Regional inequality and growth:
the role of interregional trade in the Brazilian economy

Aline Souza Magalhães
PhD candidate - CNPq Scholarship
Cedeplar/UFMG (Federal University of Minas Gerais, Brazil)

Edson Domingues
Associate Professor
Cedeplar/UFMG (Federal University of Minas Gerais, Brazil)
CNPq and Fapemig Scholar

ABSTRACT: This paper deals with interregional trade in the Brazilian Economy, estimating its role on efficiency, international competitiveness and regional inequality. Our modeling encompasses much detail. Firstly, we use a large-scale multi-regional computable general equilibrium (CGE) model of Brazil. The model is bottom-up for Brazil's 27 states. Despite the high level of regional disaggregation, the level of sectoral disaggregation is also high, at 36 sectors. Applying the CGE model in simulation exercises, we explore the impacts of reducing transport costs among Brazilian states, identifying the most relevant links for different economic goals (national growth, production costs and regional inequality). The procedure is similar to the "field of influence" approach in the input-output literature (Hewings et al, 2005). We find that trade among most developed states have impact on national growth and international competitiveness, but can also increase regional inequality.

KEYWORDS: CGE modeling, regional trade, inequality

1. INTRODUCTION

The transformations that currently occur at international level have conditioned changes at national and regional scale. The present technological revolution, along with changes in international division of labor and in the domestic productive structure, has led to changes in the pattern of industrial location in Brazil. As a consequence, it has also led to changes in the structure of interstate trade, mostly associated with movements of concentration and dispersion of various segments of productive chains over the territory (SANTOS, 2002, p. 42).

Few studies have dealt with information regarding interstate trade flows, not only in Brazil but also internationally. Krugman (1991) quoted by Castro *et al.* (1999, p. 4, free translation),

> [...] admits a certain unbalance in interest when compared with the importance given to international economics, for instance. He points out, however, that such negligence with the study of spatial issues in economics has gradually been corrected, given the acknowledgement of the importance of increasing returns in production, especially due to economies of agglomeration, vis-à-vis transportation and distribution costs, as key variables in economic geography. Furthermore, for large countries such as Brazil, the inter-regional distribution of production would be an issue as important as the one of international trade.

According to Haddad (2003, page 9), the specificities of regional economies prevent us from taking them simply as smaller scale versions of national economies. Based on Hirschman's theory, Haddad argues for the importance of specific theories on the process of regional development. According to him, both the spillover effects of growth and the polarization effects are more intense in inter-region economic relations than in international relations, partly due to the closer contact and the stronger interactions which exist within sub-national regions. In this sense, the political forces that contribute to the inter-regional transmission of growth are likely to be stronger than the ones contributing to international transmission of growth (HADDAD, 2003, page 9).

Haddad & Hewings (2007, p. 1) analyze the importance of strategic transportation linkages in the Brazilian inter-regional system, using the "field of influence" approach developed by Hewings et al. (2005). The method of "field of influence" allows capturing the impact of a change in one or more direct coefficients in the Leontief inverse matrix. In particular, it analyzes the incremental changes in the specification of transportation costs. In this case, the contributions of each transportation linkage for specific results were calculated, taking into consideration different dimensions of regional policy (HADDAD, E. & HEWINGS, G., 2007, p. 4 e 6).

Thus, based on GDP growth differentials and on regional welfare, the effects of decreasing transportation costs on regional efficiency and long-run welfare were estimated for the Brazilian macro-regions and for the country as a whole. The economic impacts in different dimensions were analyzed through the use of impact matrices by macro-region. Taking into account the increase in systemic efficiency in the Brazil, the results showed that 28 out of the 30 most influent transportation links are located in the East part of the country, in a region which includes the states of Paraíba, Pernambuco, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina e Rio Grande do Sul. Among these, São Paulo appears as the most important region. Regarding national welfare[1], it can be noted that the majority of the relevant flows has the Northeast region as destination (states of Alagoas, Ceará, Maranhão, Piauí, Rio Grande do Norte), in addition to São Paulo, Goiás e Mato Grosso.

Considering the transportation corridors, Haddad and Hewings (2007) point out to two highways as the most important trade and transportation links within the Brazilian inter-regional system: (i) BR-101, along the coast from Rio Grande do Norte to Rio Grande do Sul; (ii) BR-116, inland from Ceará to Rio Grande do Sul (HADDAD & HEWINGS, 2007, p. 6 e 7).

One could also analyze the most important links for the Brazilian macro-regions in terms of efficiency and regional welfare, based on the impact matrices presented in the paper. For instance, the Northeast, which has been a target for regional development public policies, presents important links to regional efficiency towards the less developed states in the region, such as Alagoas, Ceará, Maranhão, Piauí e Rio Grande do Norte. Many of these flows are originated from the Southeast and South, whereas other flows are intra-regional. Evaluating the regional welfare of the Northeast, on the other hand, we observe that most of the flows are addressed to Paraíba and Pernambuco and are originated from the Southeast and the South. Therefore, there is evidence that inter-regional trade plays an important role for growth and regional welfare in the Northeast.

Thus, the evidence confirms the importance of studying the inter-regional trade in Brazil and its role on regional development. This paper contributes to this field, and aims to capture the

---

[1] The national welfare estimate corresponds to national equivalent variation (HADDAD & HEWINGS, 2007, p. 12).

dimension and importance of trade flows between Brazilian States, in addition to measuring the strongest inter-state connections. Therefore, the paper intends to evaluate which flows (between states or regions) have the greatest impact in terms of efficiency (national growth and production costs), of equity (regional inequality and development), besides considering regional growth. The wide regional heterogeneity of the Brazilian economy is one of the reasons by which this dimension deserves systematic investigation.

In this context, regional methods of analysis which take into account the structural and inter-regional characteristics of the Brazilian economy, in an integrated and consistent way, are needed. Inter-regional computable general equilibrium models (CGE) are able to fulfill this task, and can be used to identify the impacts of inter-regional trade flows on several economic indicators, as the ones described before.

This paper uses a multi-regional Computable General Equilibrium (CGE) model for the Brazilian economy (IMAGEM-B), particularly suitable for the analysis of inter-regional trade flows and their impact on different territorial scales (national, macro-regional, and state, for instance). From such models, the impacts of increasing trade interactions among Brazilian states on growth and regional inequality can be examined.

The paper is divided in four sections, including this introduction, which describes the issues to be discussed and the methodology. The second section presents the CGE model used. The simulations implemented are described in section 3, as well as the interpretation of the results. Lastly, the final section presents some final remarks.

2. THE CGE MODEL[2]

The multi-regional computable general equilibrium model used in this work follows the theoretical structure of the TERM[3] model (Horridge, Madden and Wittwer 2005), calibrated for the

---

[2] This section follows Domingues et. al (2008).

Brazilian economy. TERM is a multi-regional computable general equilibrium model of the Johansen type, in which the mathematical structure is represented by a set of linearized equations and exact solutions of the underlying levels equations are obtained in the form of deviations from an initial solution. There are other works on the Brazilian economy in the same modeling tradition, such as Guilhoto (1995), Haddad (1999, 2004), Haddad and Domingues (2001), Domingues (2002), Ferreira Filho and Horridge (2006) and Haddad and Hewings (2005). The TERM model derives from the continuous development of the ORANI model (Dixon, Parmenter, Sutton *et al*. 1982) and of its present generic version, ORANI-G (Horridge, 2000).

