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***WORKING PAPERS
IN APPLIED ECONOMICS***

**ECONOMIC IMPACTS OF BRAZILIAN INDIRECT TAX
REDUCTION:
AN ANALYSIS OF THE COMPETITIVENESS WITHIN
MERCOSUEURO**

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Economic Impacts of Brazilian Indirect Tax Reduction: An analysis of the competitiveness within MERCOEURO¹

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Abstract: The objective of this paper is to determine the effects of the creation of MERCOEURO stemming from an indirect tax reduction in the Brazilian economy. Four different scenarios were analyzed taking into account the elimination of tariffs on imports among the member countries in the MERCOEURO agreement and a 10% reduction in the indirect taxes on the final consumption, on intermediary inputs, and on sectors production. Simulations are run using *GTAPinGAMS* with the GTAP database version 6.0. The creation of the MERCOEURO generated significant results mainly in the agribusiness sector. A reduction in the indirect taxes on final consumption and over the intermediate inputs improve the competition and generate gains in growth, welfare, and government revenue. However, the scenario that reduces the indirect taxes on the Brazilian sectors production cannot increase competition, even though there are positive changes in indicators of growth and welfare. The scenarios generate increased competitiveness, growth variations between 0.05% and 0.19%, with gains in welfare ranging from US\$ 2.26 billions and US\$ 3.20 billions.

Key words: regional integration, indirect taxes, general equilibrium, *GTAPinGAMS*, sectoral competition.

Classification JEL: F13, F15, C68, H20.

1. Introduction

Brazil's obsolete, extremely complex tax system has been often considered an impediment to the country's development, causing large variations in price formation, burdening

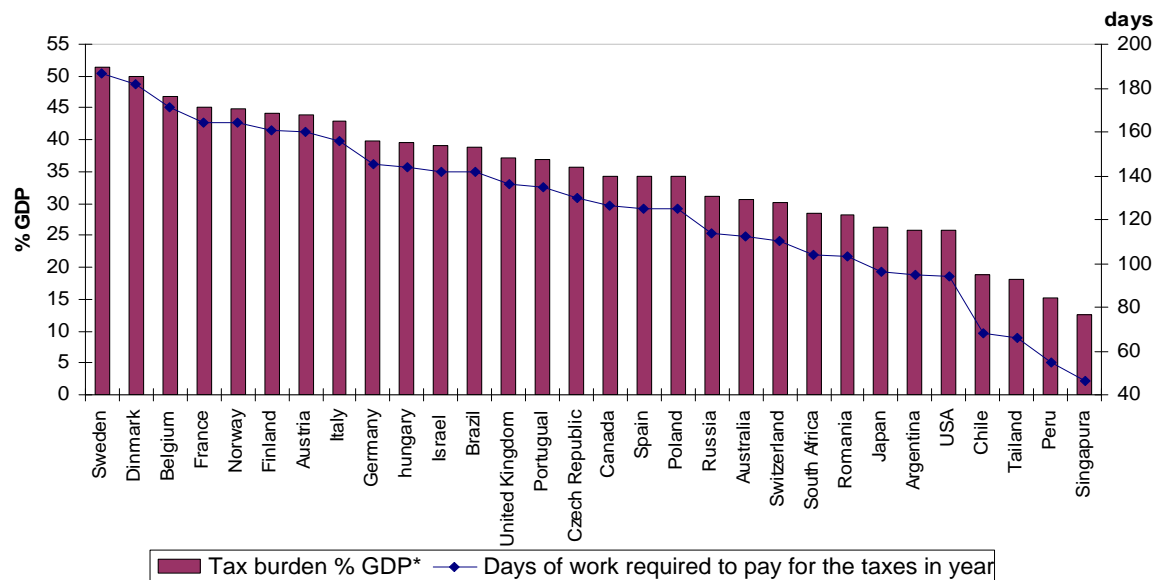
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the productive sector, damaging the country's competitive position, and encouraging tax evasion (SILVA, 2003a). The tax burden in Brazil is larger than that of the great majority of developing countries (IMF, 2005), as shown Figure 1; and the number of days Brazilians work to pay this annual burden is greater than the developing world average and greater than that of many industrialized economies, such as in the United States, the United Kingdom, Japan, and Australia.

Figure 1. Tax burden as a percentage of GDP, by country (2002-2004).



* The IMF considers tax burden as being taxes plus social contributions

Source: IMF (2005) - elaborated by the authors.

The Brazilian tax system's collection structure, presenting itself primarily as consumption taxes, exacerbates an existing problem: the inequitable distribution of personal and regional income. Although this form of indirect taxation is considered economically efficient as it does not tax savings, thereby stimulating investment and capital accumulation, it has increased the tax burden on Brazil's least economically viable members, individual consumers. Viana et al. (2000) emphasize that many other studies consider indirect taxation in Brazil to be unequivocally regressive. From the perspectives of economic growth, competitive advantage, and fairness, a change in the Brazilian tax system's structure and a reduction of the local tax burden appears justifiable.

Trade negotiations between the European Union and MERCOSUR have been extensive. Both tariff levels and non-tariff barriers were on the table. Non-tariff issues included the creation

of instruments for commercial protection, agreements on animal and vegetable quality standards, agreements on wines, rules regulating services and businesses, rules regulating investment and the movement of capital, the opening of governmental purchases and public works projects, copyright protection, regulations to control competition and cooperation, and mechanisms for the resolution of controversies.

In these non-tariff negotiations, the MERCOSUR countries focused on the creation of agreements regarding animal and vegetable quality standards, policies for competition and cooperation within the competitive arena, and mechanisms for resolving controversies. The countries of the European Union were more concerned about businesses access to services, agreements on wines, investment and the movement of capital, opening of governmental purchases and public works projects, and copyright protection. Negotiations have stagnated since October 2004, and it is now well past the date for the agreement's conclusion.

At the least, MERCOEURO's ratification would give member countries a greater degree of involvement and stronger strategic position in the international trade market. However, to maximize any strategic gains, MERCOEURO members need to be a step ahead of the international competition. In the case of Brazil, this would necessitate reduced local interest rates, a better balance between government outflows and inflows, a reduction in the costs from deficient infrastructure (the "Brazil cost"), reform of local labor laws, lower bureaucratic outlay, and especially, tax reform.

A number of studies have tried to measure the possible effect of fiscal policy in an open economy. Papers by Shoven and Whalley (1972, 1973) were the first to analyse tax change using applied general equilibrium models. However, according to their 1998 work, this type of study has effective limitations on applicability due to the incidence of tax levied during a constrained time period.

Among other works of prominence, Kehoe and Serra Puche (1983) used a general equilibrium model to analyse Mexico's 1980 fiscal reform. Diao et al. (1998) studied the case of Turkey after fiscal reform and the elimination of all tariffs using a dynamic general equilibrium model.

Braga (1999) published important work focusing on Brazil. The author analysed the effect of taxation policy on Brazilian agribusiness chains using an applied model of general equilibrium applied to the economic environment of 1995. Results suggested that taxation policy as applied to

agro-industrial chains should follow three directions: the replacement of intermediate consumption taxes by taxation based on value added; the substitution of indirect taxes for direct ones; and more uniformity among taxes levied on different activities.

