

**CONSEQUENCES OF TRADE LIBERALIZATION ON POVERTY AND
INCOME DISTRIBUTION IN BRAZIL**

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Abstract

This study evaluates the regional short run impacts of reduction in import tariffs in Brazil on poverty and distribution of income related to recent free trade area agreements. Results show that trade can reduce inter-regional income inequality, but poor urban households lose with trade liberalization. In order to compensate welfare losses for the poor, this study designs and evaluates a combination of trade and tax policies, which effectively contributes to improve welfare for poor urban households.

JEL Classification: C68, F14, O54

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1. Introduction

Although Brazil has many trade policy options as a result of several free trade agreements Brazil is a country with the great inequality in the distribution of income, with high levels of poverty and large regional differences. Since trade policies typically result in some households winning and some losing, even the most attractive trade policy would likely result in some household income losses.

The main argument used in the trade literature is that the gains from trade are obtained at the same moment the trade barriers are removed, as trade controls absorb government resources and cause net welfare losses. However, trade reform brings positive results only in the long run, with a positive investment response³.

According to Winters (2002), in the short run, trade liberalization puts great pressure on some economic agents and that, even in the long run, successful open regimes can leave some others in poverty. Even though there is a strong presumption that the long run effects from trade liberalization lead to pro-poor growth, the true effects differ among households and across countries.

The slow process of import tariff reduction that has occurred in Brazil in recent years has important consequences for urban and rural households and also for poverty and income distribution. Due to the diversity of households in Brazil and to the disparities and distributional issues discussed so far, it is likely that any trade reform will bring unequal distribution of gains for households at least in the short run.

³ Of course some other factors can affect the long-term responses of investments and the overall success of the trade reform as well, such as the economic and political environment of the country, since the degree of credibility of the reform plays an important role in this process. For more details, see Rodrik (1992) and Mehlum (2002).

Although there are possible gains from trade in the long run, the general problem addressed in this study is to evaluate the consequences of import tariffs reduction in the short run. Specifically in the case of Brazil, what are the main consequences of import tariff reduction in the presence of regional disparities, high poverty level and unequally distributed income? Would it be possible to implement any compensation scheme for those people hurt after the fall in the import tariff? Is it possible to obtain an equitable and efficient trade policy in the presence of trade-off between aggregate welfare gains and welfare gains for poor to Brazil? The questions posed represent important issues to be carefully analyzed by any government, since it is possible that the losses from trade policy reform exceed the gains, worsening the overall welfare within the country, increasing income concentration and poverty.

The major policy concern in this study is the link between trade liberalization and poverty and the regional distribution of income in Brazil. The trade liberalization analyzed in this study is the elimination of import tariffs for many goods, which is the type of liberalization frequently considered as a main component of the structural adjustment policy measures in many developing countries.

Therefore, the main objective of this study is to design an equity-efficiency policy combination to guarantee more equal opportunities of the gains from trade and to reduce the income inequality in Brazil. The study is devoted to assessing the economic impacts of a reduction in import tariffs on poverty and distribution of income, identifying a combined policy that can reduce possible negative impacts from trade reform on the poor, through a single-country multi-regional computable general equilibrium model (CGE).

There are many studies dealing with macroeconomic impacts of import tariff reduction in Brazil and other Latin American countries, but only a few evaluate the consequences of trade reforms on poverty and income inequality, such as Harrison,

Rutherford, Tarr and Gurgel (2002) and Ferreira Filho and Horridge (2004). Most of them, however, ignore equity considerations and only focus on the effects of policies on overall efficiency.

In searching for a policy complementary to trade liberalization, a specific complementary policy, a tax reform, is investigated. Direct taxes on income, for instance, can be an important instrument of redistribution of income to offset possible losses to some groups from a reduction of import tariffs. Increases in direct tax rates would promptly affect medium to high income households and enterprises, without affecting the poor.

2. Literature Review

2.1. CGE Models to Evaluate Trade Policy

The proliferation of CGE models since the pioneering studies of Harberger (1962) and Johansen (1960) has occurred in many areas, such as trade and development (Adelman and Robinson, 1978; Dervis et. al, 1982; De Melo, 1988; Robinson, 1989), and recently many trade policy issues have been addressed using many different CGE models applied worldwide⁴.

Bautista and Thomas (1997) examined the impact of alternative trade policy adjustments on income and equity, focusing on low-income rural households in the Philippines. Using a CGE model, they found that the worst possible situation for the economy as a whole would be to impose an import tariff. Trade liberalization seemed to be the best among the three policies in terms of both efficiency and equity concerns.

Cattaneo *et al.* (1999) developed a CGE model for Costa Rica using a SAM for 1991. They simulated trade liberalization under fixed and free exchange rates, with possible

⁴ For literature surveys see Shoven and Whalley (1984), Srinivasan and Whalley (1986) and De Melo (1988).

compensation for the loss of tax revenue through an increase in taxation in the domestic market. The results obtained suggest the effects on income were very small, because all households receive some type of capital income. With tariff reduction, there was an increase in GDP due to the increase in agricultural production⁵.

Davies *et al.* (1998) studied the short run consequences of trade liberalization in Zimbabwe using a five-sector CGE model based on a SAM for 1985. They conclude that trade liberalization creates short run problems⁶ and this is the main reason liberalization has been so controversial.

Chou *et al.* (1997) estimated a single-country CGE model for Taiwan to evaluate the consequences of joining GATT. Results show that liberalization benefits the domestic economy significantly, with increases in GDP, consumption and welfare.

In contrast to the numerous studies available that deal with general effects from policy reforms in many countries⁷, there are not many CGE studies that address the poverty and equity concerns to capture effects from trade policies on households and overall economy. The use of a CGE model to evaluate equity issues started from studies such as Adelman and Robinson (1978), and Piggot and Whalley (1985), but just recently more attention has been given to the impact of trade reform on poverty and distribution of income through a CGE model. According to Khan (1997), while there are many studies relating trade

⁵ Chou *et al.* (1997) also applied a single-country CGE to Taiwan and concluded, with no surprise, that the economic gains from trade liberalization are positive and with particular benefits for households in terms of income and consumption.

⁶ These problems include consumption booms, short run contractions, drops of savings, demand switching to foreign goods, and growing trade deficits.

⁷ Piggot and Whalley (1985), Ballard *et al.* (1985) and Whalley (1985) are examples of CGE models that have specified many households but have not made much about the distributional effects incorporated in their models.

to relative wages, there are just a few incorporating assessments of the size of the distribution of income⁸.

Gelan (2002) uses a urban-rural CGE model to examine the impacts of trade liberalization on structural changes and overall growth in Ethiopia. Although poverty and equity are not the main focus of Gelan's study, the concern about different responses from rural and urban areas to trade reforms is already a good insight in this direction, since the rural population tends to be poorer than the urban one in Ethiopia.

The study of Lofgren (1999) is interesting not just because it simulates reduction in trade barriers but also uses complementary policies to protect rural households. The study consists of a CGE model for Morocco to evaluate impacts of alternative scenarios for reduced protection in agriculture and industry. Simulation of trade liberalization together with government transfers to owners of agricultural resources provides gains more evenly distributed among all households.