TERM is a multi-regional "bottom-up" model, in which region-specific economic activity is modeled in its own right, and national results are aggregations of regional results. The model's theoretical structure contains region-specific technology, tax and resource supply variables, thus allowing us to simulate those aspects of the PPA that generate impacts on region-specifc prices via supply-side shocks. This proves important in modeling project sets (4), (5), and (7) to (10). TERM contains explicit modeling of inter-regional linkages via commodity-specific trade flows and factor-specific resource flows. An important and specific characteristic of TERM is its ability to deal with regionally differentiated transportation and commercialization margins. This specificity allows policies designed to improve transportation infrastructure, for example, to be thoroughly specified. This feature of the model proves important in modeling project sets (8) and (9). The version of TERM used in this paper is named IMAGEM-B (Integrated Multi-Regional Applied General Equilibrium Model for Brazil)[4]. IMAGEM-B departs from the standard TERM structure in two ways. First, it has an integrated bottom-up and top-down structure: bottom-up for Brazil's 27 states, and top-down for Brazil's 5507 municipalities. Second, it contains inter-regional sourcing twists to facilitate modeling of region-specific projects within TERM's compact data handling assumptions.

---

[3] An acronym for The Enormous Regional Model.

[4] IMAGEM-B retains the notation of its parent model, TERM, available at www.monash.edu.au/policy/term.htm.

An important feature of the IMAGEM-B model, one that distinguishes it from regional models based on the Monash-MRF framework (Adams, Horridge and Parmenter 2000), is its computational capacity to work with a large number of regions and sectors. This feature derives from the compact structure of the TERM database and from simplifying hypotheses in modeling multi-regional trade. The model assumes that all the users – say, of industrial goods – in a particular region, purchase from the various regions in fixed proportions. This eliminates the computational burden of data and theory relating to commodity-specific inter-regional trade flows to specific users within regions. This compact treatment is typical of CGE models with an international trade focus[5]. For Brazil, the compact treatment is not particularly limiting given that data to specify a more detailed multi-regional transactions table is not available. For instance, Brazilian interstate trade tables by sector (Vasconcelos and Oliveira, 2006) are available, but not information on destination by use in the purchasing regions. That is, available transaction tables register the total aggregate flows (for all uses in the destination) of goods and services among Brazilian states. This information is enough to calibrate a multi-regional model such as IMAGEM-B. Additional details about IMAGEM-B database construction can be found in Horridge, Madden and Wittwer (2005) and Domingues, Viana and Oliveira (2007) for the Brazilian model.

In the next subsection, we expand on relevant features of the model's theoretical structure.

Mechanism of composition of the regional demands by origin

Figure 1 illustrates the composition of commodity demands by origin in the IMAGEM-B model. The figure uses food demand by households of the "North" region as an example, however the diagram is generalizable to other commodities and region-specific users. Figure 1 is comprised of four levels. In the first level (I) the regional household chooses between domestic and imported (that is, foreign) food. This choice is described by a CES specification. The elasticity of substitution between the domestic and imported commodity is σ_X. This parameter is typically different for each

---

[5] See for example Hertel (1997)

commodity, but common across users and regions. Demands for domestic food in a region are aggregated (across all users) in order to determine total regional demand for domestic food.

Level II governs the sourcing of domestic food by the region in question. Again, a CES specification is used to implement imperfect substitution across domestic sources of each commodity. The CES specification implies that regions with falling relative food production costs will increase their share of the food market in all regions in which food is demanded. Indeed, substitution is based upon relative *delivered* prices, which include trade and transportation margins, in addition to production costs. Hence, even when production costs are unchanged, movements in transportation costs will affect regional market shares. Note that variables at this level do not have a user dimension – the decision is made taking into account all the users (as if wholesale stores, and not final users, decide the origin of the food imported from other regions).

Level III shows how food from any given region (say, South) delivered in North is comprised of the basic value of the good and the trade, road and railway and other margins required to get the good from South to North. The participation of each component of the delivered good is governed by a fixed proportions function. That is, we assume that delivery of a unit of each good requires fixed amounts of trade, transport and other margins. The share of each margin in the deliver price is a given by combination between origin, destination, good and source. For example, the share of transportation costs in the deliver price is expected to be high for transactions between two distant regions, and also in the case of goods with significant participation of transportation costs in its price.

The final part of the substitution hierarchy (IV) governs the supply of margins on the trade in food from South to North. Note that the theory allows for margin services to be supplied by agents not only in South and North, but also in other regions. Margin supply by other regions becomes relevant when South and North are not contiguous. A similar mechanism governs the supply of margins facilitating import flows to using regions. In the case of imports, origin is traced back to the port of entry, with the model theory allowing for potential margin supply by the port region, the using region, and all intervening regions.

Sectoral Production Technology

Each regional sector can produce more than one good, using domestic and imported inputs, labor and capital. To reduce the number of free parameters required to specify industry-specific production functions, we employ the separability hypotheses and use a generic production structure applied to each industry. The production function of a given sector is composed of two blocks. The first governs the commodity composition of each sector's output, and the second governs the input-composition of each sector's material and factor usage. The two blocks are connected by sectoral activity.

Households

There is a set of representative families in each region, who consume domestic goods (from different regions in the national economy) and imported goods. The families' demand specification is based on a combined system of preferences CES/Klein-Rubin. The demand equations are derived from a utility maximization problem, whose solution follows hierarchized steps. At the first level there is a CES substitution between domestic and imported goods. At the next level there is a Klein-Rubin aggregation of the composed goods; thus the utility derived from consumption is maximized according to this utility function. Such specification leads to the linear expenditure system (LES), in which the participation of expenditures above the subsistence level for each good represents a constant share of total subsistence expenditure for each family.

Investment Demand

"Investors" are a category of use of final demand, responsible for the production of new capital units (gross fixed capital formation). They choose the inputs to be used in the process of capital formation through a process of cost minimization subject to a hierarchized technology structure. This technology is similar to the production technology, but with some adaptations. As in the production technology, the capital goods is produced using domestic and imported inputs. At the first level, a CES function is used in the combination of domestic and imported goods. At the second level, an aggregate of the set of intermediate composed inputs is formed by combination in fixed proportions (Leontief), which defines the level of capital production in the sector. No primary factor is directly used as input in capital formation.

There are three possible model configurations for comparative statics exercises, which assume different hypotheses about investment behavior. The alternative to be chosen in the simulation will depend on the characteristics of the experiment, such as time frame (short or long-run) and capital mobility.

The use of the model for comparative statics implies that there is no fixed relation between capital and investment, this relation being chosen according to specific simulation requirements. For instance, in typical long-run comparative statics simulations, it is assumed that the growth rates of investment and capital are identical (see Peter, Horridge, Meagher *et al.* (1996)).

Exports Demand, government and inventories

In a model where the Rest of the World is exogenous, the usual hypothesis is to define negatively sloped demand curves on the very prices of world markets. In the IMAGEM-B, a vector of elasticities (different by product, but not by region of origin) represents the external demand response to changes in the FOB prices of exports. Shifting terms for prices and export demand allow for shocks on the demand curves.