Recently, Santos (2006) used a static interregional model of general equilibrium to analyse the impact of reducing three Brazilian indirect taxes: a reduction of consumer taxes on families; a reduction in the indirect taxes on agricultural inputs and resources; and a reduction of indirect taxes on all products within the state of Sao Paulo. The author noted a reduction in poverty after all tax reductions.

This paper main contribution is to model the reduction in the indirect tax, allowing the government tax collection to increase or to reduce depending on the expansion or contraction of the economic activities. Another contribution is the understanding of the effect of the tax policy in the scenarios of regional integration in which Brazil is involved.

Reducing the tax burden should make production more efficient, leading to increased output and income for the production factors' owners, reduced tax evasion, and increased governmental tax collection. The objective of this paper is to determine some effects from MERCOEURO's implementation and some effects from this implementation concurrent with lowered Brazilian taxes on the economies of Brazil and the European Union.

2. Analytical Model

This work is accomplished using the GTAPinGAMS (RUTHERFORD and PALTSEV, 2000; RUTHERFORD, 2005) empirical model, which was developed from the Global Trade Analysis Project model (GTAP-2007; HERTEL, 1997). GTAPinGAMS uses the GTAP database constructed as a problem of non-linear complementarity in a General Algebraic Modelling System (GAMS; BROOKE et al., 1998).

The main GTAP programming language is the GEMPACK (HARRISON and PEARSON, 1996). In the GEMPACK, the model is resolved (calibrated) as a system of linear equations. Using the Mathiesen's algorithm of sequential complementarity (MATHIESEN, 1985), development of GTAPinGAMS allows the model to be concluded as a problem of non-linear complementarity employing the Modelling Program System for General Equilibrium, MPSGE, for resolving models of general equilibrium (RUTHERFORD, 1999).

According to Rutherford (2005), there are substantial differences between GTAP for the GEMPACK and GAMS. In the GEMPACK model, final demand is represented by a function of constant difference demand elasticity (CDE) while final demand in the GAMS model has the Cobb-Douglas form. GAMS modelled account values differ from the GEMPACK modelled account values by a factor of 1,000. While the GTAP database measures transactions in million dollars, GTAP6inGAMS measures the transactions in billion dollars. The GEMPACK model assumes the existence of a "global bank" that allocates capital flows in response to the changes in regional tax returns while the GTAP6inGAMS model assumes that demand for investment and the flow of international capital are exogenous and fixed at the benchmark values.

2.1. The GTAP6inGAMS model

The GTAP6inGAMS model is static, multi-regional, and represents the production and distribution of goods in the worldwide economy. The model is based on consumer behaviour, as it divides the world into regions (or countries) such that each region has a final demand structure comprised of public and private expenses for goods. The consumers' increased welfare is limited by a budgetary restriction, given by the fixed levels of investment and public expenses. Productive process combines intermediate inputs with primary factors (qualified and non-qualified labor, land, natural resources and physical capital) to minimize production costs subject to a given technology. The model's database includes bilateral trade flows among all regions. The database includes transportation costs, and import and export taxes associated with the flow of commerce.

GTAP6inGAMS uses the GTAP database. The model establishes three sets of variables: Regions, represented by subtexts r (origin of goods) and s (destination of goods); Sectoral Goods, represented by subtext I , with j representing the firms, and Primary Factors, represented by subtext f . With certain limitations, regions, goods, and factors can be aggregated. The economic structure of the GTAP6inGAMS is illustrated in Figure 2. The symbols presented in this flow correspond to the economic model's variables, where, Y_{ir} represents the production of goods i in region r ; and C_r , I_r and G_r represent private consumption, investment, and public demand, respectively. Within region r ; M_{ir} is importation of goods i ; HH_r and $GOVT_r$ represent

consumption by domestic consumers and government; FT_{sr} represents allocation of the sluggish factors of production (land and natural resources) among individual sectors.

In Figure 2, commodity flows and factor markets are represented by solid lines. The top of the illustration shows domestic and imported goods markets, represented by horizontal lines. The value of the aggregate product determines the market price, vom_{ir} , and is distributed as FOB export value net of export tax, $vxmdirs$; international costs of transport, $vstir$; aggregate domestic intermediate demand, $vd fm_{ijr}$; aggregate demand of domestic private agents, $vd pm_{ir}$; investments, $vd im_{ir}$; and aggregate government demand for domestic goods, $vd gm_{ir}$. The equation-identity for domestic products in the GTAP6inGAMS is:

$$vom_{ir} = \sum_s vxmd_{irs} + vst_{ir} + \sum_j vdfm_{ijr} + vdp m_{ir} + vdg m_{ir} + vdim_{ir}. \quad (1)$$

The estimated total value of importation, including tariffs to vim_{ir} , is given by the sum of aggregate demand for intermediate imports, $vifm_{jir}$, aggregate private agent import demand, $vipm_{ir}$, and government demand for imported goods, $vigm_{ir}$. This estimate is calculated using the following equation:

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

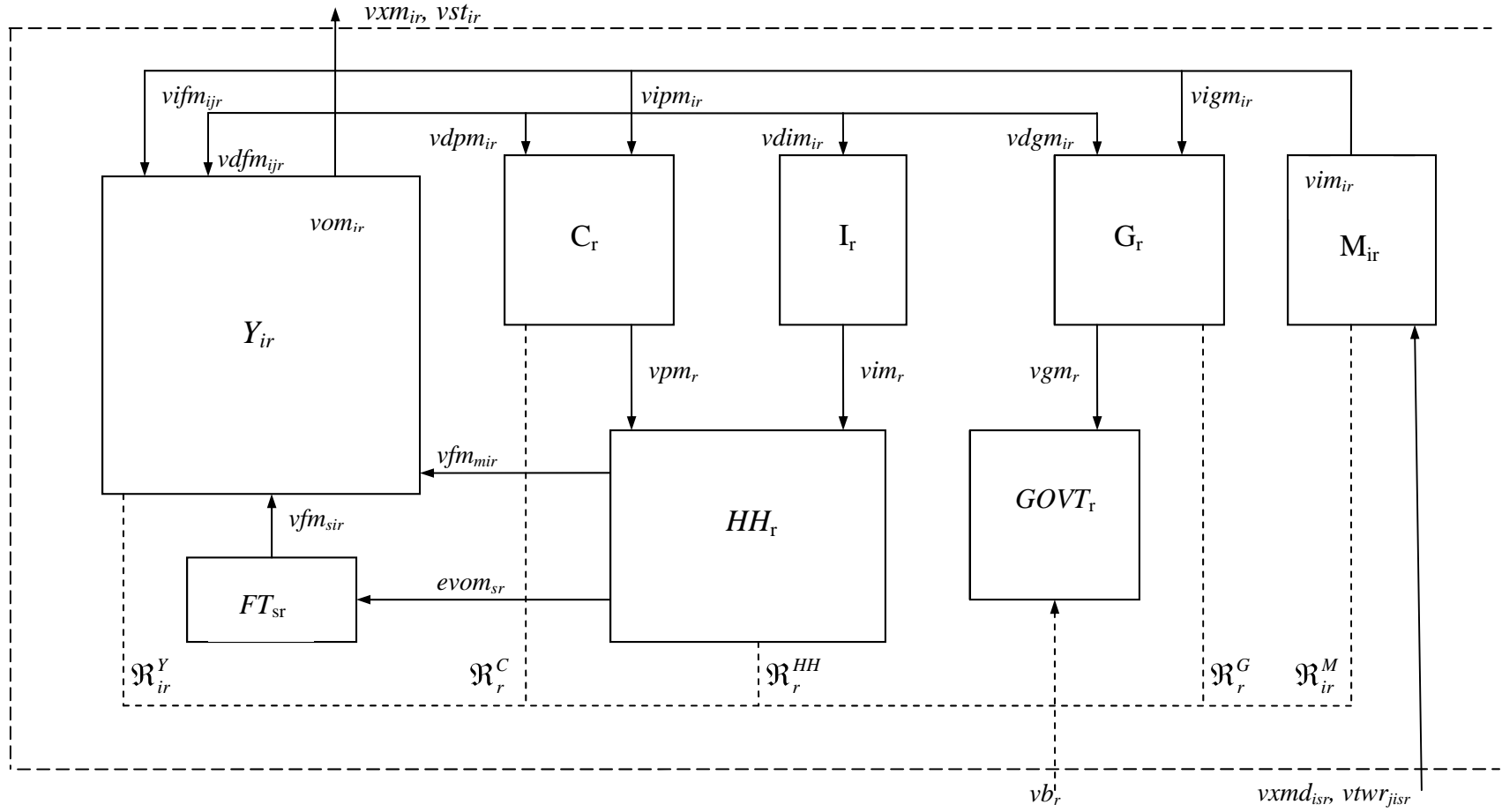
The inputs for Y_{ir} include domestic and imported intermediate inputs, mobile production factors ⁴ (vfm_{jir} , $f \in m$) and sluggish production factors ⁵ (vfs_{jir} , $f \in s$). Households receive the payment for the primary factors service. The equilibrium in market factors is given by an identity relating the payments for the primary factors service to the income of the factor ($evom_{fr}$):

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

⁴ Indicated by the letter m .

⁵ Indicated by the letter s .

Figure 2 - Structure of a Regional Economy



Source: Rutherford (2005).

The condition of international market liberalization requires that region r exports goods i , (vxm_{ir} - top of Figure 2) equal to the value of all goods imported by all its commercial partners ($vxml_{irs}$ - near bottom of Figure 2):

$$vxm_{ir} = \sum_s vxml_{irs}. \quad (4)$$

The condition of international market liberalization also applies to international transportation services, necessitating that the aggregate value of transport services j (vt_j) be equal to the total international transport sales for all products in all regions, as represented by equation (5), and that the trade balance in the market for transport service j be equal to the supply of transport service for all bilateral trade flows of imputed service, $vtwtj_{isr}$, shown in the latter part of Figure 2, and represented by equation (6)

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

$$vt_j = \sum_{isr} vtwt_{jisr}. \quad (6)$$

In Figure 2, solid lines indicate government tax revenue and the value of transfers. Entitled flows \mathfrak{R} correspond to the tax revenue.⁶ The flow of taxes consists of indirect taxes on production/exportation, \mathfrak{R}_{ir}^Y , consumption, \mathfrak{R}_r^C , public demand, \mathfrak{R}_r^G , and importation, \mathfrak{R}_{ir}^M . Government revenue includes direct taxes on consumers, \mathfrak{R}_r^{HH} , and external net transfers, vb_r . The budgetary restriction, vgm_r , is given by

$$\sum_i \mathfrak{R}_{ir}^Y + \mathfrak{R}_r^C + \mathfrak{R}_r^G + \sum_i \mathfrak{R}_{ir}^M + \mathfrak{R}_r^{HH} + vb_r = vgm_r. \quad (7)$$

The budgetary restriction on families (8) requires that after tax income from primary factor services is equal to consumption expenditures and private investment (vi_r)⁷:

⁶ These revenues are not explicitly shown as variables in the GTAP database and are defined on the basis of expenditures and tax rates in a description below.

⁷ For the sake of simplicity, international capital flows are portrayed as part of the public restriction; the difference between family savings and investment is represented by implicit transfers in \mathfrak{R}_r^{HH} .

$$\sum_f evom_{fr} - \mathfrak{R}_r^{HH} = vpm_r + vi_r. \quad (8)$$

Rutherford (2005) considered two types of consistency conditions, which are part of the GTAP database: market liberalization (i.e., supply = demand of all goods and factors) and balanced income/revenue (net income = net expenditure). The third set of identities entails some operational profit for all economic sectors. The GTAP model defines "production" as being under perfect competition with constant returns to scale; therefore, the model does not allow for surplus profit, as total input costs equal total product values. These conditions are applied to each production sector and are represented by equations (9) through (15):

$$Y_{ir}: \sum_f vfm_{fir} + \sum_j (vifm_{jir} + vdfm_{jir}) + \mathfrak{R}_{ir}^Y = vom_{ir}. \quad (9)$$

$$M_{ir}: \sum_s (vxmd_{isr} + \sum_j vtwr_{jisr}) + \mathfrak{R}_{ir}^M = vim_{ir}. \quad (10)$$

$$C_r: \sum_i (vdpm_{ir} + vipm_{ir}) + \mathfrak{R}_{ir}^C = vpm_r. \quad (11)$$

$$G_r: \sum_i (vdgm_{ir} + vigm_{ir}) + \mathfrak{R}_{ir}^G = vgm_r. \quad (12)$$

$$I_r: \sum_i vdim_{ir} = vi_r. \quad (13)$$

$$FT_{fr}: evom_{fr} = \sum_i vfm_{fir} \quad f \in s. \quad (14)$$

$$YT_j: \sum_r vst_{jr} = vt_j = \sum_{irs} vtwr_{jirs}. \quad (15)$$

The relationships above are the GTAP model's economic identities but do not describe the behaviour of economic agents, which are taken up by Rutherford (2005).

2.2. Database and GTAP aggregations

Version 6.0 of the GTAP database is used in this study. Compiled for the year 2001, the database has Input-Output Matrices for 87 countries (regions), 57 sectors (commodities) and 5 primary factors, being the Input-Output Matrices for Brazil from 1996. For a complete discussion of the GTAP database see McDougall (2005).

This study analyzes the effect of tax and tariff variations on 11 commodities/sectors and 8 countries/regions (Table 1), emphasizing the agricultural sector because of its importance to Brazil and the other MERCOSUR countries.