Even though the paper of Konan and Maskus (2000) does not evaluate the impact of policy reforms directly on poverty and inequality, it is a study that addresses the issue of trade liberalization at the same time that allows domestic taxes to adjust endogenously to satisfy a real government revenue target. Through a CGE model for Egypt, they show that welfare effects depend on the type of tax selected to replace the loss of tax revenue. Trade and tax reforms are important, but neither dominates.

Indeed, the link between trade and tax reforms is very important to account for implementation of any of these policies. Most studies of the welfare impacts of trade reforms have ignored the interactions of these policies with existing economy-distorted taxes, whose negative impacts can be even larger than the positive ones from the trade reforms in the second-best world (Williams III, 1999).

⁸ For example, Deardorff and Haveman (1991).

Harrison *et al.* (2003) is a good example of a study that not only addresses the poverty and equity effects from trade liberalization, but also accounts for a value added tax adjustment to assure tax revenue neutrality and equity concerns. Without complementary reforms, it might be the case that no trade reform is possible to bring welfare gains, due to second best effects. The authors stress that there are not many studies that attempt to capture the equity effects of policy reforms⁹. They use a CGE model for Turkey to evaluate the equity effects from trade reform. Results show that the sum of welfare gains over all households is positive, but some of the poorest households lose from the reform.

There are many studies that try to capture the impacts of trade policies and regional integration on the Brazilian economy. Some of them are partial equilibrium studies (Carvalho and Parente, 1999), which fail to consider the regional integration as a general equilibrium phenomenon, producing inaccurate estimates. Other studies use a general equilibrium approach to study issues related to Mercosur policies, such as Campos-Filho (1998) and Flores (1997); and others, such as Haddad (1999), Haddad and Azzoni (2001), and Carneiro and Arbache (2002), analyze issues related to unilateral liberalization and their implications for resource allocation.

Carneiro and Arbache (2002) used a CGE model to analyze the labor market reactions to trade liberalization. Their results have shown that trade liberalization contributes to improved economic welfare by means of greater output, lower domestic prices, and higher labor demand, but the benefits of this economic improvement tend to be appropriated by the most skilled workers in the most trade-oriented sectors.

Haddad *et al.* (2002) evaluated different strategies of economic integration for the Brazilian economy. Results show that the trade strategies tested are likely to increase the

⁹ Studies like Fougere and Merette (2000), Harrison and Rutherford (1999), Keuschnigg and Kohler (2000), and Rutherford (2000).

regional inequality in Brazil. Their main concern was the consequences in the regional inequality due to the Brazilian trade liberalization. Although this study evaluates regional short run effects of trade liberalization, it does not address the income inequality and poverty that are very heavily affected by the regional distribution of resources, population, and production sectors in the Brazilian economy.

The pioneering work of Taylor *et al.* (1980), and Lysy and Taylor (1980) that evaluate the income distribution in Brazil using a general equilibrium model are some of the few studies that consider the effects of economic policies and programs on the size distribution of income in Brazil. They conclude that trade improves the distribution of income, increasing the income of the poorest households.

Barros *et al.* (2001) is one of a few studies known so far that addresses the impact of trade liberalization on poverty in Brazil. They used a CGE model and simulated an increase of protection to the same level as in 1985. They conclude that trade liberalization is beneficial for the whole country, but mainly for both urban and rural poor households. Other recent studies are Harrision, Rutherford, Tarr and Gurgel (2002) and Ferreira Filho and Horridge (2004).

3. Model Database and Model Description

3.1. Social Accounting Matrix (SAM)

The disaggregated Brazilian Social Accounting Matrix (SAM) to be used in this study was constructed for 1995-96 by Andrea Cattaneo, of the Economic Research Service's Resource and Environment Policy Branch (USDA) (Cattaneo, 1998), and it was primarily generated from 1995 Input-Output tables for Brazil (IBGE, 1997a), National Accounts (IBGE, 1997b), as well as the Agricultural Census data for 1995-96 (IBGE, 1998). According to Cattaneo (1999), total labor, land and capital value added were allocated across the

agricultural activities based upon the Agricultural Census. The description of the SAM is summarized in Table 1. It captures both regional and small and large-scale productive technologies. Four agricultural categories (annuals, perennials, livestock, and other agriculture) are disaggregated by holder size (small and large). The SAM also includes three manufacturing activities, three service activities, and 24 commodities. There are 18 labor categories; including 10 urban (further disaggregated by skill level and sector) and 8 agricultural (by skill level and region); 9 capital categories, 8 of which are agricultural and distinguished by holder size and region; and 12 land categories disaggregated by land type (arable, grassland, and forested) and region. Finally, the SAM includes five household accounts (rural and urban by income level), three tax accounts, a savings as well as inventory account, and one account each for enterprises, government, and rest-of-world (ROW).

The “tops-down” approach will be used to perform the disaggregation of national flows to regional levels, since the “bottoms-up” approach requires a great deal of data that are not fully available for Brazil¹⁰. It is assumed that each region always produces a fixed share of each sector’s national output (Higgs *et al.*, 1988). The procedure is basically the same as the one performed in the ORANI Regional Equation System (Higgs *et al.*, 1988), and also the one to obtain regional input-output tables described in Leontief (1966).

The industry and services sectors will be disaggregated into four regions in three stages: regional intermediate consumption, regional value added (capital and labor), and taxes. The regional intermediate consumption will be calculated according to the regional participation on total intermediate consumption (IBGE, 2000a). The regional value added for capital purchases will be obtained through regional GDP participation (IBGE, 2000a), and labor purchases will be calculated by the regional proportion of people employed in each

¹⁰ See Liew (1984) for a good evaluation of both “tops-down” and “bottoms-up” approaches. Higgs *et al.* (1988) give a third procedure that consists of a hybrid of both “tops-down” and “bottoms-up” approaches.

sector (IBGE, 2000b). The tax payments by each regional industry and services sector will be calculated through the regional participation on total value added (IBGE, 2000a). The flows of regional output for each disaggregated sector (industry and services) will be obtained through the regional output shares of each sector. The household income from the regionalized labor categories used by the regional industry and services sectors will be obtained through the regional shares of people employed by each sector according to the income level (IBGE, 2001). Finally, the payments made to enterprises by the regionalized capital categories used in each regional industry and services sectors will be obtained from the regional shares of enterprises in each sector according to the value added participation (IBGE, 2000b).

3.2. The CGE Model

The CGE model to be used in this study is a regional adaptation of the so-called “standard CGE model”¹¹, which was first developed and distributed through a study¹² of the International Food Policy Research Institute (IFPRI). The model follows the neo-classical-structuralist (Chenery, 1975) modeling tradition that is presented in Dervis, de Melo, and Robinson (1982), and includes important characteristics developed in recent years in research projects conducted at IFPRI. Such characteristics are of particular importance in developing countries, and include household consumption of non-marketed commodities, explicit treatment of transaction costs for commodities that enter the market, and a distinction between producing activities and commodities that permits any regional activity to produce multiple commodities and any commodity to be produced by multiple activities.

