROW, for the rest of the world.

Source: Research data.

All regions present economic growth under this Doha Round scenario. Because of the Doha Round failure, all regions in this aggregation lose the opportunity to increase economic growth. The Rest of America (ROA) gets the largest GDP growth rate of 0.37 % followed by China (CHN) with

a growth rate of 0.32 % and the Midwest region of Brazil (NDE) with a rate of 0.33%. These results can be viewed as the loss to the regions due to the Doha Round failure. In times of international economic crisis, in which a decrease in the world-wide demand is expected to be around 9 % (GAMBERONI and NEWFARMER, 2009), the results of the Doha Round would contribute to the recovery of global demand growth.

4.2. Regional impacts in production from the Doha Round of negotiation

Table 9 shows the main results in terms of changes in the production value if the Doha Round were to be implemented. As such, the results of this section can be interpreted as losses that would occur (in the case of positive variations) if the Doha Round was not implemented.

Table 9 – Percentage changes in production value - Doha Round scenario (%)

	NOR	NDE	COE	SDE	SUL
pdr	13.63	2.30	0.30	8.35	4.78
gro	5.83	2.12	2.21	4.92	3.76
osd	13.44	6.54	4.19	9.85	7.43
c_b	7.40	2.47	1.03	1.82	2.91
oap	6.57	5.29	2.73	5.60	5.05
rmk	8.74	3.18	1.08	5.47	4.86
agr	8.37	3.48	2.08	4.38	3.36
foo	8.30	12.01	4.27	9.89	8.29
tex	0.30	-7.66	-4.45	-2.03	-5.95
wap	2.29	-1.63	-2.77	0.41	-2.66
lum	3.38	-0.79	-2.39	0.55	-2.76
ppp	0.42	-1.26	-3.48	-0.91	-1.88
crp	0.23	-5.97	-3.98	-1.92	-3.16
man	-6.12	-7.94	-8.30	-2.00	-5.68
siu	0.70	-1.32	-1.56	0.04	-0.60
cns	0.00	-0.02	-0.16	0.19	-0.24
trd	1.53	-0.19	-0.37	0.36	0.19
otp	1.50	0.01	-0.64	0.43	0.12
ser	-0.39	-0.43	-0.41	-0.35	-0.61

* The sectors are: rice (pdr); corn and other grains (gro); soybean (osd); sugar-cane and sugar beet (c_b); meats (oap); raw milk (rmk); other agriculture goods (agr); other processed foods (foo); textiles (tex); clothing and shoes (wap); wood and furnishings (lum); paper goods, publishing (ppp); Chemical, rubber, plastic prods (crp); manufactured (man); Industrial Services of Public Usefulness (siu); civil construction (cns); trade (trd); transport (otp); services and public administration (ser).

Source: Research results.

The results for the Northern region (NOR) show an expressive growth in agribusiness sectors with a distinction for growth in the production of rice (13.63%), and Soybeans (osd)

(13.44%). Also, the raw milk (rmk), other agriculture goods (agr) and other processed foods (foo) present considerable growth. The wood and furniture production (lum) would also have expressive growth. Those are the main sectors to lose the opportunity to grow due to the Doha Round failure. On the other hand, the manufactured sector (man), which is an important sector for the region, would have a reduction in production value by -6.12 %[8] with the Doha round.

In the Northeast region (NDE) an expressive growth of agribusiness sectors is observed, with a distinction in the sectors of processed foods (foo), soybeans (osd) and meats (aop). On the other hand, all the northeastern sectors of manufactured goods would present losses caused by the increase in competition with foreign manufactured goods.