Table 1 – Aggregation between regions and commodities made in the GTAP

Regions	Commodities*
1- USA	1- Paddy rice and processed rice (pdr)
2- Rest of NAFTA (RNF)	2- Wheat (wht)
3- Brazil (BRA)	3- Maize and other cereals (gro)
4- Rest of MERCOSUR (MER) ⁸	4- Soybean and other oilseeds - grain, oil and bran (osd)
5- Rest of Latin America (ROA)	5- Sugar cane, sugar beet and sugar (sgr)
6- European Union (EU15) ⁹	6- Raw milk, and dairy (mil)
7- New Members of the EU (EU10) ¹⁰	7- Meat and live stock (ctl)
8- Rest of the World (ROW)	8- Other Foods - tobacco, staple fibres, coffee, orange juice, fruits, vegetables and others (fod)
	9- Energy - coal, oil, generation and distribution of electric energy, gas and water (enr)
	10- Manufactures - chemical metals in general, vehicles, products, machines and equipment and others (mfc)
	11- Services and public administration (svc)

Note: * The nomenclature presented in parentheses will be used to facilitate the presentation of the data.

Source: Version 6.0 GTAP database.

2.3. Analytical scenarios and specific aspects of the model

Distinct scenarios that simulate a free trade area between the MERCOSUR and the European Union are analyzed. The scenarios consider the possibility of joint implementation of trade and fiscal policies by the two existing trade blocks.

The MERCOEURO 1 scenario simulates the formation of the MERCOEURO free trade area, an area in which import tariffs between MERCOSUR and European Union member countries are eliminated.

The MERCOEURO 2 scenario simulates the formation of the same MERCOEURO free trade area and a 10% reduction in the effective rates of indirect taxes levied on final consumption in the Brazilian economy.

The MERCOEURO 3 scenario simulates the formation of the MERCOEURO free trade area and a 10% reduction in the effective rates of indirect taxes levied on intermediate inputs in the Brazilian economy.

⁸ Paraguay will not be analyzed because it is not in the GTAP 6 database.

⁹ Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Holland, Ireland, Italy, Luxemburg, Portugal, United Kingdom and Sweden.

¹⁰ Cyprus, Slovakia, Slovenia, Estonia, Hungary, Leetonia and Lithuania, Malta, Poland and Czech Republic.

The MERCOEURO 4 scenario simulates the formation of the MERCOEURO free trade area and a 10% reduction in the effective rates of indirect taxes levied on production in the Brazilian economy.

Subsidies to production and exportation have not been considered because they are recognized as being part of the multilateral negotiations within the scope of the WTO; therefore, outside the purview of regional free trade area negotiations, despite great interest in the removal of such barriers by the MERCOSUR countries.

To make the model more closely resemble the Brazilian economy, it is imposed to the model that government transferences to families remain constant, as the majority of these transferences, by the Brazilian legislation, cannot be reduced.¹¹ This assumption, within the general equilibrium, necessitated the stipulation that a tax reduction cannot result in a change in family support payments in order to balance government accounts and brings into clearer focus the impacts of tax reduction on the Brazilian economy.

3. Results of MERCOEURO Scenarios

The results from simulation of the four scenarios are presented in this section. The section begins with a discussion of variation in the value of sectoral production and regional trade flow arising from the simulation of each scenario, followed by an examination of each scenario's effect on economic growth and welfare, and concluded with an analysis of each scenario's impact on government tax revenue.

3.1. MERCOEURO 1--Impacts on production and trade flow

This scenario simulates the removal of import tariffs and export taxes on trade between the countries of MERCOSUR and the European Union (BRA, MER, EU15 and EU10) through the creation of the MERCOEURO free trade area. Table 2 presents the effects on production, exportation and importation from simulation of this scenario as percentile changes from the pre-MERCOEURO condition.

Table 2 shows the biggest percentage production value variations occur in Brazil, the Rest of MERCOSUR, the European Union (EU15), and among new members of the European Union (EU10). Results for the Brazilian economy are extremely expressive, with great increases in the production of meats (ctl) (87.09%), sugar (sgr) (28.78%), maize (gro)

¹¹ As it is the case of INSS payments (public retirement)

(18.50%) and other foods (fod) (2.07%) and falls in the production of manufactured goods (mfc) (-8.67%), soy (osd) (-7.80%), wheat (wht) (-4.05%) and energy (enr) (-3.53%).

Table 2 – MERCOEURO 1: production value and trade flow, percentile variations

Percentile variation in the value of production											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-0.33	0.06	0.20	0.58	0.00	-0.02	-0.17	-0.04	0.05	-0.03	0.01
RNF	-0.01	0.06	0.02	0.44	0.01	-0.02	-0.13	-0.03	0.08	-0.03	0.01
BRA	-0.32	-4.05	18.50	-7.80	28.78	0.01	87.09	2.07	-3.53	-8.67	-0.65
MER	30.53	-0.93	4.22	-3.12	4.94	-0.40	6.61	3.84	-1.85	-0.94	-0.22
ROA	-0.17	0.37	0.11	0.61	-1.25	-0.05	-0.12	-0.18	0.30	-0.05	0.01
EU15	-4.22	-0.27	-3.86	0.69	-9.30	-1.69	-9.23	-0.16	0.11	0.59	0.00
EU10	0.68	-1.81	0.70	3.39	2.03	25.87	3.17	0.76	-0.07	0.65	-0.93
ROW	-0.06	-0.02	0.16	0.59	-0.26	-0.16	-0.48	-0.12	0.07	-0.01	0.02
Percentile variation in the value of exportations – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-1.20	0.14	0.93	2.15	-1.81	-0.86	-2.03	-0.49	0.72	-0.36	0.37
RNF	-2.30	0.08	0.41	1.70	-1.75	-1.44	-0.90	-0.14	0.26	-0.07	0.24
BRA	-18.44	-42.93	-11.69	-22.81	116.01	-5.36	434.29	4.92	-25.21	-12.77	-12.75
MER	76.97	-3.24	5.07	-5.15	46.26	-5.00	78.01	15.29	-6.95	13.24	-4.68
ROA	-4.45	4.95	1.00	2.85	-4.83	-1.47	-5.27	-0.72	0.50	-0.49	0.45
EU15	-5.68	3.20	0.35	4.56	-22.75	-2.51	-24.80	1.30	0.69	1.21	0.05
EU10	16.71	-12.55	4.98	7.54	52.48	225.94	38.97	16.74	0.22	4.43	-1.94
ROW	-1.08	0.35	0.84	2.00	-9.02	-2.54	-9.04	-0.96	0.27	-0.09	0.30
Percentile variation in the value of importations – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	0.03	-0.05	0.04	0.03	-0.68	0.16	-0.25	-0.15	-0.11	-0.16	-0.17
RNF	0.01	-0.03	-0.04	0.28	-1.39	-0.27	0.00	0.00	0.08	0.00	-0.09
BRA	13.27	8.16	21.98	23.32	62.08	52.76	88.78	19.49	4.78	19.30	6.84
MER	13.05	7.27	5.75	4.49	24.03	27.54	5.62	7.72	1.67	12.90	2.54
ROA	-1.05	-0.75	-0.84	-1.71	-0.46	-0.19	-2.26	-0.46	-0.43	-0.25	-0.20
EU15	5.47	-0.51	0.59	-2.07	57.33	6.81	14.56	0.39	0.15	0.30	0.04
EU10	14.25	63.95	26.60	13.16	87.02	154.85	45.14	20.84	2.19	4.01	0.60
ROW	-0.15	-0.64	-0.48	-1.16	-3.17	0.08	-0.63	-0.13	0.02	-0.07	-0.12

Source: Research results.