¹¹ Lofgren, Robinson and Thurlow (2002), Thurlow and Van Seventer (2002) and Wobst (2002) applied this standard CGE model, respectively, to Zambia, South Africa and five Southern African countries. Mathematical description of the model can be seen in Appendix.

¹² For more details about this model, see Lofgren *et al.* (2001).

Activity	Commodities produced	Factors used
Annuals production	Corn, Rice, Beans, Manioc, Sugar, Soy, Horticultural goods, and Other Annuals	Arable land, unskilled rural labor, skilled rural labor, agricultural capital
Perennials production	Coffee, Cocoa, Other Perennials	Arable land, unskilled rural labor, skilled rural labor, agricultural capital
Animal products	Milk, Livestock, Poultry	Grassland, unskilled rural labor, skilled rural labor, agricultural capital
Forest products	Non-timber tree products, Timber, and Deforested land for agricultural purposes	Forest land, unskilled rural labor, skilled rural labor, agricultural capital
Other agriculture	Other agriculture	Arable land, unskilled rural labor, skilled rural labor, agricultural capital
Food Processing	Food Processing	Urban skilled labor, urban unskilled labor, urban capital
Mining and Oil	Mining and Oil	Urban skilled labor, urban unskilled labor, urban capital
Industry	Industry	Urban skilled labor, urban unskilled labor, urban capital
Construction	Construction	Urban skilled labor, urban unskilled labor, urban capital
Trade and Transportation	Trade and Transportation	Urban skilled labor, urban unskilled labor, urban capital
Services	Services	Urban skilled labor, urban unskilled labor, urban capital

Source: Cattaneo (1999).

Table 1: Summary of activities, commodities, and factors included in the 1995 Brazilian SAM

3.2.1 – Prices, Activities, Production, and Factor Markets

This model assumes that producers in each region maximize profits, taking prices as given, subject to the technology, which is specified by a Constant-Elasticity-of-Substitution (CES) or a Leontief function of the quantities of value added and aggregate intermediate input. Value added is a CES function of primary factors, and the aggregate intermediate input is a Leontief function of disaggregated intermediate inputs. The factor market closure to be used in this study considers that the quantity supplied of each factor is fixed at the initial

level (SAM). Labor is considered to be mobile across sectors, which is a medium run assumption. Capital and land are considered sector-specific. Hence, we expect that the resources will be reallocated to more productive uses, after reduction in import tariffs. The regional activities pay an activity-specific wage that is the product of the economy-wide wage and a fixed activity-specific wage term. The main price, production, and commodity equations¹³ for each region are given in Appendix.

3.2.2 – Institutions and Commodity Markets

Institutions are households, government, enterprises, and rest of the world.

Households receive income from payments for the use of factors of production, and transfers from other institutions. Their consumption is allocated across different commodities according to a Linear Expenditure System (LES) demand functions. Enterprises can receive direct payments from households and transfers from other institutions. Since enterprises do not consume, they allocate their income to direct taxes, savings, and transfers to other institutions. Government receives taxes (fixed at *ad valorem* rates) and transfers from other institutions, and uses this income for consumption and for CPI-indexed¹⁴ transfers to other institutions. Transfer payments from the rest of the world, domestic institutions, and factors are all fixed in foreign currency. Foreign savings is the difference between foreign currency spending and receipts.

According to Figure 1, the first stage in the flows of regional marketed output consists on generating aggregated domestic output from the regional output of different activities of a given commodity. Such regional outputs are not perfect substitutes. A Constant-Elasticity-of-Substitution (CES) function is used as the aggregation function. Aggregated domestic output is allocated between exports and regional domestic sales, where

¹³ Description of parameters and variables can be seen in Appendix. For a detailed description of this regional model see Bittencourt (2004).

¹⁴ Government transfers indexed to the CPI makes the model homogeneous of degree zero in prices.

suppliers maximize sales revenue for any given aggregate output level, subject to imperfect transformability between exports and regional domestic sales, through a Constant-Elasticity-of-Transformation (CET).

All domestic market demands are for a composite commodity made up of imports and domestic output. It is assumed that domestic demanders minimize cost subject to imperfect substitutability. This is also captured by a CES aggregation function (Armington function)¹⁵. The derived demands for imported commodities are met by international supplies that are infinitely elastic at given world prices. Import tariffs and fixed transaction costs are included in the import prices paid by domestic demanders. The derived demand for domestic output is also met by domestic suppliers, and the prices paid by demanders include the cost of transaction services.

The value of the elasticity of substitution between imported and domestic commodities are based on Tourinho, Kume and Pedroso (2002), which estimated the Armington elasticities for 28 industrial sectors in Brazil for the period 1986 –2001. Other elasticities are borrowed from Asano and Fiuza (2001).

The macroeconomic closure¹⁶ used here considers that the government savings¹⁷ is a flexible residual while all tax rates are fixed. Therefore, the government consumption is fixed, either in real terms or as a share of nominal absorption. For the external balance, the real exchange rate¹⁸ is considered flexible while foreign savings is fixed. The trade balance is also fixed, since transfers between rest of the world and domestic institutions are fixed. For

¹⁵ Based on Armington (1969).

¹⁶ According to Lofgren *et al.* (2001), the choice of macroeconomic closures depends on the context of the analysis. Since it is a single-period model, a closure chosen here with fixed foreign savings, fixed real investment, and fixed real government consumption may be preferable for simulations that explore the equilibrium welfare changes of alternative policies, as it is the case of our study.

¹⁷ It is defined as the difference between current government revenues and current government expenditures.

¹⁸ The Brazilian exchange rate policy in recent years allows flexible exchange rate fluctuations within a band as range controlled and determined by the Central Bank under government decision.

the savings-investment balance, closure is investment-driven, where real investment quantities are fixed. This implies that, in order to generate savings that equal the cost of the investment bundle, the base-year savings rates of selected non-government institutions are adjusted by the same proportion.