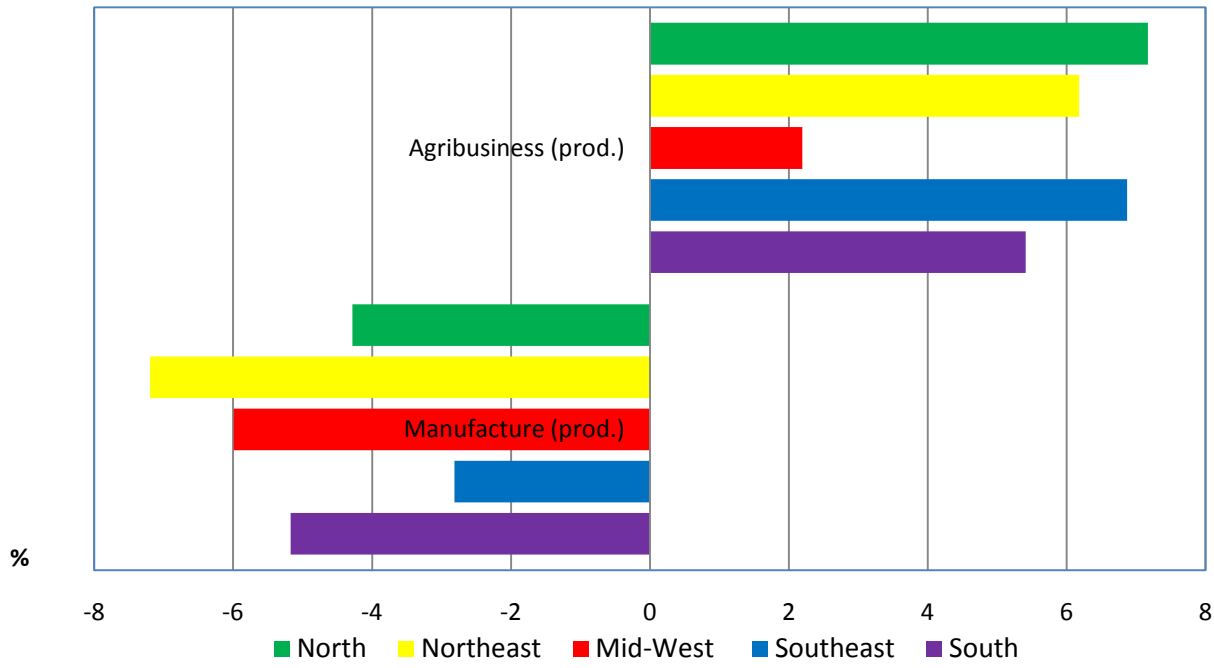
In the Midwest region (COE) there is a strong increase in production in the sectors of processed foods (foo), soybeans (osd) and meats (oap). All the manufactured goods sectors are negatively affected, with 8.3 % reduction in the output of manufactured goods (man), which suggests such sectors are relatively less efficient in the Midwest region.

The Southeast (SDE) and South (SUL) regions present very similar results with growth in agribusiness especially in the sectors of processed foods (foo), soybeans (osd), meats (aop), raw milk (rmk), paddy rice (pdr) and agriculture goods (agr). The manufactured goods sectors in general present small decreases (sectors tex, wap, ppp, crp). The manufactured goods sector (man) in the Southeast (SDE) presents a decrease, but is smaller than in the South (SUL).

Figure 3 summarizes the production value changes for the aggregated agribusiness and manufactures sectors in the Brazilian regions. It is observed agriculture production value increase and manufacture production value decrease in all regions. This means the manufacture sector is not competitive[9] under this scenario of trade liberalization in all Brazilian regions.

[8] This study does not speculate on the effect the increase in agriculture production has on deforestation in the North region, since primary factors are fixed. More details on the subject can be seen in FERRAZ (2001).

[9] In the HAGUENAUER (1989) concept competitiveness is a structural characteristic; it is the capacity of a country to produce determined goods equaling or surpassing the observable levels of efficiency in other economies.



Source: Research results.

Figure 3 – Percentage changes in production value for the aggregated agribusiness and manufacture sectors in the Brazilian Regions.

4.3. Regional impacts in trade flows.

Table 10 shows the percentage changes in trade flows for the Brazilian regions with the implementation of the Doha Round. Expressive changes in trade flow are observed due to a decrease in the reduction of trade barriers.

The increase in the production of agribusiness sectors in the Northern region (NOR) would be followed by a strong increase in its exports and a decreases in its imports. The increase in the exports would be greater in the sectors of other processed foods (foo), rice (pdr), soybean (osd), agriculture goods (agr) and sugar-cane (c_b). Increases in the wood and furnishings (lum) exports would also occur (4.29%). The manufactured goods (man) exports would decrease considerably. This indicates that implementation of private and public policies are necessary to increase competitiveness before implementing the Doha Round.

Expressive increase in the exports of agribusiness goods and decrease in the imports of agricultural goods were observed in the Northeast (NDE). The highest increase is in the sectors of other processed foods (foo), soybean (osd) and agriculture goods (agr). Following the decrease in production, all sectors of manufactured goods would experience decreases in the exports under the Doha Round.

Table 10 – Variation in trade flows resulting from the implementation of the Doha Round (%).