The Rest of the MERCOSUR countries presented positive results for the production of rice (pdr) (30.53%), meats (ctl) (6.64%), sugar (sgr) (4.94%), maize (gro) (4.22%) and other foods (fod) (3.84%), but production of soy (osd) (-3.12%), energy (enr) (-1.85) and manufactured goods (mfc) (-0.94%) decreased.

In the European Union (EU15), simulation of MERCOEURO 1 generated generally negative production changes, mainly in the agribusiness sector. There were expressive falls in the production of sugar (sgr) (-9.30%), meats (ctl) (-9.23%), rice (pdr) (-4.22%) and maize (gro) (-3.86%) but slight increases in the production of manufactured goods (mfc) (0.59%) and energy (enr) (0.11%). Simulation of the scenario resulted in new members of the

European Union (EU10) greatly increasing their production of milk and dairy (mil) (25.87%) and less expressively increasing soy and meat production (osd, 3.39%; ctl, 3.17%).

Production in the United States was little affected by the simulated creation of MERCOEURO. The most affected products were soy (osd) (0.58% increase) and rice (pdr) (0.33% fall). Production variations for the other NAFTA countries did not exceed 0.21% except for soy, the production of which increased 0.44%.

All sectors within the remaining portion of Latin America (ROA) showed small production variations, the most sensitive being the sugar sector (sgr) (-1.25%) and the soybeans sector (osd) (0.61%). In the Rest of the World (ROW), the implementation of MERCOEURO caused only small changes in production, with the largest production variations being in the soy (osd) and meats (ctl) sectors, 0.59% and -0.48%, respectively. These minor alterations demonstrate that implementation of a MERCOSUR-EU free trade area would have little impact on production in countries outside of the MERCOEURO economic block.

The largest export changes from the simulation of MERCOEURO 1 were found in the meats and livestock (ctl) segment: 434.29% in Brazil, 78.01% in the Rest of MERCOSUR, and 38.97% in the EU10. These extreme increases were accompanied by reductions in other countries: -24.05% in the EU15, -9.04% in the ROW, -5.27% in the ROA, and -2.03% in the USA. Simulation of MERCOEURO caused rather large variations in the exports of sugar and sugar products, with extreme increases in Brazil (116.01%), EU10 (52.48%) and the Rest of MERCOSUR (46.26%) but noticeable falls in the EU15 (-22.75%), ROW (-9.02%) and the Rest of America -ROA (-4.83%). The milk and dairy sector (mil) also showed a strong export increase in the EU10 (225.94%) and a fall in all other countries, with Brazil and the Rest of MERCOSUR suffering the largest decrease, -5.36% and -5.00% respectively. Results for the rice sector (pdr) presented varied results, with Brazilian exports falling 18.44% while exports in the Rest of MERCOSUR and the EU10 expanded 76.97% and 16.71%, respectively.

Brazilian exportation patterns were altered considerably by simulation of MERCOEURO 1, with large increases in the exportation of meats (ctl), sugar (sgr) and other foods (fod), but falls in the exportation of energy (enr) (-25.21%), soy (-22.81%), manufactured goods (mfc) (-12.77%) and services (svc) (-12.75%). Because of the importance of energy, services, manufactures, and soy exportation to the Brazilian economy, these reduced exports have a significant impact on the total value of Brazilian exports.

In general, simulation of MERCOEURO 1 elicited an increase in the value of imports by the MERCOEURO countries and small decrease in the value of imports by all other

countries and aggregations (USA., RNF, ROA and ROW). In Brazil, the largest distinguishable level of increase is in the importation of manufactured goods (19.30%), which represents a significant value.

The variation of production caused by formation of MERCOEURO is highly favourable for the majority of Brazilian agribusinesses, with exception of those in the soya (osd), wheat (wht) and rice (pdr) sectors; but it had an adverse affect on production by the manufacturing and energy sectors. The great positive variation shown in the value of production by important Brazilian agribusiness sectors confirms the country's competitive advantage over the EU in agriculture; however, results for the manufacturing sector indicates that EU competition after implementation of MERCOEURO would be economically disadvantageous for Brazil.

3.2. MERCOEURO 2--Impacts on production and trade flow

This scenario simulates the creation of MERCOEURO as defined in the MERCOEURO 1 scenario and adds a 10% reduction of Brazilian indirect taxes on final consumption. Table 3 presents the effects on production, exportation and importation from simulation of this scenario as percentile changes from the pre-MERCOEURO condition.

Simulation of the MERCOEURO 2 scenario resulted in changes that were very similar to those generated by the MERCOEURO 1 scenario; however, some variations were more expressive. For that reason, a comparative analysis between scenarios MERCOEURO 1 and MERCOEURO 2 is presented in the following discussion.

The reduction of Brazilian indirect taxes on final consumption simulated in the MERCOEURO 2 scenario led to greater production variations in all analysed Brazilian sectors than from the simulation of MERCOEURO 1, except for the services sector. Brazilian indirect consumption tax reduction was found to considerably improve Brazilian agricultural product competitiveness in terms of production value. Rice production showed the greatest variation between scenarios, falling in MERCOEURO 1 and increasing in MERCOEURO 2. The manufacturing (mfc) and energy (enr) sectors also showed improved production in MERCOEURO 2 when compared with MERCOEURO 1. Although Brazilian production of manufactures and energy decline in both scenarios, the decline was less in MERCOEURO 2. The reduction of indirect taxes on final consumption in MERCOEURO 2 did not significantly modify the structure of Brazilian exports or imports relative to MERCOEURO 1. As the tax change was the only difference between the conditions stipulated in both scenarios,

this finding indicates that internal tax changes in Brazil's relatively small economy would have little effect on international trade.