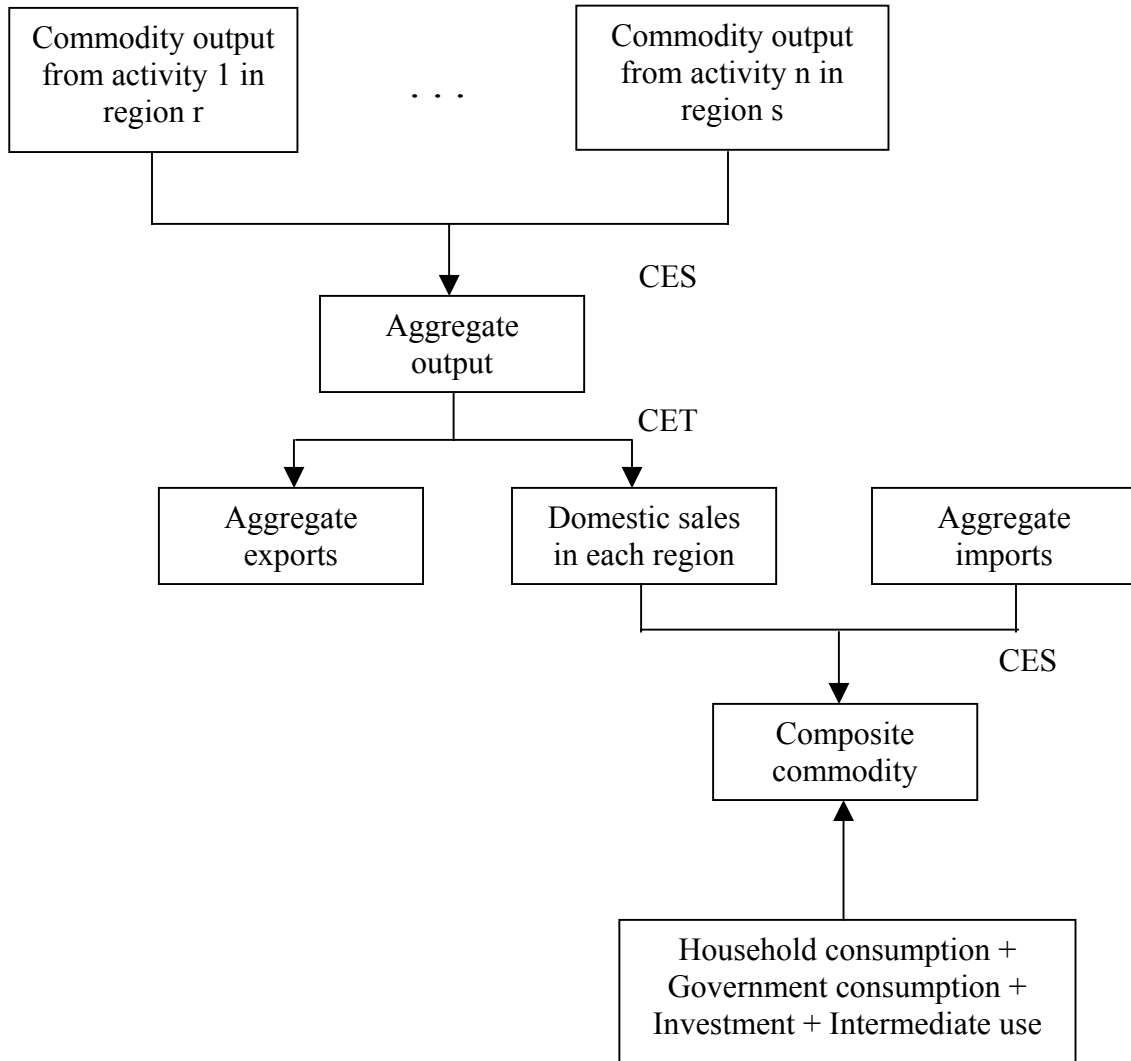


Figure 1: Flows of regional marketed commodities in the standard CGE model

3.2.3 – Inequality Measures

In order to verify the impacts of reduction in import tariffs on poor households and on income inequality, we need to define what would be the tools to quantify such effects. When policy simulations are carried out, factor prices, transfers, or other endogenous variables may change, which modify not only the total households net income, but also any representation of the distribution of income (Khan, 1997).

The main measures of inequality to be used at the regional level¹⁹ are the Gini coefficient (index), through its decomposition, and some generalized entropy inequality measures such as Theil, Hirschman-Herfindahl, and Bourguignon indexes. We will use a decomposition²⁰ of these four indexes in order to better evaluate the impacts of import tariff reduction on households at a regional level²¹.

According to Silber (1989), Dagum (1997), and Mussard *et al.* (2003), we can decompose the Gini index by factor components when detailed income sources are available, as it is the case of our regional standard CGE model and the available SAM. It is possible to breakdown the inequality into within and between classes inequality when there are groups with different income ranges. Since our data contain not only different household groups arranged by income, but also by location (urban and rural), or population subgroups, with income sources from activities from different regions, we can also have some interaction term²².

¹⁹ The Gini and Theil indexes will be used in the overall results.

²⁰ More details about the decomposition of these indexes can be found in Silber (1989), Dagum (1997), and Mussard *et al.* (2003).

²¹ There is no CGE model known so far that has implemented this approach to verify detailed consequences from counterfactual simulations on households.

²² It is also possible to decompose the Gini index by factor components, which in our case will not be feasible in the case of capital income, since the capital rents are paid to the enterprises account, and not directly to households. Therefore, we will only consider the case of decomposition when we have different income classes.

4 – Trade Policy Simulations

The regional CGE model allows accounting for short to medium run effects that the import tariff reductions will have on the welfare of households (gains and losses). This study accounts for two different scenarios.

Scenario 1: a simulation consisting of elimination of import tariffs²³ for all and specific sectors.

The idea here is to find the regional short to medium run effects that the import tariff reductions will have on the welfare of households (gains and losses). Due to the characteristics of the model, we expect that the resources will be reallocated to more productive uses, after reduction in import tariffs.

However, it might be the case that even a sector-specific trade reform is not enough to guarantee equal and efficient welfare gains. According to Harrison *et al.* (2003), there can be many ways to include complementary policies to trade reform in order to generate the greatest aggregate welfare gains and that do not bring losses for the poor households. The one to be analyzed will be the import tariff reduction together with a domestic tax reform²⁴, which will be addressed in the next scenario.

²³ In general, the average nominal import tariff in Brazil is around 13 %, as noted by Estevadeordal *et al.* (2000), Leipziger *et al.* (1997), and Monteagudo and Watanuki (2002). Some sectors present, on average, low levels of protection, but there are some specific products with very high import tariffs. For instance, the industry average import tariff is around 10.6 %, but the import tariff for vehicles is 39 %, and for clothing and shoes is 18.3 %.

²⁴ Another possibility would be an increase in wages as a way to compensate households from losses due to the reduction in import tariff. The logic behind that is that the Brazilian government regulates the increments in the minimum wages paid most for the poor workers, whose labor contracts are generally indexed to the law-determined minimum wage. There would be many problems with the use of this policy. The first is its political appeal, since it is a very common practice in election times to increase the minimum wage. Second, the policy may not achieve a significant proportion of the population because of the size and composition of the formal and informal labor markets. The SAM used here does not have a specified informal labor market account. Third, depending on the labor/capital ratio and elasticity values used in the sectors of our CGE model, an increase in minimum wage does not guarantee an improvement in welfare for households, since the counterpart reaction of firms would be the reduction of production due to the increase in its costs (labor cost). Fourth, to perform this simulation, one of our closure rules should change, and this should be the factor market closure, implying that labor market, at least, should be considered as having

Scenario 2: a simulation consisting of elimination of import tariffs for specific sectors, and 20 % increase in direct (income) tax rates.

In the second scenario we try to combine policies such that no poor household is harmed from a reduction in import tariffs, trying to identify the equity-efficiency tradeoffs available in Brazil, and to indicate the most attractive alternative.