	Variation in the value of exports (%)					Variation in the value of imports (%)				
	NOR	NDE	COE	SDE	SUL	NOR	NDE	COE	SDE	SUL
pdr	24.01	6.01	0.14	10.01	4.28	-3.30	4.46	5.28	3.30	8.14
gro	6.95	1.85	2.07	3.65	2.47	0.04	4.64	2.48	4.11	4.83
osd	16.40	10.06	5.06	14.59	8.84	-1.19	4.63	3.92	4.58	5.65
c_b	12.52	2.97	1.39	7.15	3.73	-1.81	5.61	2.67	3.53	4.11
oap	9.34	3.27	3.71	4.21	4.86	-0.75	5.01	3.38	4.96	5.19
rmk	14.32	5.18	1.07	5.11	2.99	-2.36	4.57	3.75	3.12	5.36
agr	12.99	7.23	3.19	11.37	4.31	-0.54	5.19	3.10	3.92	6.12
foo	24.07	30.39	9.99	30.52	12.99	-0.66	1.40	3.96	0.88	6.63
tex	5.23	-11.54	-11.37	-3.77	-8.73	0.42	0.42	1.65	2.29	3.10
wap	2.04	-6.35	-9.31	-0.51	-2.79	-1.09	1.01	3.18	-0.69	28.37
lum	4.29	-6.26	-5.72	1.16	-4.01	-3.58	0.87	1.64	-0.97	9.21
ppp	0.55	-6.23	-8.06	-1.30	-5.46	-0.92	0.73	1.10	9.19	3.88
crp	-0.93	-8.88	-8.63	-1.83	-5.94	1.11	0.95	1.90	5.46	1.57
man	-6.87	-11.54	-13.69	-0.03	-6.96	-0.70	1.07	0.44	5.55	1.50
siu	1.53	-2.36	-6.50	-0.16	-3.56	-1.58	1.08	3.73	-1.43	2.91
cns	2.74	0.00	-3.54	2.17	-1.39	-2.50	0.50	1.76	-1.35	0.91
trd	4.08	-0.71	-3.80	1.48	-1.91	-0.60	0.56	2.04	-0.80	1.46
otp	3.54	-1.42	-4.56	0.16	-2.71	-1.58	1.27	2.23	-0.07	2.64
ser	1.95	-0.98	-3.70	1.67	-1.98	-1.49	0.93	2.16	-0.74	1.38

* The sectors are: rice (pdr); corn and other grains (gro); soybean (osd); sugar-cane and sugar-beet (c_b); meats (oap); raw milk (rmk); other agriculture goods (agr); other processed foods (foo); textiles (tex); clothing and shoes (wap); wood and furnishings (lum); paper goods, publishing (ppp); Chemical, rubber, plastic prods (crp); manufactured (man); Industrial Services of Public Usefulness (siu); civil construction (cns); trade (trd); transport (otp); services and public administration (ser).

Source: Research results.

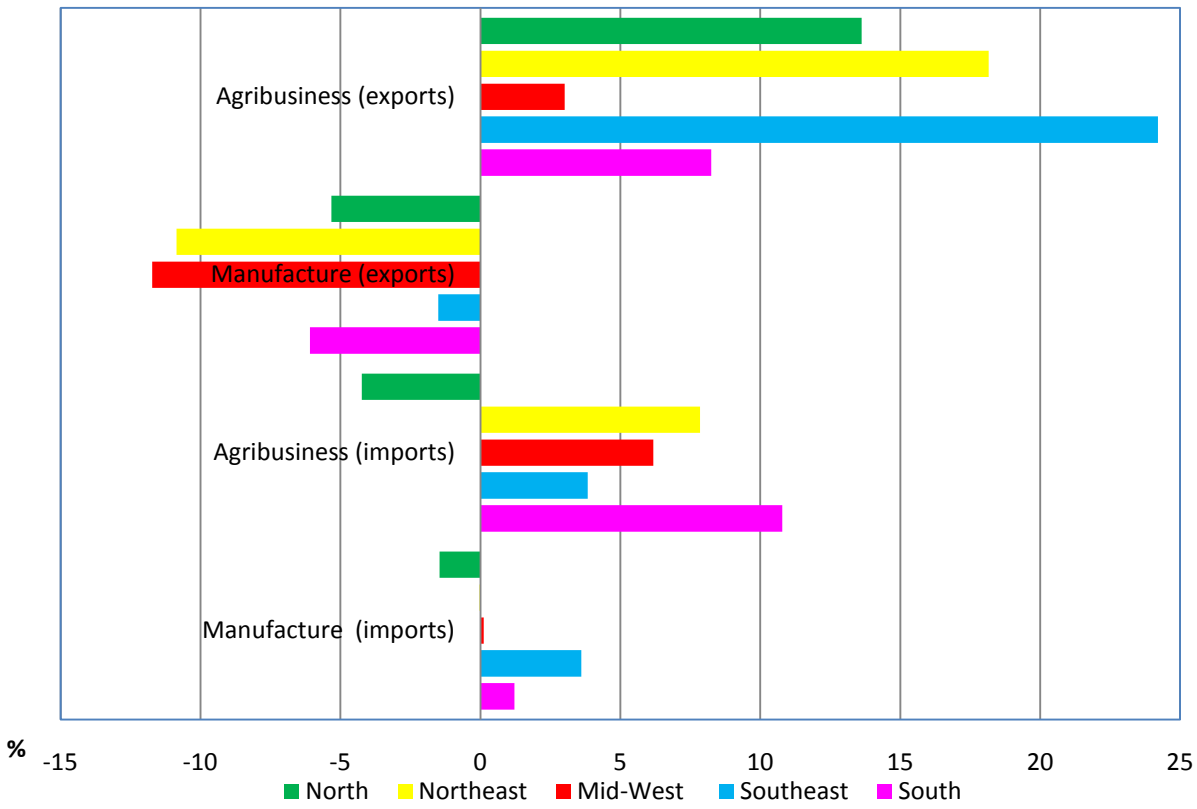
In the Midwest (COE) a strong increase in the exports of other processed foods (foo), soybean (osd) and meats (oap) by 9.99%, 5.06% and 3.71% respectively, would be observed. All the other sectors would present decreases in exports, with a distinction for decreases in the manufactured goods (man), which indicates that there would be specialization in favor of the meats and corn sectors in this region. The increase in imports of all sectors in this region would still be noticeable.