Table 3 MERCOEURO 2: production value and trade flow, percentile variations

Percentile variation in the value of the production											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-0.33	0.07	0.21	0.58	0.00	-0.02	-0.17	-0.04	0.05	-0.03	0.01
RNF	-0.01	0.07	0.02	0.44	0.01	-0.02	-0.13	-0.03	0.09	-0.03	0.01
BRA	0.78	-3.39	18.96	-7.30	29.73	1.14	87.80	3.16	-2.20	-7.93	-1.00
MER	30.62	-0.71	4.21	-3.17	4.93	-0.40	6.59	3.84	-1.84	-0.95	-0.22
ROA	-0.17	0.38	0.12	0.62	-1.25	-0.05	-0.12	-0.18	0.31	-0.06	0.01
EU15	-4.21	-0.26	-3.85	0.69	-9.31	-1.69	-9.24	-0.16	0.11	0.59	0.00
EU10	0.68	-1.81	0.70	3.39	2.03	25.87	3.17	0.76	-0.06	0.65	-0.93
ROW	-0.06	-0.02	0.16	0.59	-0.26	-0.16	-0.48	-0.12	0.08	-0.02	0.02
Percentile variation in the value of exportations – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-1.20	0.15	0.94	2.15	-1.83	-0.85	-2.03	-0.48	0.76	-0.36	0.36
RNF	-2.29	0.10	0.42	1.70	-1.76	-1.43	-0.90	-0.14	0.27	-0.07	0.24
BRA	-18.46	-43.24	-11.85	-22.72	116.31	-5.14	434.50	5.11	-25.09	-12.22	-12.25
MER	77.21	-2.89	5.07	-5.21	46.15	-5.05	77.81	15.27	-6.87	13.30	-4.74
ROA	-4.43	5.24	1.08	2.94	-4.86	-1.47	-5.28	-0.72	0.52	-0.49	0.44
EU15	-5.67	3.20	0.36	4.57	-22.78	-2.51	-24.81	1.30	0.70	1.22	0.04
EU10	16.72	-12.54	4.99	7.54	52.43	225.95	38.96	16.74	0.25	4.43	-1.95
ROW	-1.08	0.36	0.85	2.00	-9.04	-2.54	-9.04	-0.96	0.29	-0.09	0.30
Percentile variation in the value of importations – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	0.03	-0.04	0.04	0.03	-0.67	0.16	-0.25	-0.15	-0.11	-0.16	-0.17
RNF	0.01	-0.03	-0.04	0.28	-1.38	-0.27	0.00	0.00	0.08	0.00	-0.08
BRA	13.97	9.15	22.88	23.98	62.79	52.99	89.18	20.34	5.64	19.68	6.60
MER	13.12	7.39	5.76	4.51	24.12	27.62	5.68	7.76	1.73	12.97	2.57
ROA	-1.05	-0.75	-0.84	-1.71	-0.46	-0.19	-2.25	-0.46	-0.42	-0.24	-0.20
EU15	5.46	-0.51	0.59	-2.07	57.42	6.81	14.57	0.39	0.15	0.30	0.04
EU10	14.25	63.94	26.59	13.16	87.02	154.85	45.14	20.84	2.19	4.01	0.60
ROW	-0.15	-0.65	-0.49	-1.16	-3.16	0.08	-0.63	-0.13	0.02	-0.07	-0.12

Source: Results of the research.

3.3. MERCOEURO 3--Impacts on production and trade flow

MERCOEURO 3 simulates the creation of the MERCOEURO free trade area and a 10% reduction in the effective indirect tax that falls on intermediate inputs to the Brazilian economy. Table 4 presents the effects on production, exportation and importation from simulation of this scenario as percentile changes from the pre-MERCOEURO condition. The following offers a comparative analysis of scenarios MERCOEURO 1, MERCOEURO 2, and MERCOEURO 3.

Results from MERCOEURO 3 most closely resemble those from MERCOEURO 1. The 10% reduction in Brazilian indirect taxes on intermediate inputs caused a small improvement in the value of Brazilian production in all but the services sector relative to MERCOEURO 1 and presented a small decrease in production in all but the service sector relative to MERCOEURO 2.

Table 4 – MERCOEURO 3: production value and trade flow, percentile variations

Percentile Variations in Production value											
	Pdr	wht	gro	osd	sgf	mil	ctl	fod	enr	mfc	svc
USA	-0.33	0.06	0.20	0.58	0.00	-0.02	-0.17	-0.04	0.05	-0.03	0.01
RNF	-0.01	0.06	0.02	0.44	0.01	-0.02	-0.13	-0.03	0.08	-0.03	0.01
BRA	-0.12	-3.90	18.57	-7.67	28.99	0.23	87.21	2.25	-3.31	-8.51	-0.72
MER	30.58	-0.90	4.22	-3.13	4.94	-0.39	6.61	3.84	-1.87	-0.94	-0.22
ROA	-0.17	0.37	0.11	0.61	-1.25	-0.05	-0.12	-0.18	0.30	-0.05	0.01
EU15	-4.22	-0.27	-3.85	0.69	-9.31	-1.69	-9.23	-0.16	0.11	0.59	0.00
EU10	0.68	-1.81	0.70	3.39	2.03	25.87	3.17	0.76	-0.07	0.65	-0.93
ROW	-0.06	-0.02	0.16	0.59	-0.26	-0.16	-0.47	-0.12	0.07	-0.01	0.02
Percentile Variations in Exportations – FOB											
	pdr	wht	gro	osd	sgf	mil	ctl	fod	enr	mfc	svc
USA	-1.20	0.14	0.93	2.15	-1.83	-0.85	-2.03	-0.48	0.71	-0.36	0.37
RNF	-2.30	0.09	0.41	1.70	-1.76	-1.44	-0.90	-0.14	0.25	-0.07	0.24
BRA	-18.52	-42.97	-11.75	-22.78	116.29	-5.47	434.02	4.93	-25.01	-12.47	-12.81
MER	77.08	-3.19	5.07	-5.17	46.20	-4.94	78.01	15.29	-7.03	13.30	-4.69
ROA	-4.44	5.00	1.02	2.88	-4.85	-1.46	-5.26	-0.72	0.49	-0.49	0.45
EU15	-5.68	3.20	0.35	4.56	-22.78	-2.51	-24.79	1.30	0.68	1.21	0.05
EU10	16.71	-12.55	4.98	7.54	52.43	225.95	38.99	16.74	0.21	4.43	-1.94
ROW	-1.08	0.35	0.84	2.00	-9.04	-2.54	-9.04	-0.96	0.27	-0.09	0.30
Percentile variations in Importations – FOB											
	pdr	wht	gro	osd	sgf	Mil	ctl	fod	enr	mfc	svc
USA	0.03	-0.05	0.04	0.03	-0.67	0.16	-0.25	-0.15	-0.11	-0.16	-0.18
RNF	0.01	-0.03	-0.04	0.28	-1.38	-0.27	0.00	0.00	0.08	0.00	-0.09
BRA	13.56	8.33	22.15	23.50	62.27	53.20	89.07	19.75	4.50	19.50	6.98
MER	13.07	7.29	5.75	4.49	24.09	27.55	5.63	7.72	1.67	12.93	2.55
ROA	-1.05	-0.75	-0.84	-1.71	-0.46	-0.20	-2.26	-0.46	-0.43	-0.24	-0.20
EU15	5.47	-0.50	0.59	-2.07	57.42	6.81	14.55	0.39	0.15	0.30	0.04
EU10	14.25	63.95	26.59	13.16	87.02	154.85	45.14	20.84	2.19	4.01	0.60
ROW	-0.15	-0.64	-0.49	-1.16	-3.16	0.08	-0.64	-0.13	0.01	-0.07	-0.12

Source: Research Results.

The reduction of indirect taxes on intermediate inputs did not alter Brazilian export values or the structure of Brazilian exportation significantly. This result is similar to that from simulation of MERCOEURO 1 and 2.

The value of imports by all sectors of the Brazilian economy increased a bit after simulation of MERCOEURO 3; although, these increases did not significantly change the

structure of worldwide importation. Changes in importation from simulation of MERCOEURO 3 were even less significant than those from MERCOEURO 2.