The direct use of sidepayments to compensate those households that lose through transfers from those that gain from the import tariff reduction is just the “compensation principle” in welfare economics. It may not be feasible in practice. Instead, we can use the direct taxation system to capture part of the earnings of the high-income households to be indirectly distributed to those poor households, at the same time that it would compensate for government revenue losses. In Brazil, the increase in direct tax rates would affect enterprises, medium-income households, and high-income households, since the poor do not pay direct taxes. Therefore, a combination of trade and tax reform might be proposed through the second scenario, in order to improve welfare for all poor households in rural and urban areas.

The direct tax system in Brazil is still a progressive system, but with only three tax rate categories. Before 1989, however, there were more than nine different tax rates compatible with the income level. After 1988’s Constitution, there were many changes in the tax rates applied to the population. In 1996-1997, which is the period our SAM was constructed, the direct tax rates were: 0% (for low income), 15 % (for medium income), and 25 % (for high income). Since 1998, people with annual income less than R\$ 10,800²⁵ do not pay income tax. Those with annual income between R\$ 10,800 and R\$ 21,600 pay income tax at the rate of 15 %. People with annual income larger than R\$ 21,600 pay 27.5% as

fixed economy-wide wage and some unemployment. This could be an issue when comparing the results with other simulations under different labor market closure rules.

²⁵ This minimum income became R\$ 13,968 in 2005.

income tax. The rationale here is to increase the tax rate for high-income people, since the tax rate of 25 % is very small in comparison to the rate in place during the 70s and middle 80s²⁶, which can help in the reduction of income concentration and inequality. Many of the developed countries reduced their ceiling tax rates over time, but their rates are still higher than in Brazil in 1997.

The tax that the government uses to raise revenue affects the outcome, since the direct tax chosen (due to operational features of the model) does not impose the least marginal excess burden among the tax instruments available. There might be a risk in this complementary policy that the loss due to the increase in domestic taxes can be larger than the gains from the import tariffs reduction, but it needs to be empirically investigated.

5. Main Results and Discussion

5.1. Overall and Sectoral Trade Liberalization (Scenario 1)

The simulations performed in scenario 1 consist on 100 % reduction in import tariff for overall and some specific sectors. The sectors considered are divided in three groups: (i) agriculture (AGR), which is composed of corn, rice, soybeans, beans, perennial commodities, annual commodities, horticultural products, forest products, cattle meat, poultry meat, milk, sugar, and other agricultural commodities; (ii) industrial (IND), which is composed of industrial commodities, mining and oil goods, and processed foods; and (iii) the last group is given by a combination of industry and agriculture (MIX), which Brazil is more likely to trade such as corn, rice, perennial commodities, annual commodities, forest products, milk,

²⁶ One way to justify an increase in the high-income taxation would be to compare the tax rate applied to a person with annual income of R\$ 24,000, who would pay the same tax rate as one that earns R\$ 240,000 per year. Although there was a more complex system with more income categories with different and larger tax rates, before 1988, the system at that time was fairer than the one seen nowadays that allows this type of distortion.

cattle meat, other agricultural commodities, processed foods, mining and oil goods, and industrial products.

In this section, our main goal is to verify the possibility of finding a sectoral reduction in import tariffs that does not harm poor households. As seen in overall trade liberalization, poor urban households are likely to experience welfare losses after reduction in the import tariffs. If there is no sectoral trade liberalization that can bring gains for all households' categories, then it may be instructive to find an efficiency-equity combination of policies not only to reduce the protection of domestic sectors in Brazil, but also to bring welfare improvements for all households²⁷.

The sectoral trade liberalization in the agricultural sector²⁸ does not bring considerable modifications in the economy in the short to medium run. The impacts on trade are small, without any substantial change in the inequality measures. However, the poorest people lose, which is not surprising, as we can see by the decrease in welfare for rural households. In this case, resources from agriculture would be reallocated in the most capital-intensive sectors, and it would even bring gains for urban households when the import tariffs are totally eliminated, as in Table 2.

As expected, the industrial sector plays the most important role in the Brazilian attempt to open its economy due to the existence of a high degree of protection in this sector for many decades. The results from trade liberalization for agriculture stressed the importance of the industry in the Brazilian liberalization process in such a way, that the results from an overall import tariffs reduction was not that different from the results obtained from import tariffs elimination only in the industry sector. Results show a

²⁷ However, this task goes beyond the scope of this study.

²⁸ Even though agriculture is composed of many different activities (sectors) in four different regions in the SAM, we are referring to the agricultural sector and agricultural sectors interchangeably.

substantial increase in trade, with a devaluation on the real exchange rate. Although the level of inequality falls through a reduction in the Gini and Theil indexes, the main negative impact seems to be once again on the urban poor households through their welfare reduction. As expected, rural poor households win with the reduction or elimination of the protection in the capital-intensive sectors. However, this result can be seen as a potential danger in policy making because it can be an invitation to strategic lobbying by the industrial sector members.

The elimination of the import tariffs in agriculture does not improve inequality in the distribution of income in any region (Table 3). This is a strong result against sectoral trade liberalization in Brazil.

Elimination of an import tariff in the industry harms urban low and medium income households instead of rural households as seen in the case of AGR. Rural households are those that gain from trade reform in the industry sector, allowing substantial increase in their wages. Although urban households lose with sectoral trade liberalization in the industry, the distribution of income within regions improves (Table 4).

This section emphasized the main overall and regional consequences of removing import tariffs in some specific sectors and combination of sectors. The results suggest that Brazil should find another type of policy to be combined with the import tariffs reduction in order to achieve welfare improvements for all households in all regions.

5.2. Equity-Efficiency Trade Liberalization (Scenario 2)

The price changes due to trade liberalization affect the incentives to produce particular goods and the technologies they employ. The Stolper-Samuelson Theorem (SST) predicts that, under particular conditions, an increase in the price of the commodity that is unskilled labor intensive in production will increase the unskilled real wage and decrease that of skilled labor. The results for the rural households confirm exactly the SST. But what can be said about the results from scenario 1 for urban poor households?