The export demand functions represent the outflow of composed goods that leave the country through a given region (port). Since the same specification of demand composition by origin applies to exports, the model can capture transportation costs of, for instance, goods from Minas Gerais being exported via the port of Vitoria (Espírito Santo). This particular characteristic of the model allows to distinguish the region producing the exported good from its point (region) of export. It is worth noting that this kind of information (volume of state exports leaving the country through a specific port of exit) is available for Brazil, in SECEX (Secretary of Foreign Trade), and it was used for calibrating the model.

The demand from the regional government in the model represents the sum of demands from the three levels of administration (federal, state, and municipal). Government's demand is not explicitly modeled, and it can follow either the regional income or an exogenous scenario. The model has shifting terms which allow for variations in specific components of government demand (by good or by region), accommodating specific expenditures associated with different macroeconomic scenarios. Finally, the change in inventories is linked to the level of production of the regional sector.

Labor Markets

We employ different labour market closures in short-run and long-run simulations. In the standard "short-run" configuration, regional wages are indexed to the regional consumption price index, with regional employment endogenous. In the usual "long-run" configuration, national employment is exogenous, requiring the national real wage to be endogenous. Regional employment is endogenous, under an assumption of fixed or sticky regional wage differentials.

Market equilibrium, demand for margins and buying prices

The model works with market equilibrium equations for all the goods locally consumed, both domestic and imported. The buying prices for each of the use groups (producers, investors, families, exporters, and government) are given by the sum of basic values, sales taxes (direct and indirect) and margins (trade and transportation). Sales taxes are treated as *ad valorem* taxes on the basic flows. There is market equilibrium for all the goods, both domestic and imported, as well as in the factor (capital and labor) markets in each region. Demands for margins (trade and transportation) are proportional to the flows of goods to which the margins are related.

IMAGEM-B is a CGE model for Brazil which implements the possibility of change between modals (uses of transportation margins). In the current version, there is a possibility of substitution between road and railway transportation margins. The substitution between the road modal and the railway modal follows the CES specification, as in the substitution between domestic and imported goods. Thus, a decrease in railway transportation prices in relation to road transportation leads to a substitution in the margin toward the cheapest modal.

Database and parameters

The model's database presents two sets of representative matrices of the use of goods in each state and of the trade flows. USE represents the relations of use of goods (domestic and imported) for 40 users in each of the 27 Brazilian states: 36 sectors and 4 final users (families, investment, exports, government). The set TRADE represents the trade flows between states for each of the 36 goods in the model, in both origins (domestic and imported). In this set, the domestic origin-destination flow of a given good represents the monetary flow between two states, for all the uses in the state of origin, including exports.

A large set of primary information was used to build these two datasets. The primary data come from the complete accounts of the 2003 national input-output table Guilhoto and Sesso Filho (2005)[Guilhoto and Sesso Filho (2005)]. These data have been aggregated in 31 sectors. The original Public Services and Transports sectors have been disaggregated in this national table by using coefficients of use, sales and production, from various sources.

The primary information for the construction of the trade matrices is the data on interstate trade from 1999 published by Vasconcelos and Oliveira (2006). These data had to be adjusted so that all the states were represented in the matrices (the original datum do not present information for 5 states).

A distinction of the IMAGEM-B model is the specification of 4 transportation margins, which capture the main transportation modals: road, railway, airway, and others (basically, ductway and hydroway). The model specification allow for substitution between transportation modals, which is a significant development in transportation modeling using general equilibrium models. Furthermore, the margins can be produced by the respective modal sectors both in the state of origin and in the destination, which is closer to economic reality (usually, CGE models consider margins being produced at the region of origin). The calibration of transportation margins was made according to information from the interstate trade flows matrices, described above, and specific data on freight and intermodal uses for Brazil.

The final database also contains a further, sub-regional, disaggregation into 5507 municipalities. For example, there are 854 municipalities in Minas Gerais. The only additional regional data consists of a 36*5507 matrix showing how sectoral output is divided among municipalities. This allows for a useful system of “top-down” modeling – which is not too computationally costly. [6] The top-down results will not be used in this paper.

3. SIMULATIONS AND RESULTS

3.1 DATABASE AND SIMULATIONS

---

[6] For example, there is no explicit modeling of trade within states. Even it were possible to build a fully detailed database with 5507 regions, such a huge and detailed model would take days or weeks to solve.

The simulations implemented in this paper aim to capture the importance of trade flows between Brazilian states[7], under the perspective of efficiency and equity. The simulations represent a reduction of 1% in transportation margins[8] for each pair origin-destination of interstate trade flows. The goal is to determine the strongest interstate trade connections using the impact of each flow in terms of efficiency (national economic growth), equity (regional inequality) and growth in the poorest regions, particularly the Northeast of Brazil.

For the interstate trade flows of agricultural and industrial goods, we run simulations which resulted in specific impacts, for all the endogenous variables in the model. Overall, there were 702 connections (27x27 – 27) for each interstate origin-destination link, since intra-state flows were not considered. As mentioned before, the research will focus specifically on the impacts on variables related to growth, efficiency and regional inequality.

The simulations were implemented in the IMAGEM-B model with a short-run comparative statics closure[9]. The assumptions used in this closure follow the standard literature on computable general equilibrium models, with some adjustments for the Brazilian case, as follows:

i. Factor markets: fixed supply of capital and land (nationally, regionally and among sectors) for all the sectors.

ii. Factor markets: regional and national employment is endogenous (responds to changes in regional real wage.

iii. Regional real wage is fixed (nominal wage in indexed to CPI).

---

[7] The domestic flow origin-destination also includes the exports until the exit region. Thus, for instance, the exports of siderurgical products from Minas Gerais, which leave from the port of Tubarão (in the state of Espírito Santo), are also represented in the flow from Minas Gerais to Espírito Santo.

[8] We define as margins the distribution and transportation services required to facilitate trade flows, representing transference costs in a broad sense (Haddad, E. 2004, p. 70). The variable used for the shock was ATRADMAR, which refers to technical change in the use of margins, and appears in the theoretical specification of the IMAGEM-B model.

[9] The model closure represents considerations on the operating hypothesis of the model, associated with the hypothetical time horizon of the simulations, related to the amount of time needed for the change in endogenous variables towards a new equilibrium. Take, for instance, the adjustment in the markets for primary production factors, labor and capital. The closures can be for short-run and long-run. The main difference between the two closures relates to the adjustment in the capital stock and in the mobility of labor. In the short run, the capital stock is given, whereas in the long run capital and labor can move between sectors and between regions. On CGE model closures, see Dixon, et al. (1982); Dixon e Parmenter (1996).

iv. Real consumption adjusts endogenously and depends upon disposable income.

v. External trade balance as a share of GDP is endogenous.

vi. Real government spending is exogenous.

In this sense, the following simulation results were selected, in order to verify the impacts of interstate changes in the economic system:

i. Short-run overall GDP growth, to capture national efficiency.

ii. Short-run variation in the GINI coefficient, in order to examine the impacts on development and regional inequality.

iii. Short-run GDP growth in the Northeast, to analyze the interactions for this specific region and to evaluate the perspectives for development in the region.

An overview of the causality mechanisms in the simulations, which is useful for the interpretation of the results, can be seen in figures 2 and 3. Figure 2 describes the main implications of the decline in transportation costs in the destination region d (importing), whereas figure 2 summarizes the effects in the origin region r (exporting).