3.4. MERCOEURO 4--Impacts on production and trade flow

MERCOEURO 4 simulates the creation of the tariff free area and a 10% reduction in the effective Brazilian indirect tax that falls on production. Table 5 presents the effects on production, exportation and importation from simulation of this scenario as percentile changes from the pre-MERCOEURO condition.

Table 5 – MERCOEURO 4: production value and trade flow, percentile variations

Percentile variations in Production											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-0.33	0.06	0.22	0.60	0.00	-0.02	-0.16	-0.03	0.05	-0.03	0.01
RNF	-0.01	0.07	0.02	0.45	0.01	-0.02	-0.12	-0.03	0.08	-0.04	0.01
BRA	-0.03	-4.92	18.12	-7.81	28.96	0.39	86.36	2.38	-3.11	-8.04	-0.81
MER	30.74	-0.84	4.24	-3.12	4.96	-0.37	6.65	3.85	-1.86	-0.97	-0.22
ROA	-0.16	0.38	0.12	0.63	-1.23	-0.05	-0.11	-0.18	0.30	-0.06	0.02
EU15	-4.21	-0.26	-3.81	0.71	-9.27	-1.69	-9.16	-0.16	0.11	0.58	0.00
EU10	0.68	-1.80	0.72	3.40	2.04	25.87	3.22	0.76	-0.07	0.64	-0.93
ROW	-0.06	-0.02	0.17	0.60	-0.26	-0.16	-0.47	-0.12	0.07	-0.02	0.02
Percentile Variations in Exportation – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	-1.19	0.15	0.97	2.20	-1.76	-0.84	-1.98	-0.47	0.73	-0.37	0.38
RNF	-2.29	0.10	0.45	1.75	-1.73	-1.42	-0.87	-0.13	0.26	-0.07	0.25
BRA	-19.50	-44.60	-12.57	-23.37	115.35	-6.67	429.29	4.63	-24.88	-11.83	-13.36
MER	77.50	-3.10	5.10	-5.15	46.36	-4.74	78.45	15.31	-6.96	13.22	-4.70
ROA	-4.42	5.09	1.07	2.99	-4.79	-1.46	-5.18	-0.71	0.50	-0.50	0.45
EU15	-5.67	3.19	0.40	4.63	-22.68	-2.50	-24.62	1.31	0.68	1.20	0.05
EU10	16.72	-12.58	5.02	7.60	52.62	225.94	39.36	16.75	0.22	4.42	-1.94
ROW	-1.08	0.36	0.90	2.06	-8.97	-2.53	-8.97	-0.96	0.27	-0.10	0.31
Percentile variations in Importations – FOB											
	pdr	wht	gro	osd	sgr	mil	ctl	fod	enr	mfc	svc
USA	0.03	-0.04	0.04	0.03	-0.69	0.16	-0.26	-0.15	-0.11	-0.16	-0.18
RNF	0.01	-0.03	-0.03	0.29	-1.41	-0.27	0.00	0.00	0.08	0.00	-0.09
BRA	14.52	8.61	22.59	24.02	63.06	54.51	89.81	20.20	4.93	19.32	7.40
MER	13.07	7.34	5.77	4.52	23.96	27.49	5.51	7.70	1.69	12.97	2.55
ROA	-1.05	-0.74	-0.84	-1.73	-0.47	-0.20	-2.29	-0.47	-0.43	-0.24	-0.20
EU15	5.47	-0.50	0.59	-2.10	57.15	6.81	14.37	0.39	0.15	0.30	0.04
EU10	14.25	63.98	26.59	13.16	87.02	154.86	45.13	20.84	2.19	4.01	0.60
ROW	-0.15	-0.65	-0.49	-1.18	-3.21	0.08	-0.65	-0.13	0.02	-0.07	-0.12

Source: Research Results.

Variation in the value of production from simulation of MERCOEURO 4 in comparison to MERCOEURO 1 is positive in some sectors and negative in others: The rice

(pdr), sugar (sgr), milk (mil) and other foods (fod) sectors showed small improvements in terms of production value in comparison with MERCOEURO 1 while the wheat (wht), maize (gro), Soya (osd), meat (ctl), energy (enr), manufactured (mfc) and services (svc) sectors presented small declines relative to MERCOEURO 1. This behaviour differs significantly from that found in MERCOEURO 2 and MERCOEURO 3, in which the value of production improved relative to MERCOEURO 1 in all sectors except services.

As in the preceding three scenarios, simulation of MERCOEURO 4 diminished the total value of all Brazilian sectors' exports¹² and elicited increases in the total value of all Brazilian sectors imports.

It is noted that simulation of MERCOEURO 2 led to the best sectoral production results of all scenarios, indicating that a reduction of Brazilian indirect taxes on final consumption generates superior sectoral competitiveness within MERCOEURO.

3.5. MERCOEURO's Impact on Growth and Wealth indicators

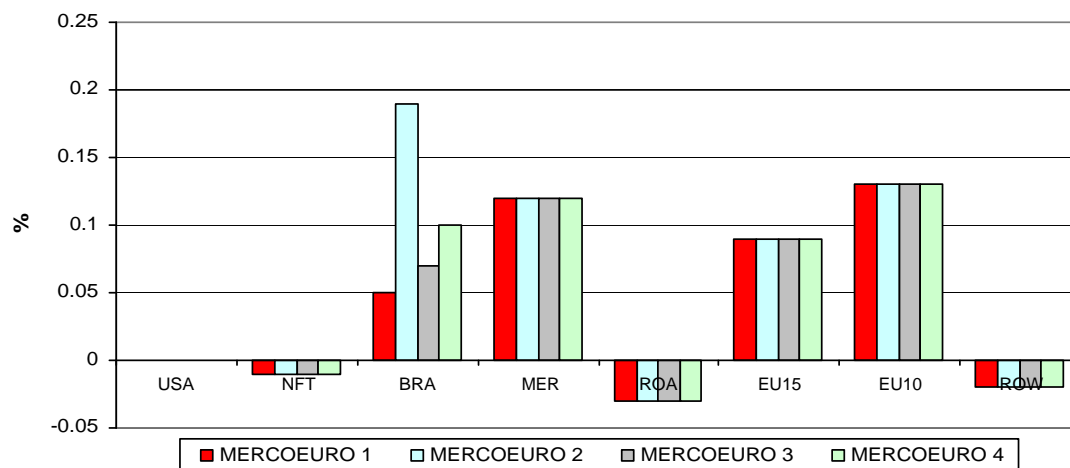
Figure 3 shows the percentile GDP variation in the analysed regions/countries from simulation of scenarios MERCOEURO 1, 2, 3, and 4. It is observed that after implementation of MERCOEURO (MERCOEURO 1), some countries/regions present very small variations¹³, such as the Rest of NAFTA (-0.01%), the Rest of America (-0.03%) and ROW (-0.02%). These results are virtually the same in all scenarios. The variations are slightly more significant in the Rest of MERCOSUR (0.12%), EU15 (0.09%) and EU10 (0.13%) while the GDP of the United States remained unaffected in all scenarios.