	100 % reduction import tariff			
	OVERALL	AGR	IND	MIX
Absorption	0.1	-	0.1	0.1
Private consumption	0.1	-	0.1	0.1
Exports	14.4	1.3	13.1	14.1
Imports	12.4	1.3	11.2	12.1
Real exchange rate	4.4	0.2	4.2	4.3
<i>Share of GDP (%)</i>				
Investment	-0.2	-	-0.2	-0.2
Private savings	0.5	-	0.5	0.5
Foreign savings	0.1	-	0.1	0.1
Government savings	-0.9	-	-0.8	-0.8
Tariff revenue	-0.9	-0.1	-0.9	-0.9
Direct tax revenue	0.1	-	0.1	0.1
<i>Equivalent Variation (%)</i>				
Rural low inc. household	0.7	-0.4	1.1	1.0
Rural medium income household	0.7	-0.4	1.0	0.9
Urban low income household	-0.7	0.2	-0.8	-0.7
Urban medium income household	0.0	0.1	-0.2	-0.1
High income household	0.3	-	0.3	0.3
Total welfare	0.1	0.02	0.1	0.1
Gini coefficient	-0.2	-	-0.2	-0.2
Theil index	-0.3	-	-0.4	-0.3

Table 2: Simulation results for overall and sectoral elimination of the import tariffs (scenario 1), % change from benchmark values

Indexes	North		Northeast		Center-West		South/Southeast	
	Base ^(*)	Sim ^(**)	Base	Sim	Base	Sim	Base	Sim
Gini	0.258	0.259	0.353	0.354	0.402	0.403	0.475	0.476
Theil	0.115	0.116	0.229	0.231	0.275	0.276	0.390	0.391
H-H	0.106	0.106	0.201	0.203	0.275	0.276	0.388	0.389
Bourguignon	0.139	0.140	0.310	0.315	0.342	0.344	0.526	0.528

(*) Base indicates values at the benchmark solution

(**) Sim refers to values after simulation

Table 3: Regional income inequality measures before and after elimination of the import tariffs in agriculture

Indexes	North		Northeast		Center-West		South/Southeast	
	Base ^(*)	Sim ^(**)	Base	Sim	Base	Sim	Base	Sim
Gini	0.258	0.255	0.353	0.350	0.402	0.400	0.475	0.474
Theil	0.115	0.112	0.229	0.225	0.275	0.272	0.390	0.387
H-H	0.106	0.103	0.201	0.198	0.275	0.272	0.388	0.385
Bourguignon	0.139	0.135	0.310	0.304	0.342	0.336	0.526	0.520

(*) Base indicates values at the benchmark solution

(**) Sim refers to values after simulation

Table 4: Regional income inequality measures before and after elimination of the import tariffs in industry

According to Harrison *et al.* (2003), due to the second best effects it might be the case that there is no trade reform that can improve welfare for the whole society without having a compensatory mechanism, which can imply that low income households in urban areas may experience welfare gains only if an import tariff reduction is combined with some alternative policy that compensates their losses from trade reform.

Since sectoral trade reform does not bring any substantial improvement in households' welfare, compared to overall trade reform, we consider the overall reduction of the import tariffs as the main instrument of trade liberalization in our analysis in this section.

Therefore, overall reduction in the import tariffs is combined with a different policy in order to improve welfare for all poor households. This policy is the increase in direct tax rates, which was discussed in section 4.

Trade and Direct Tax Reform

Our findings showed that overall and sectoral reductions in the import tariffs do not improve welfare for urban poor households. But the question becomes whether there is a combination of trade policy and direct tax policy to achieve more efficiency and equity in Brazil. Therefore, the challenge becomes to find a “win-win” combination of policy reforms for all poor households. One word of caution is needed here since we are in a second-best world. Although the alternative policy to be considered is a simple tax reform²⁹ that will bring more distortion to the economy, it consists of an increase of tax rates for medium to high income households that will serve as a compensatory scheme to offset poor households’ losses after reduction in the import tariffs. The use of sidepayments or lump-sum taxes as options of policies is not considered in our analysis.

The combined reduction of import tariff/increase in direct tax rates improves overall income, welfare, and production for some selected sectors, and brings a better distribution of income. Note that the level of direct tax rate for urban medium-income households is very low, since the household income categories in the SAM do not coincide to those in the official Brazilian direct tax rate schedule. Enterprises and high-income households are key agents to serve as instruments of income re-distribution in the proposed combined trade/tax reform (scenario 2).

²⁹ According to the discussion in section 4, a possible politically appealing alternative could be an increase in the minimum wage that is determined by the Brazilian government. However, as expected and discussed in that section, the results of the simulations accounting for this type of policy bring welfare losses for all households when combined with reduction of the import tariffs. Due to space constraint, the explicit and detailed results were omitted from our results discussion in this section.

The main result from these combined policies is that the trade balance improves, at the price of real exchange rate devaluation (Table 5). Investment and private savings fall, but the government savings increase in order to balance the government account. Direct tax revenues increase 2.6 %, as a result of the 20 % increase in the direct tax rates. The overall and individual household's welfare improve, except for high income households, who will pay more taxes after the implementation of the combined policies. The distribution of income also improves substantially with the simulation. To be more specific, the values for the Gini and Theil indexes for the base (0.5054 and 0.6344, respectively) become 0.5043 and 0.6324, after elimination of the import tariffs.

Figure 2 summarizes all sets of simulations performed by both scenarios. It is possible to see the effects of the combined trade and tax reforms (scenario 2), under which we could verify that the high-income households are the only ones to lose from such policy.

The results seem to suggest that the specific combination of trade and tax reform can improve overall poverty and income inequality in Brazil, with few differences with respect to the level of reduction of the import tariffs, since the qualitative differences between partial or total elimination of import tariffs were very small. Therefore, it is possible to have an equity-efficiency policy that can bring openness and larger welfare gains for the poor with smaller income inequality.

It is interesting to note how an increase in direct tax rates plus an elimination of the import tariffs can help urban poor households to overcome welfare losses by eliminating only the import tariffs. Table 6 shows a comparison of consumption expenditure changes for all household categories, for scenarios 1 and 2. Although high income households in rural and urban areas are worse off than any of the scenarios analyzed, poor households in both urban and rural areas are better off under scenario 2. Scenario 2 can be considered as a combination

of policies that is at the same time equity-efficient because under these trade/tax reform all poor households in both rural and urban areas become better off.

All four regions experience many similar impacts from a reduction in the import tariffs combined with an increase in the direct tax rates. Some regional differences can be seen in Table 7. Once again, larger labor income gains are obtained in the North and Center-West, mainly for rural households.

The equity-efficiency trade/tax policies proposed do not bring important changes in the income inequality measures seen in previous scenario. Although the income inequality is slightly reduced after using the combined trade/tax policies, the overall results from simulation do not change the structure of how the labor income is distributed within and between regions. This simulation does not modify the structure of the inequality within and among regions in Brazil, in comparison to the simulation accounting only for the import tariffs reduction.

If we consider only capital income, Table 8 shows that the decomposition of capital income follows the same pattern as that of labor income. However, the proposed combined trade/tariff policy seems to increase the inequality between regions and, consequently, improves inequality of capital income within regions. As seen before with labor income, most of the bad distribution of capital income in Brazil is due to substantial differences among regions. This result is not surprising since it was also obtained by Haddad *et al.* (2002), which found that trade liberalization through free trade area agreements can lead to an increase in regional inequalities in Brazil.