Thus, according to the model structure, a reduction in transportation margins from region r to region d brings about a decline in the prices of goods from r to d, with implications for the production costs in d, export prices and also on the real regional income. In this process of simultaneous adjustment, the decline in prices acts in several fronts. One of these refers to the reduction of production costs in sectors from region d, which makes these sectors more competitive and, in turn, leads to increasing production and supply to other regions, including external markets and region r itself. However, such increase in supply may lead to higher demand for inputs and primary production factors (labor can move between sectors in the short run), which ends up causing an increase in the price of goods in region d. Consequently, such increase in prices triggers second-order effects (probably weaker) which retro-feeds the system.

In sum, the net effect of these direct and indirect causalities will be given by the intensity of the various forces in the system, by the characteristics and degree of integration of interstate trade and also by the structure of the regions. Another important effect is obtained in the reduction of export prices that reflect, broadly, the so-called "Custo Brasil", ie, Brazilian exports becomes more competitive due to the reductions in the internal transports costs. Furthermore, there is a change in the regional composition of families' consumption, due to an increase in real income in region d, caused by the decline in prices, which causes a direct increase in consumption in the region d, along with changes in its composition (increase in the share of goods from regions r and d).

Some indirect effects should also be noted, such as the substitution effect in region r. In this case, higher production and sales of goods to region d require higher amounts of inputs in region r, which will be sold at lower prices, given the decline in production costs in other regions. Consequently, an increase in production and sales in region r may occur, which will benefit this region.

Such increase in sales (figure 3), on one hand, increases economic activity in sectors from region r and it also raises labor demand. This effect, in turn, may bring about an increase in the production costs in the region. In addition, there is another adjustment related to reduction in the level of activity in the transportation sector in the place where the margins are produced. In the model used here, the margins can be produced by the sectors of highway transportation margins both in the origin and in the destination region, in different proportions, which is a realistic assumption[10]. In general, however, in the calibration of the model's database, the larger portion of margins in an origin-destination flow is produced in the origin region r. Consequently, this is the region where there is the larger decline of production in the transportation sector. This decline, in turn, causes an excess supply of primary factors due to the release of workers to other sectors of the economy. This brings about a decline in the price of factors via a downward pressure on wages, which then lowers

---

[10] Na grande maioria dos modelos inter-regionais de equilíbrio geral computável, as margens são produzidas em sua totalidade na região de origem.

production costs. Thus, the net effect of opposite forces of increase and decrease in the demand for primary factors may result in rise or decline in the level of economic activity in region r.

In order to have a better understanding of the results, a descriptive analysis of the model's database is needed, particularly on the information regarding each state's balance in regional trade, and the magnitude and direction of transportation flows and margins. It's worth noting that the trade flow analyzed in this paper consists of the aggregation of all sectors in the model (agricultural sector, 25 industrial sectors and 10 services sectors).

Thus, a detailed understanding of the causality mechanisms needs to consider the intensity of trade flows between regions. Table 1 and Map 1 presents the total balance in Brazilian interstate trade, in 2003 – base-year of the model. The table shows that 10 states were in surplus in 2003. In the North region, only Amazonas was a net exporter in interstate trade. The states of Acre and Amapá are also interesting cases in the region, since – due to the small size of the state's economy – the negative trade balance exceeds GDP.

In the Northeast, the states of Sergipe and Bahia are the only ones presenting a positive balance in domestic trade. Maranhão, on the other hand, shows the highest dependence on interstate trade, since it is the state with the highest deficit as a proportion of GDP.

Minas Gerais and São Paulo, in turn, appear as net exporters in the Southeast, whereas Rio de Janeiro and Espírito Santo present negative trade balance. The latter state, in particular, has a high trade deficit in proportion to GDP. In the South and Center-West, on the other hand, the states with interstate trade deficits are Rio Grande do Sul and Distrito Federal.

One could argue that net importers, i.e. states with negative balances in interstate trade, tend to benefit from a reduction in transportation costs, since they gain competitive advantages associated with lower production costs. Furthermore, they tend to accrue welfare gains due to the increase in real income and in private consumption. On the other hand, the net exporters would benefit by the increase in production and sales to other states.

In order to complement this descriptive analysis, figures 4 and 5 present the share of interstate domestic trade in purchases per state and in GDP of the state of origin, respectively. The intra-state flows are usually the most important component in domestic trade (figure 4)[11], but the data shows that such component is smaller in less developed states, such as Tocantins and Amapá, which suggests a stronger dependence on inter-regional trade. The intra-state flows, although important, are not considered in the simulations, otherwise they would be dominant in the results and the role of interstate flows would not be captured.

São Paulo and Rio de Janeiro are the most relevant states regarding the share in purchases per state. Minas Gerais and Rio Grande do Sul also present significant proportion in domestic purchases. Equivalently, when the share of domestic trade in the origin state's GDP is concerned (figure 5), São Paulo and Rio de Janeiro have the most intense flows with the other states of Brazil.

Given the results of these matrices, one could initially presume that the most significant flows would bring about the highest impacts in national GDP growth. However, the simulations can indicate different patterns, represented for instance by other flows responsible for the increase in overall efficiency, but without much weight in the trade matrices. In this context, there are other determinants which influence the impacts of commerce flows on national economic growth and which depend on the structure and parameterization of the CGE model: the size of transportation margins (transport infrastructure), the elasticities of substitution in domestic trade, the simulation closures (determination of endogenous and exogenous variables, which determines factor mobility), and the structure of the state economies (shares in the sectors and in the state economy). Such elements of analysis are not taken into account merely by looking at trade flows, or even by using partial equilibrium models.

Figure 6 summarizes the distribution in the use of margins among states for the agricultural and industrial sectors (the use of transportation margins in commerce and services is null). The most

---

[11] It is important to stress that intra-state flows have not been considered in the simulations.

significant margins, above average, are shown in grey. This mapping of the margins is needed since the simulation shocks (reduction in 1% for each pair origin-destination) impact upon them. The calibration of the transportation margins was done by following information from the interstate trade matrix and also according to specific data on inter-mode freights and uses for Brazil (CEDEPLAR, 2007). It is worth noting that the matrix of margins on domestic flows is not symmetrical, suggesting that the margins have different weights according to the direction of the flows. For instance, in the flows between the North and Northeast regions the margins are significantly higher than the ones in the South and Southeast regions. The margins are also high in flows between the North or Northeast regions and specific states such as Espírito Santo. Several factors may cause this result, such as the specific flow which occurs and the mode of transportation which is used.

3.2 RESULTS

The results of the simulations are presented below. The shocks implemented represent reductions of 1% in the origin-destination transportation margin of inland trade, considering the short-run closure. In the short run, the capital stock is fixed (by sector and by region) and labor responds endogenously but it is not able to move inter-regionally. Since the focus here is a comparative analysis of the most relevant flows for some chosen variables, we opted for the elaboration of matrices of results. The matrices that follow present the most relevant trade links, for each policy dimension approached, sorted by state and by macro-region. Relevance is defined according to the impact of the respective origin-destination link on the variable under analysis. Therefore, the matrices represent a set of simulations of decline in domestic transportation costs, in which the most significant results were stressed according to the criteria which defines best a standard for the results[12] (due to small values of impact in percentage terms, the numbers were multiplied by an order of potency for better viewing). Moreover, the most relevant impacts to each pair of origin-destination were ordered by their magnitude, based on standard deviations for a better interpretation of results).