The results for Brazilian GDP are quite different. The formation of MERCOEURO in the first scenario caused Brazilian GDP to increase 0.05%. After inclusion of the 10% reduction of indirect Brazilian taxes on final consumption (MERCOEURO 2), the country's GDP increased 0.19%. Simulation of MERCOEURO 3, with its 10% reduction of indirect taxes on intermediate inputs, caused Brazilian GDP to increase 0.07%; and the 10% reduction of indirect taxes on production simulated in MERCOEURO 4 caused a 0.10% increase in Brazilian GDP. The reduction of Brazilian indirect taxes on final consumption generated the most significant GDP growth, most probably because the structure of the country's indirect taxation has its greatest impact on final consumer.

¹² Except in the manufacturing sector (mfc).

¹³ The variations are between brackets.

Figure 3 – Percentile variation in Gross Domestic Product (GDP) from Scenarios MERCOEURO 1, 2, 3 & 4.

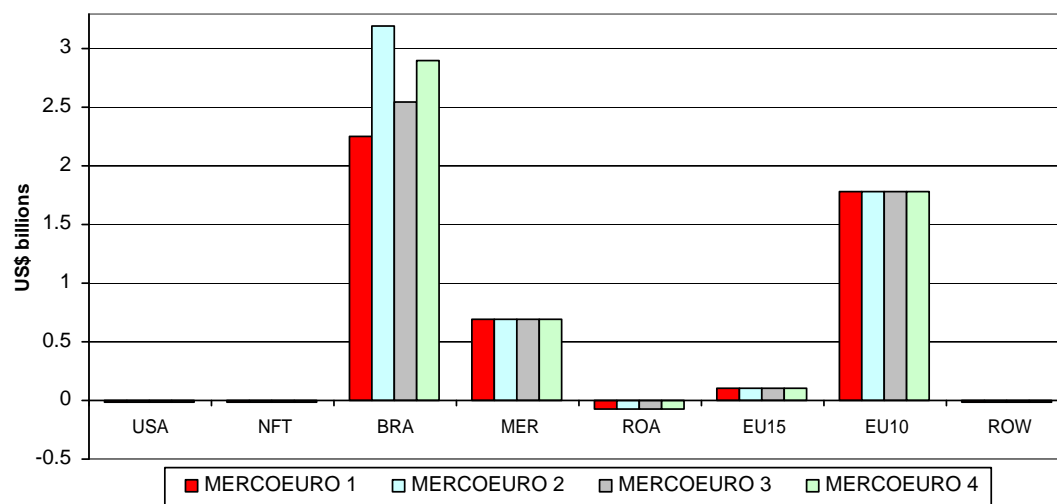


Source: research data.

To summarize, the creation of MERCOEURO does not significantly affect GDP growth; although, the countries that do benefit from MERCOEURO are countries allied within MERCOEURO. Countries outside MERCOEURO are unaffected by the pact.

Figure 4 demonstrates gains in welfare caused by the formation of MERCOEURO, represented by equivalent variations from the benchmark.

Figure 4 – Gains in welfare from simulation of scenarios MERCOEURO 1, 2, 3 & 4 (US\$ billions),



Source: Research data.

The simulated elimination of commercial restraints and concurrent fall in domestic prices generated increased wealth in all MERCOEURO allied countries in all scenarios. In Brazil, the gains totalled US\$ 2.26 billion from simulation of MERCOEURO 1, US\$ 3.20 billion in MERCOEURO 2, US\$ 2.55 billion in MERCOEURO 3, and US\$ 2.90 billion in MERCOEURO 4. Brazil showed the greatest wealth/welfare gains of all countries and regions in all scenarios.

Gains for the Rest of MERCOSUR were US\$ 0.69 billion in MERCOEURO 1 and 3 and US\$ 0.70 billion in MERCOEURO 2 and 4. The EU15 gained US\$ 0.11 billion, the EU10 gained US\$ 1.79 billion, and the countries outside MERCOEURO (USA, NAFTA, ROA, ROW) showed very small welfare/wealth losses in all scenarios.

3.6. Impacts on government revenue from the formation of MERCOEURO

Table 6 shows government revenue and percentage variation from the 2001 *benchmark* after simulation of the four scenarios, in US\$ trillions.

Table 6 – Government revenue (US\$ trillions) and the percentile variation from 2001 data – MERCOERUO 1, 2, 3, & 4

Scenarios:	<i>Benchmark</i>	MERCOEURO 1		MERCOEURO 2		MERCOEURO 3		MERCOEURO 4	
	Government Revenue	Government Revenue	Variation %	Government Revenue	Variation %	Government Revenue	Variation %	Government Revenue	Variation %
USA	0.987	0.987	0.008	0.987	0.008	0.987	0.008	0.987	0.008
NFT	0.229	0.229	0.032	0.229	0.032	0.229	0.032	0.229	0.032
BRA	0.123	0.128	3.787	0.127	3.400	0.128	3.805	0.128	3.967
MER	0.069	0.070	1.177	0.070	1.191	0.070	1.180	0.070	1.183
ROA	0.077	0.077	-0.016	0.077	-0.015	0.077	-0.017	0.077	-0.016
EU15	1.991	1.992	0.062	1.992	0.062	1.992	0.062	1.992	0.062
EU10	0.090	0.091	0.261	0.091	0.261	0.091	0.261	0.091	0.263
ROW	1.794	1.794	0.016	1.794	0.016	1.794	0.015	1.794	0.016

Source: Research results.

In Brazil, an increase in government revenue from the benchmark occurs in all scenarios. This data should assist government decision makers when determining indirect tax reductions. It must be emphasised that these are long-term results and that it is possible to occur adjustments of a short-term macroeconomic nature.

In the Rest of MERCOSUR, the results indicate revenue gains varying from 1.177 to 1.191%. In the Rest of America (ROA), the results show a slight fall in government revenue. Government revenue in the other regions increased as follows: 0.062% in EU15; 0.263% in EU10 and 0.016% in ROW (Table 6).

For the long term, these results are in opposition to the stated beliefs that a reduction of the tax burden would generate revenue loss and consequent growth decline. It must also be emphasised, that major gains, both for private and public sectors, would arise from the simulated commercial agreement.

4. Conclusions

MERCOEURO was found to be advantageous for Brazilian agro-business interests and less so for the Brazilian manufacturing sector, which may suffer from unfettered European competition. These results point out the importance of improving Brazilian manufacturing sector efficiency should MERCOEURO be implemented. Results also indicate that the implementation of MERCOEURO and a reduction in Brazilian indirect taxes would improve its industries' competitive position, its citizens' welfare, its government's tax revenues, and its economic rate of growth.

The main contribution of this research is the generation of a model to calculate the effects of indirect tax reduction that includes an estimate of government tax revenue variation. This study also presents the effect of tax reform on regionally integrated trade areas and the effects of targeted tax changes on various economic sectors.

It was found that the reduction of Brazilian indirect taxes on the final consumption had the most beneficial impact in terms of Brazilian competitiveness, GDP growth, and social welfare while the reduction of indirect taxes on production lead to the largest government tax revenue gains.

The results did not account for short term shocks from the simulated tax reductions. It is suggest that to avoid a short term loss in government revenue, the tax and tariff reductions should be gradual.

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