In the Southeast (SDE), as well as in the regions previously presented, a strong growth in the sectors of processed foods (foo), soybeans (osd), meats (aop), raw milk (rmk), paddy rice (pdr) would be observed. However, it should be added that there are expressive increases in the exports of other processed foods (foo), agriculture goods (agr), soybean (osd), and rice (pdr) which are important sectors in this region. The exports of manufactured goods (man) keeps constant.

Summed up, the non-implementation of the Doha Round prevents the trade flow in the Southeast from growing considerably.

In the Southern region (SUL), similar to other regions, a strong increase in the exports of processed foods (foo), soybeans (osd), and also in the rest of the agribusiness sectors was observed. The exports decreased for all manufactured products. On the other hand, increase in the imports of all sectors for this region are expected. In general a specialization is observed in the Southern region on behalf of the agribusiness goods in this region.

Figure 4 summarizes the changes in trade flows for the aggregated agribusiness and manufacturing sectors in the Brazilian regions. It is observed positive changes in agribusiness exports in all regions, and decrease in manufacture exports in most of the regions. Agriculture Imports decrease in all regions except in the Midwest and South. On the other hand, manufacture imports increase in most of the regions, but not in the North and Northeast regions.



Source: Research results.

Figure 4 – Percentage changes trade flows for the aggregated agribusiness and manufacture sectors of Brazilian Regions.

5. Final considerations

The main objective of this study is to identify the losses in the Brazilian regions resulting from the failure of the Doha Round. To reach this goal, an applied general equilibrium model, a software to run the model, and a database putting Brazilian regional data into the GTAP database are developed. This package is known as the General Equilibrium Analysis Project of the Brazilian Economy (PAEG).

The results suggest modest gains in GDP and in welfare for all regions. The Brazilian region with larger economic growth is the Midwest. This is the region that would lose more due the failure of the Doha Round. The South is the Brazilian region that present the highest increase in welfare, thus it would be the area that would lose the most with the failure of the Round.

The agribusiness sectors register strong production increases in the Brazilian regions. This is especially true for the sectors of processed foods, soybeans and meats. The failure of the Doha Round must be seen as a lost opportunity to expand agriculture production.

Due to trade liberalization, some Brazilian regions can specialize in the production of determined goods. This would happen visibly in the South and Midwest regions in favor of the agribusiness activities. In general, exports in the agribusiness sectors will grow rapidly, while the manufactured sectors exports will decrease in lesser intensity. Thus, policy makers should get ready to face this reality after the implementation of the new Doha Round of negotiations.

The manufactured activities such as chemicals, textiles, shoes, wood and furniture, and paper present, in general, small negative production changes reflecting the lack of competitiveness of those sectors in the main regions. The improvement of the internal business environment is the most important factor for the encouragement of Brazilian competitiveness. So, policies that would reduce indirect taxation and increase investment in infrastructure are basic for competitiveness improvement in the Brazilian economy.

The new deadline for the conclusion of the Doha Round, 2013, warrants additional time for the private and public sectors to implement policies that will increase the competitiveness of the manufacture sector in all Brazilian regions.