	100 % reduction import tariff + 20 % increase direct tax rates
Absorption	0.1
Private consumption	0.1
Exports	14.1
Imports	12.2
Real exchange rate	4.3
<i>Share of GDP (%)</i>	
Investment	-0.2
Private savings	-2.1
Foreign savings	0.1
Government savings	1.7
Tariff revenue	-0.9
Direct tax revenue	2.6
<i>Equivalent Variation (%)</i>	
Rural low inc. household	2.4
Rural medium income household	2.4
Urban low income household	0.9
Urban medium income household	1.3
High income household	-1.0
Total welfare	0.1
Gini coefficient	-0.2
Theil index	-0.3

Table 5: Simulation results for overall elimination of import tariffs combined with 20 % in direct tax rates (scenario 2), % change from benchmark values

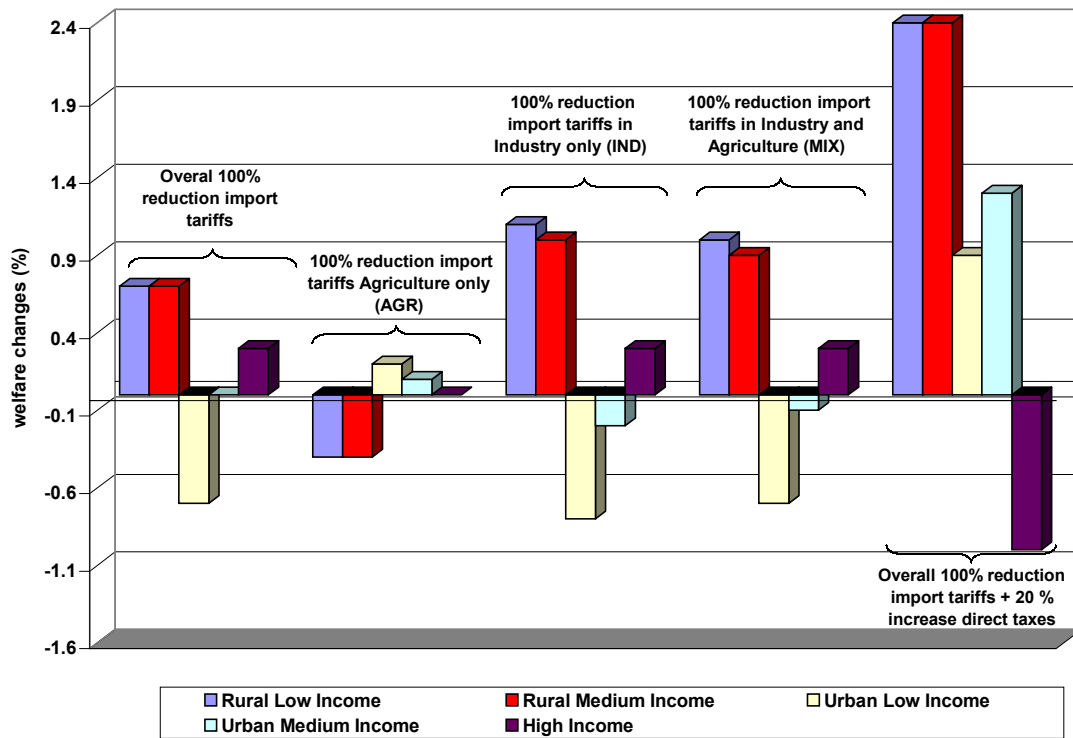


Figure 2: The main effects of different simulations on household's welfare changes from base (%)

Scenarios	Rural low income household (%)	Rural medium income household (%)	Urban low income household (%)	Urban medium income household (%)	High income household (%)
100% import tariffs (scenario 1)	0.14	0.09	1.22	0.78	-0.03
100% import tariffs + 20 % direct tax rates (scenario 2)	1.85	1.41	2.98	2.50	-1.37

Table 6: Main changes in consumption expenditures by households for scenarios 1 and 2

As seen before, the four inequality indexes also show that all regions contribute to reducing the overall inequality among regions (Table 7).

Indexes	North		Northeast		Center-West		South/Southeast	
	Base ^(*)	Sim ^(**)	Base	Sim	Base	Sim	Base	Sim
Gini	0.258	0.255	0.353	0.352	0.402	0.400	0.475	0.474
Theil	0.115	0.112	0.229	0.228	0.275	0.272	0.390	0.388
H-H	0.106	0.103	0.201	0.200	0.275	0.273	0.388	0.386
Bourguignon	0.139	0.136	0.310	0.309	0.342	0.337	0.526	0.522

(*) Base indicates values at the benchmark solution

(**) Sim refers to values after simulation

Table 7: Regional income inequality measures before and after an overall elimination of the import tariffs combined with an increase in the rate of direct tax

Indexes	% of the within-region component		% of the between-regions component		% of transvariation	
	Base ^(*)	Sim ^(**)	Base	Sim	Base	Sim
Gini	17.9	17.8	77.5	77.7	4.5	4.4
Theil	45.7	45.2	54.3	54.8	-	-
H-H	67.0	66.7	33.0	33.3	-	-
Bourguignon	38.3	37.6	61.6	62.3	-	-

(*) Base indicates values at the benchmark solution

(**) Sim refers to values after simulation

Table 8: Contribution of the four decompositions to overall capital income inequality before and after simulation

6. Conclusions

Our major policy concern was the interaction between trade policy changes and poverty and income distribution in Brazil. The main challenge of our research was not only to find an efficient trade policy in the Brazilian trade liberalization process, but also to find an efficient instrument of policy that has, at the same time, equity concerns, without hurting poor and reducing income inequality.

Brazil has a progressive direct tax rate system, but with very few categories and a low level for the maximum rate. This study found an equity-efficiency policy based on a combination of import tariff and an increase in the direct tax rate, in order to compensate “losers” from considering only reduction in the import tariffs.

A single country, static, CGE model was used to evaluate trade policy experiments in Brazil under two different scenarios, through a top-down-regionalized social accounting matrix (SAM) with 60 sectors divided in four regions and five households categories. The model experiments were divided into two stages. In the first stage the model considered only the global and sectoral reduction in import tariff. The second stage was based on the attempt of finding a complementary policy in order to compensate losers, mainly poor households, to the import tariff reduction.

The main overall and regional consequences of a global and sectoral elimination of import tariffs showed the following main conclusions:

- (i) There was an overall welfare gain from trade reform;
- (ii) Urban poor households lose, which indicates the presence of a trade-off between aggregate welfare gains and the welfare gains to the urban poor from reduction in import tariffs, as found by Harrison *et al.* (2003) for Turkey;
- (iii) Overall and regional income inequality is reduced among households, contrary to what was found in Haddad (1999) and Haddad *et al.* (2002);

- (iv) The reduction or elimination of import tariff is not enough to change the structure of the inequality in the distribution of the regional income. The inequality among regions is the most important component that contribute for the overall inequality in Brazil;
- (v) South/Southeast has the most important weight in determining the inequality of income among the regions in Brazil;
- (vi) Although there were some small differences among regions, the main regional impacts from trade reform indicate a similar pattern for the whole country, in which industry had suffered the main negative impacts, consequently reducing income and welfare of poor households employed in this sector;

The second scenario showed that it is possible to find an equity-efficiency policy combination through import tariff reduction and an increase in the direct tax rates. The simulation results showed that all households gain from the combined policies in the short to medium run, with an overall improvement in the distribution of income. GDP, exports, and imports increased, at the macro level. At the regional level, there was an improvement in the distribution of labor income within and among regions. However, the distribution of capital income among regions became more unequal.