The following figures illustrate the most relevant trade flows for the economic dimensions discussed in this paper, based on the simulation results: national GDP growth, regional inequality and GDP growth in the Northeast region. Figure 7 indicates the most significant (above average) trade flows for national GDP growth. In order to get a dimension of the aggregate impact, that is, the one which considers reductions in transportation margins altogether, for all pairs of origin and destination, we can calculate an impact multiplier effect.

Regarding the most significant interactions which influence GDP growth, it is clear that they are spatially concentrated in the center-south portion of Brazil. In particular, the trade links from the South region to the Southeast region are the most relevant, as seen in the trade matrix. More specifically, the greatest impact on GDP growth comes from the trade links between Minas Gerais and São Paulo. There are also important flows originated from the Center-West, North and Northeast regions, particularly from the state of Bahia, towards the Southeast region.

This result can be interpreted according to the mechanisms shown in figures 2 and 3, since net export regions such as the South and the Center-West may benefit via expansion of production and sales, whereas regions with negative interstate trade balances accrue gains in terms of competitiveness and increases in real private consumption (due to lower prices of imported goods from other regions).

Other links should also be stressed, such as the ones associated with the trade flows of São Paulo. There are potential impacts in the links with states in the North region (Rondônia, Amazonas,

---

[12] For the matrices which represent the most relevant flows for national GDP growth and for GDP growth in the Northeast region, above-average impacts were selected. In turn, for the matrices which show the most important flows for reduction and increase in regional inequality, the criteria was based on the 15% lower and 15% higher impacts, respectively.

Pará), and in the Northeast (Maranhão, Ceará, Pernambuco and Bahia, for instance). By the way, the latter state is the most important in the Northeast and it has relevant links within its own region and the Southeast in terms of economic efficiency.

With respect to the issue of regional equity, figures 8 and 9 show the most important flows in terms of their impacts on inequality[13]. The analysis of the Gini coefficient is peculiar, because it considers the state distribution of GDP. In general, it is expected that stronger impacts on less developed states may cause a decline in the Gini coefficient (reduction in inequality), whereas greater impacts on wealthier regions may increase inequality. However, there may be cases in which the increase in GDP in a state with small participation would generate (negative) competitive effects on even poorer states, which may increase regional disparity.

In this sense, there is a greater dispersion of the most relevant flows for the reduction of regional inequality (figure 8). These include flows originating from the North, Northeast, South and Center-West, mostly towards the South and Southeast regions. The greatest impact, however, is located within the Southeast region, in the flow originated in the state of Espírito Santo towards the state of São Paulo. Still regarding the reduction of regional inequality, there are also important impacts in the flows originated in Rio Grande do Sul towards states in the Northeast region. By the way, there are also relevant intra-regional flows for the reduction of inequality in the Northeast, especially towards the states of Pernambuco and Bahia. Flows to the states of Amazonas and Pará also contribute to that policy goal.

Figure 9, on the other hand, illustrates the most relevant trade flows for the increase in inequality, which are mainly originated in the South and Southeast and have the Northeast as

---

[13] The criteria for choice of the most relevant impacts for reducing regional inequality, able to generate a visible pattern in the results, was to choose the 15% lowest (negative variations in the Gini coefficient). Regarding the matrix of increasing inequality, in turn, the 15% highest impacts were chosen (positive variations in the Gini coefficient). The Gini coefficient was based on variations in state GDP obtained through short-run simulations. The first step was to calculate the Gini coefficient for the distribution of state GDP before the shock (state GDP from the basic database), using the STATA software. Next, with the variations obtained after the shock, one can get a new distribution of state GDP and then calculate the index for each interstate link. After such calculations, one can compare the Gini coefficients before and after the shock, in order to find the variations in the coefficient.

destination. The most representative flow for the increase in regional inequality is the one between Pará and Maranhão. Considering all the distribution of GDP among states, this result may probably me associated with the fact that an increase in GDP of a less developed state, for instance, has generated competitive effects in poorer states, which increased the gap between them and worsened the overall GDP distribution.

The simulations also allow us to study the interactions in specific regions, such as the Northeast region in Brazil. An interesting discussion about the Northeast is the issue regarding the development prospects of the region based on greater integration of the Northeastern states themselves – in this case, via intra-regional trade – in comparison with the integration with the other regions, particularly the Southeast, which presents significant trade flows with the region. Despite these regional issues, figure 10 shows the most relevant flows for the growth of GDP in the Northeast and, in turn, based in such results, it is measured the importance of intra-regional integration or the interdependence with the other regions in Brazil.

Regarding the growth of regional GDP in the Northeast, it is important to stress that the improving trade accessibility to the Northeast has potential impacts on economic growth in the region, particularly considering trade flows from states in the Southeast (São Paulo and Minas Gerais) and in the South (Paraná, Santa Catarina and Rio Grande do Sul). This result is confirmed when one analyzes the magnitude of impact from these regions. The impacts on GDP growth in the Northeast, due to flows originated in the Southeast and South, correspond respectively to 55% and 21% of the most relevant flows in the matrix. In contrast, only 26% of the greatest impacts refer to intra-regional flows within the Northeast.

In sum, considering all the sectors and all transportation modes, we can infer that integration with the other regions, particularly South and Southeast, plays an important role on the growth prospects of the Northeast, even though the relevance of within-region integration via intra-regional trade may not be discarded.

4. FINAL REMARKS

This paper discussed the importance of domestic trade flows between Brazilian states with respect to economic policy issues (growth and regional inequality), using simulations in the multi-regional computable general equilibrium model IMAGEM-B.

Thus, this work contributes to a systematic analysis of Brazilian interstate trade using recent data. From the analysis of aggregate potential effects, we could notice the great relevance of improving accessibility and integration of domestic markets for the efficiency of the economic system and for regional equity. However, the results suggest that such effects vary across the national territory.

According to this perspective, some issues may be stressed, in order to summarize the results presented in this paper. The standard result regarding the main trade links, in terms of efficiency, shows the predominance of flows associated with the main polarizing regions in Brazil, i.e. South and Southeast, what constitutes a center-periphery relationship. These results confirm empirical evidence found in previous studies [Galvão (1993), (Castro (1999), Haddad & Perobelli (2002)]. The results show the concentrating role of trade flows, both due to concentration in the most developed region in the country, and due to the dependence of the less developed regions.

This is what Haddad (2004, p. 169) calls “spatial trap”, polarized by São Paulo, the most important region in Brazil. This center of gravity, formed by the state of São Paulo and its surroundings, has a strong influence on the spatial and economic structure of Brazil, and works as a convergence point due to better market accessibility, generating the greatest impacts in terms of efficiency.

Regarding the impacts of trade on regional inequality, there seems to be a trade-off between growth and reducing inequality for many of the flows, which confirms the heterogeneity of trade integration, which affects differently the various regions in Brazil.