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Appendix

Table A1 - Compatibility among the sectors of the PAEG and GTAP

Sectors PAEG	Sectors of the GTAP
Rice (pdr)	pdr "Paddy rice", pcr "Processed rice"
Corn (gro)	gro " Cereal grains nec ",
Soy (osd)	osd " Oil seeds " vol " Vegetable oils and fats "
Sugar cane (sgr)	c_b "Sugar cane, sugar beet" sgr "Sugar"
Meats (aop)	ctl " Cattle, sheep, goats, horses " oap "Animal products nec" cmt " Meat: cattle, sheep, goats, horse " omt "Meat products nec"
Dairy and deivates (rmk)	rmk "Raw milk" mil " Dairy products "
Other farming goods (agr)	wht " Wheat " v_f " Vegetables, fruit, nuts " pfb " Plant-based fibers " ocr " Crops nec " wol " Wool, silk-worm cocoons "
Food Products (foo)	ofd " Food products nec " b_t " Beverages and tobacco products "
Textile Industry (tex)	tex " Textiles "
Clothing and Shoes (wap)	wap " Wearing apparel " lea " Leather products "
Wood and Furniture (lum)	lum " Wood products "
Pulp, Paper and publishing. (ppp)	ppp " Paper products, publishing "
Rubber, chemistry, pharmaceutical and plastics Ind (crp)	crp " Chemical, rubber, plastic prods "

Table A1 - Compatibility among the sectors of the PAEG and GTAP (cont.)

Sectors PAEG	Sectors of the GTAP
Manufactured goods (man)	frs " Forestry " fsh " Fishing " coa" Coal " oil " Oil " gas " Gas " p_c " Petroleum, coal products " nmm " Mineral products nec " i_s " Ferrous metals " nfm " Metals nec " fmp " Metal products " mvh " Motor vehicles and parts " otn " Transport equipment nec " link " Electronic equipment " ome " Machinery and equipment nec " omf " Manufacture nec " omn " Minerals nec "
Siup (siu)	ely " Electricity " gdt " Gas manufactures, distribution" wtr " Water "
Civil construction (cns)	cns " Construction "
Commerce (trd)	trd " Trade "
Transports (otp)	otp " Transport nec " wtp " Sea transport " atp " Air transport "
Services (ser)	cmn " Communication " ofi " Financial services nec " isr " Insurance " obs " Business services nec " ros " Recreation and other services " osg " PubAdmin/Defence/Health/Educat " dwe " Dwellings "

Appendix B

Table B1- Applied and consolidated Brazilian import tariffs

	Applied Tariffs								Bounds tariffs							
rTMS	BRA	RMS	USA	RNF	ROA	EUR	CHN	ROW	BRA	RMS	USA	RNF	ROA	EUR	CHN	ROW
1 pdr	0	0	7.7	0	0	11.4	0	4.6	0	0	14.8	14.8	0	22.7	0	3.7
2 agr	0	0	8.2	5.6	7	7.5	7	10.7	0	0	8.8	8.8	5.6	6	5.6	8.6
3 gro	0	0	5.2	4.7	0	7	4.8	0.6	0	0	14.4	14.4	0	12.2	8.1	7.3
4 osd	0	0	4.9	4.7	4.3	4.5	4.9	5	0	0	5	5	3.4	4.7	5.5	4.3
5 c_b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 oap	0	0	4	1.7	3.3	5.8	9.7	4.4	0	0	3.2	2.9	2.6	5.8	7.8	3.5
7 rmk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 man	0	0	9	5.6	2.5	12	10.8	5.8	0	0	5.2	3.6	5.1	6.9	6.2	3.3
9 foo	0	0	14	8.7	9.5	15.9	11.7	10.1	0	0	8.1	5	5.5	9.1	6.7	5.8
10 tex	0	0	14.9	12.5	7	15.7	17.4	16.4	0	0	8.6	7.2	4	9.03	10.01	9.4
11wap	0	0	18.8	16	7.8	17	20.6	15.7	0	0	10.8	9.2	4.5	9.8	9.9	9.03
12 lum	0	0	16.7	12.2	6.1	17.7	15.8	16	0	0.064	9.6	7.1	3.5	10.2	9.1	9.2
13 ppp	0	0	8.7	10.5	5.9	12.2	11.5	10.5	0	0	5	6.1	5.1	7.02	6.6	6.04
14 crp	0	0	9.7	5.1	6.2	9.1	8.3	6.8	0	0	5.6	3.6	5.1	5.2	4.8	3.9
15 siu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 cns	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 trd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 otp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 ser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Research data.