In the next rounds of free trade negotiations, the Brazilian government should consider the importance of interregional differences for a better understanding of the consequences of those agreements at the national and regional levels. There should be more options for public policy that can be used together with different strategies of trade reforms, such as the tax reform proposed in this study, in order to generate a more efficient and equitable relationship between producers and consumers, enhancing the outcomes of such policies and even increasing Brazilian competitiveness in international markets.

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Appendix – Regional adaptation of the Lofgren’s model (Lofgren *et al.*, 2001)

Sets

$a \in A$	activities	$i \in INS$	institutions
$c \in C$	commodities	$i \in INSD(\subset INS)$	domestic institutions
$c \in CE(\subset C)$	exported commodities	$i \in INSDNG(\subset INSD)$	domestic non-government institutions
$c \in CM(\subset C)$	imported commodities	$h \in H(\subset INSDNG)$	households
$c \in CX(\subset C)$	domestic production	$r \in R$	regions
$f \in F$	factors of production		

Parameters

α_a^a	efficiency parameter in the CES activity function	$shif_{if}$	share for domestic institution i in the income from f
α_a^{va}	efficiency parameter in the CES value added function	ta_a	tax rate for activity a
α_c^{ac}	shift parameter for domestic commodity aggregation function	tf_f	direct tax rate for factor f
δ_a^a	CES activity function share parameter	$trnsfr_{if,r}$	transfer from factor f to institution i in region r
δ_{fa}^{va}	CES value added function share parameter for factor f in activity a	tva_a	rate of value added tax for activity a
$\theta_{ac,r}$	yield of output c per unit of activity a in region r	ica_{ca}^r	c used as intermediate input per unit of final output in a in region r
ρ_a^a	CES production function exponent	$inta_a^r$	amount of aggregate intermediate input per activity unit in region r
ρ_a^{va}	CES value added function exponent	iva_a^r	amount of aggregate value added input per activity unit in region r
ρ_c^{ac}	domestic commodity aggregation function exponent		

Variables

$\overline{QFS}_{f,r}$	quantity supplied of factor in region r	$QF_{fa,r}$	demand for factor f from activity a in region r
$\overline{WFDIST}_{fa,r}$	wage distortion factor for factor f in activity a in region r	QHA_{ach}	household home consumption of c from activity a by household h
EXR	foreign exchange rate	$QINTA_{a,r}$	aggregate intermediate input in region r
$PA_{a,r}$	price of activity a in region a	$QINT_{ca,r}$	output of commodity c as intermediate input to activity a in region r
$PINTA_{a,r}$	aggregate intermediate input price for activity a in region r	$QVA_{a,r}$	aggregate value added in region r
PQ_c	composite commodity price	QX_c	aggregate domestic output
PX_c	producer price	$QXAC_{ac,r}$	output of commodity c from activity a in region r
$PVA_{a,r}$	value added price of a in region r	$WF_{f,r}$	average price of factor f in region r
$PXAC_{ac,r}$	producer price of commodity c for activity a in region r	$YF_{f,r}$	income of factor f in region r
$QA_{a,r}$	level of activity a in region r	$YIF_{if,r}$	income to domestic institution i from factor f in region r

Equations

Regional prices:

$$(1) PA_{a,r} = \sum_{c \in C} \theta_{ac,r} PXAC_{ac,r} \quad (\text{Regional Activity Price})$$

$$(2) PINTA_{a,r} = \sum_{c \in C} PQ_c \cdot ica_{ca}^r \quad (\text{Regional Intermediate Input Price})$$

$$(3) PA_{a,r} \cdot (1 - ta_a) \cdot QA_{a,r} = PVA_{a,r} \cdot QVA_{a,r} + PINTA_{a,r} \cdot QINTA_{a,r} \quad (\text{Regional Activity Revenues and Costs})$$

Production and commodity regional equations:

$$(4) QA_{a,r} = \alpha_a^a \cdot \left(\delta_a^a \cdot QVA_{a,r}^{-\rho_a^a} + (1 - \delta_a^a) \cdot QINTA_{a,r}^{-\rho_a^a} \right)^{\frac{1}{\rho_a^a}} \quad (\text{Regional CES Activity Production Function})$$

$$(5) \frac{QVA_{a,r}}{QINTA_{a,r}} = \left(\frac{PINTA_{a,r}}{PVA_{a,r}} \frac{\delta_a^a}{1 - \delta_a^a} \right)^{\frac{1}{1 + \rho_a^a}} \quad (\text{Regional CES Value added-Intermediate-Input Ratio})$$

$$(6) QVA_{a,r} = iva_a^r \cdot QA_{a,r} \quad (\text{Demand for Regional Value added})$$

$$(7) QINTA_{a,r} = inta_a^r \cdot QA_{a,r} \quad (\text{Demand for Regional Intermediate Input})$$

$$(8) QVA_{a,r} = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa,r}^{-\rho_a^{va}} \right)^{\frac{1}{\rho_a^{va}}} \quad (\text{Regional Value added and Factor Demands})$$

$$(9) W_{f,r} \cdot \overline{WFDIST}_{fa,r} = PVA_{a,r} \cdot (1 - tva_a) \cdot QVA_{a,r} \cdot \left(\sum_{f \in F'} \delta_{fa}^{va} \cdot QF_{fa,r}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot QF_{fa,r}^{-\rho_a^{va} - 1} \quad (\text{Regional Factor Demand})$$

$$(10) QINT_{ca,r} = ica_{ca}^r \cdot QINTA_{a,r} \quad (\text{Regional Intermediate Input Demand})$$

$$(11) QXAC_{ac,r} + \sum_{h \in H} QHA_{ach,r} = \theta_{ac}^r \cdot QA_{a,r} \quad (\text{Regional Commodity Production and Allocation})$$

$$(12) QX_c = \alpha_c^{ac} \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac,r}^{-\rho_c^{ac}} \right)^{\frac{1}{\rho_c^{ac} - 1}} \quad (\text{Regional Output Aggregation Function})$$

$$(13) \quad PXAC_{ac,r} = PX_c \cdot QX_c \cdot \left(\sum_{a \in A'} \delta_{ac}^{ac} \cdot QXAC_{ac,r}^{-\rho_c^{ac}} \right)^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac,r}^{-\rho_c^{ac}-1}$$

(First-order Condition for Regional Output Aggregation Function)

Institutions:

$$(14) \quad YF_{f,r} = \sum_{a \in A} WF_{f,r} \cdot \overline{WFDIST}_{fa,r} \cdot QF_{fa,r} \quad (\text{Regional Factor Income})$$

$$(15) \quad YIF_{if,r} = shif_{if,r} \cdot [(1 - tf_f) \cdot YF_{f,r} - transfr_{rowf,r} \cdot EXR]$$

(Regional Institutional Factor Incomes)

System constraints:

$$(16) \quad \overline{QFS}_{f,r} = \sum_{a \in A} QF_{fa,r} \quad (\text{Regional Factor Market Equilibrium})$$