With respect to the most relevant flows for reducing inequality, the results show that regional inequality is reduced with improved access to markets in the South and Southeast regions, particularly for flows from the North, Northeast and Center-West regions, in this order. Considering the impacts on growth in the Northeast, the results suggest that although the importance of intra-regional integration is not negligible (large intra-regional flows), trade with South and Southeast regions of the country may have a greater role for the growth of the region. This result strengthens the regional inter-dependence of the Northeast, probably because of more intense effects of leaks and / or regional spillovers.

It is important to stress that the results are part of a counterfactual analysis, which is a structural limitation of comparative statics CGE model. Therefore, the results obtained are based on a given structure of the economy being analyzed, for the base-year 2003, not considering other structural changes or future economic events.

Given this caveat, the goal of this paper was to contribute to a better understanding of the behavior and the importance of domestic trade flows and, consequently, of integration of the Brazilian domestic market for national economic development.

Also, it aimed to contribute in the presentation of the multi-regional CGE model IMAGEM-B, which brings in detailed analysis in sectoral and municipal aspects and transportation modes, and is especially suited for the analysis of specific regional policies. The model contributes to the literature by building an “empirical” trade matrix, by using new regional trade elasticities estimates, and by allowing the municipal decomposition of the main results.

Figure 1. Demand composition mechanism in the IMAGEM-B model

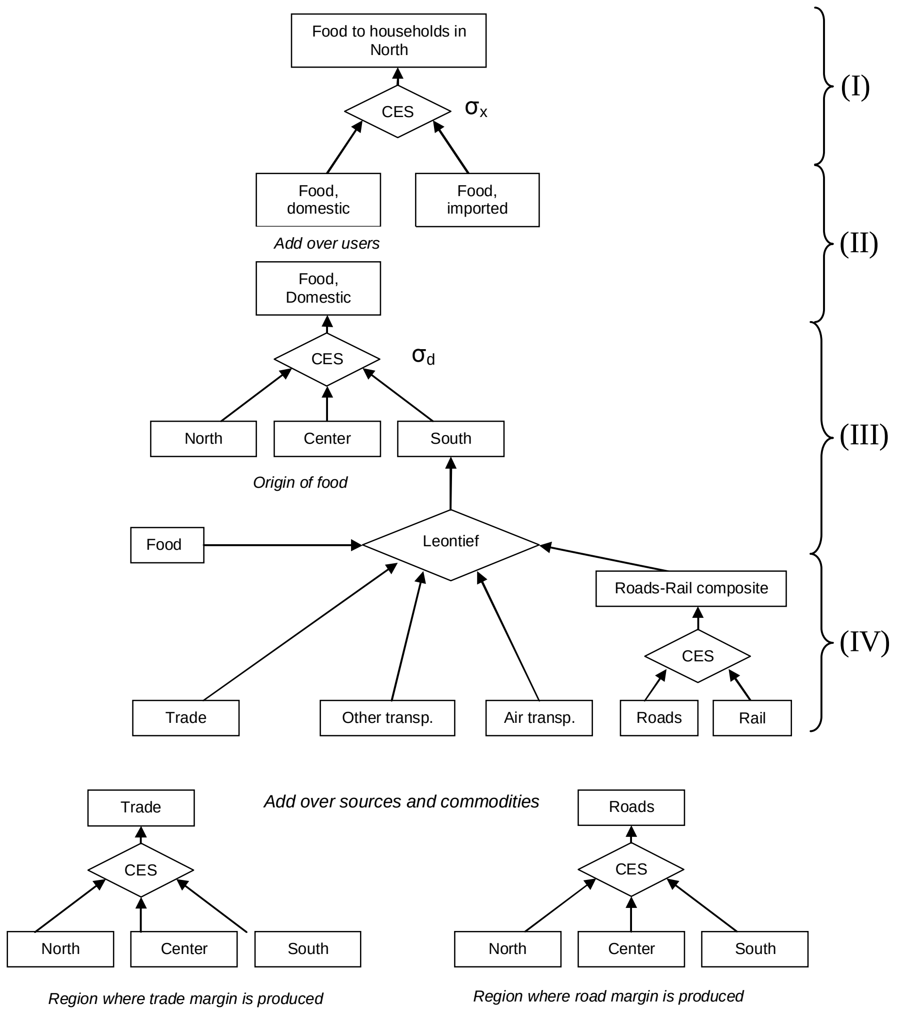
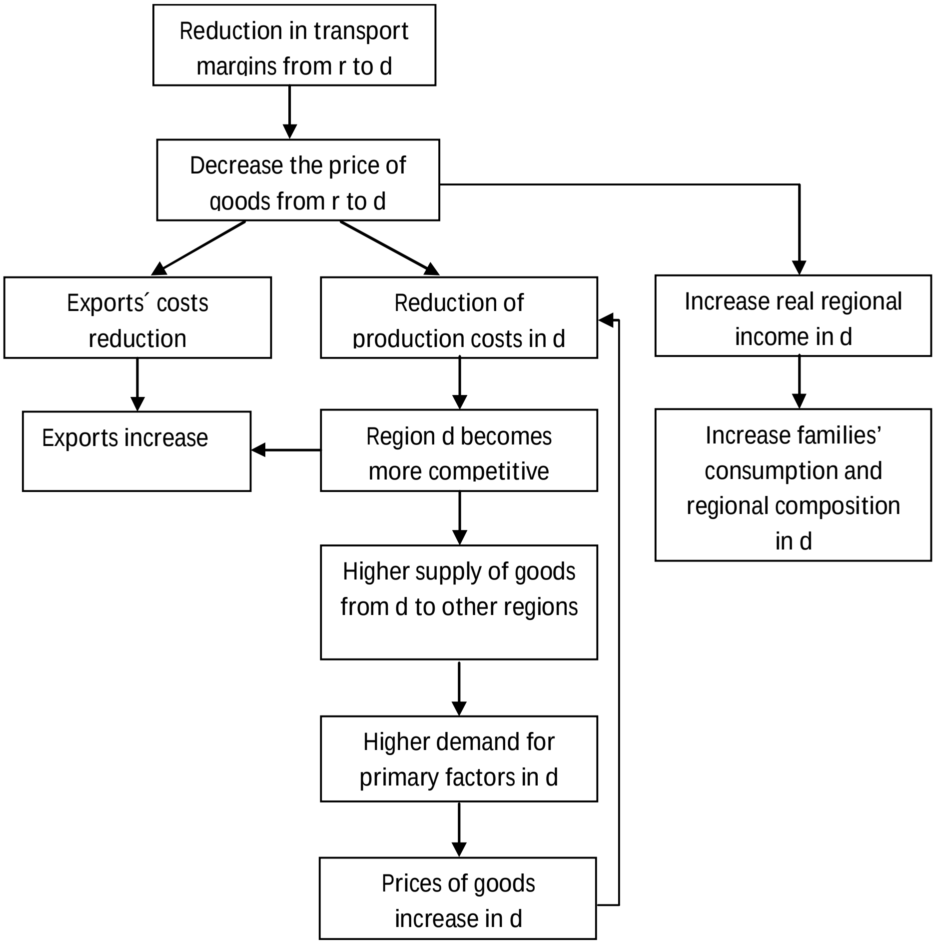
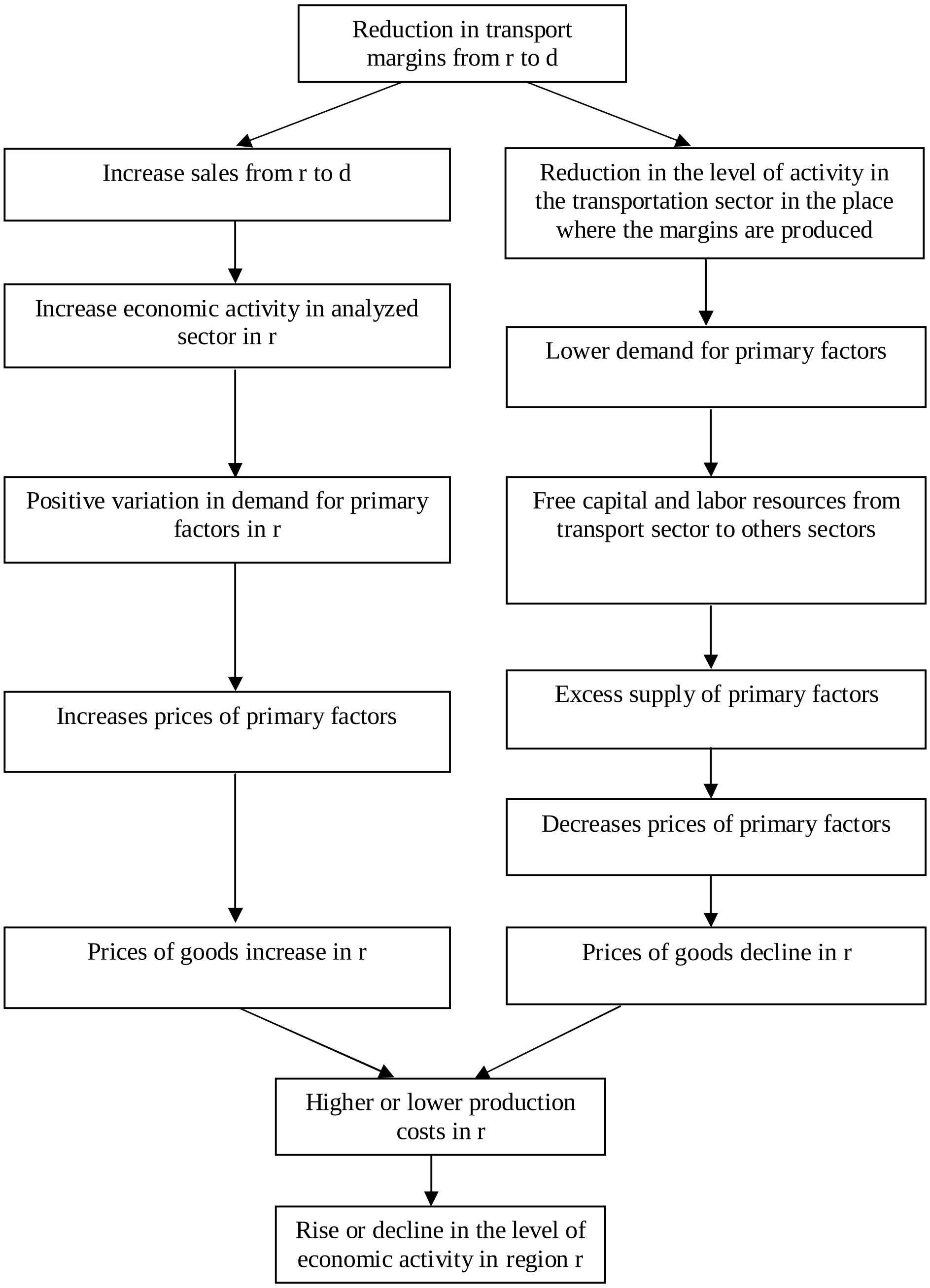


Figure 2 - Interpretation of the effects of reducing in transportation costs in the destination region (d)



Source: Author's elaboration based in Haddad (2004).

Figure 3 - Interpretation of the effects of reducing in transportation costs in the source region (r)



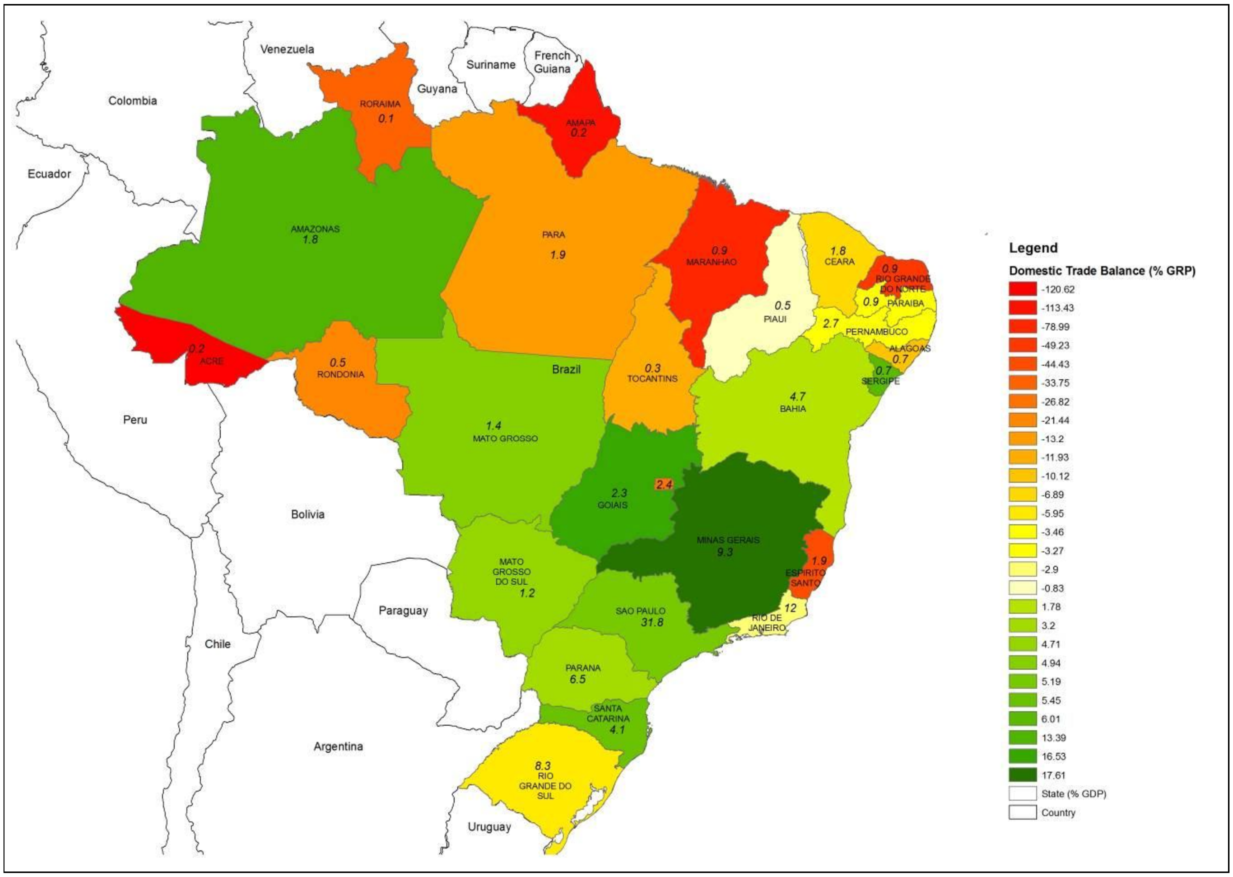
Source: Author's elaboration based in Haddad (2004).

Table 1 - Trade balance and Gross Regional Product (GRP) in Brazil, 2003

Region (% on national GDP)	State		State Share (% national GDP)	Regional Trade Balance (% state GRP)
North	RO	Rondonia	0.5	-21.4
5.0	AC	Acre	0.2	-120.6
	AM	Amazonas	1.8	13.4
	RR	Roraima	0.1	-33.8
	PA	Para	1.9	-13.2
	AP	Amapa	0.2	-113.4
	TO	Tocantins	0.3	-11.9
Northeast	MA	Maranhao	0.9	-79.0
13.8	PI	Piaui	0.5	-0.8
	CE	Ceara	1.8	-6.9
	RN	Rio Grande do Norte	0.9	-49.2
	PB	Paraiba	0.9	-3.3
	PE	Pernambuco	2.7	-3.5
	AL	Alagoas	0.7	-10.1
	SE	Sergipe	0.7	6.0
	BA	Bahia	4.7	1.8
Southeast	MG	Minas Gerais	9.3	17.6
55.0	ES	Espirito Santo	1.9	-44.4
	RJ	Rio de Janeiro	12.0	-2.9
	SP	Sao Paulo	31.8	5.2
South	PR	Parana	6.5	3.2
18.9	SC	santa Catarina	4.1	5.5
	RS	Rio Grande do Sul	8.3	-6.0
Center-West	MS	Mato Grosso do Sul	1.2	4.7
7.3	MT	Mato Grosso	1.4	4.9
	GO	Goias	2.3	16.5
	DF	Distrito Federal	2.4	-26.8

Source: IMAGEM-B database.

Map 1 - Trade balance and Gross Regional Product (GRP) in Brazil, 2003



Source: IMAGEM-B database.

Figure 4 - Brazilian interstate trade (% purchases by source)

		Destination																									
		RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
Origin	RO	47,9	1,9	0,5	0,5	0,0	0,1	0,1	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,1	0,0	0,2	0,2	0,1	0,3	0,2	0,1	0,1	0,1	0,9	0,1	0,6
	AC	1,3	44,4	0,1	0,1	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0
	AM	2,5	1,4	59,2	5,4	1,6	0,4	0,7	2,1	0,5	0,8	0,3	0,5	0,4	0,4	0,7	0,5	0,3	0,4	0,3	1,4	0,4	0,4	0,4	0,5	1,4	0,8	0,4
	RR	0,3	0,2	0,3	46,9	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0
	PA	0,3	0,5	1,0	0,2	56,8	3,0	1,6	5,6	2,3	1,7	1,1	0,8	0,8	10,2	2,2	0,7	0,5	0,5	0,5	0,3	1,7	0,1	0,5	0,1	0,2	0,6	0,6
	AP	0,0	0,0	0,1	0,0	0,1	41,9	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,0	0,1	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	TO	0,0	0,3	0,1	0,1	0,2	0,1	22,1	1,1	0,2	0,1	0,1	0,0	0,2	0,1	0,2	0,0	0,1	0,0	0,1	0,1	0,1	0,1	0,3	0,1	0,2	1,9	0,4
	MA	0,6	0,3	0,1	0,1	1,4	1,1	0,5	49,0	2,5	0,3	0,3	0,3	0,2	0,6	0,7	0,2	0,1	0,1	0,1	0,2	0,1	0,1	0,1	0,1	0,2	0,3	0,1
	PI	0,1	0,2	0,1	0,2	0,3	1,2	0,4	3,2	59,1	2,5	0,3	0,2	0,1	0,5	0,6	0,1	0,2	0,1	0,2	0,1	0,0	0,0	0,1	0,0	0,1	0,1	0,1
	CE	0,7	1,3	0,4	0,9	1,0	3,1	1,9	3,0	4,9	64,1	6,5	2,6	1,4	1,4	1,2	0,7	0,3	0,2	0,3	0,5	0,2	0,2	0,3	0,4	0,4	0,3	1,5
	RN	0,1	0,1	0,0	0,0	0,2	0,1	0,1	0,3	0,2	0,9	52,8	3,1	1,5	0,3	0,2	0,2	0,1	0,0	0,6	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,1
	PB	0,3	0,6	0,1	0,1	0,1	0,6	0,3	0,2	0,3	0,9	1,6	53,5	2,3	0,5	0,3	0,3	0,3	0,2	0,3	0,3	0,2	0,2	0,2	0,0	0,1	0,2	0,2
	PE	0,7	1,7	0,9	0,8	2,1	3,6	0,9	2,2	2,7	3,0	8,1	13,0	63,6	5,3	4,0	1,6	0,2	0,2	0,4	0,7	0,3	0,2	0,3	0,2	0,3	0,6	0,9
	AL	0,3	0,4	0,1	0,1	0,3	0,9	0,4	1,5	1,4	1,2	1,2	1,2	1,7	55,7	2,2	1,6	0,1	0,1	0,1	0,2	0,0	0,0	0,1	0,1	0,1	0,1	0,1
	SE	0,2	0,3	0,2	0,2	0,3	0,5	0,2	1,3	0,9	0,3	0,4	0,4	0,5	2,5	50,3	2,9	0,2	0,2	0,3	0,1	0,1	0,0	0,3	0,1	0,1	0,4	0,1
	BA	0,9	1,8	1,4	1,4	1,5	2,3	2,4	2,8	4,6	2,7	3,1	2,9	3,0	3,4	7,2	68,5	1,1	4,6	1,1	1,6	1,4	0,6	1,0	0,5	0,6	0,6	1,9
	MG	3,6	5,3	2,1	3,6	2,6	5,5	6,7	3,5	1,6	2,1	2,5	1,8	2,0	1,5	2,5	2,4	70,3	15,3	5,9	4,6	1,9	2,4	2,4	2,3	2,8	4,2	5,7
	ES	0,9	1,1	0,8	0,8	0,5	1,0	1,1	1,3	0,3	0,3	0,7	0,4	0,2	0,9	0,6	0,6	0,8	48,8	1,2	0,8	0,5	0,2	0,9	0,3	0,3	0,2	0,6
	RJ	9,6	7,5	2,9	7,9	4,1	7,1	11,2	4,8	2,6	2,1	3,7	2,3	2,3	1,8	2,8	5,0	4,0	5,9	64,6	4,8	2,7	4,6	2,6	4,4	6,1	4,3	4,5
	SP	15,2	12,9	20,1	14,0	19,3	11,5	22,2	9,9	9,1	10,7	10,0	10,7	13,9	7,9	10,7	9,7	13,3	13,7	14,6	74,1	15,0	15,1	11,6	19,5	15,7	14,6	14,5
	PR	2,7	2,3	1,7	1,8	2,0	1,3	3,8	1,9	1,1	1,3	1,3	1,4	1,5	1,1	1,8	1,4	1,6	3,3	2,3	3,0	64,7	8,4	2,5	4,6	5,1	1,7	1,9
	SC	2,0	2,8	1,6	2,7	1,2	2,7	3,6	1,6	1,1	1,2	1,6	1,4	1,3	1,4	2,2	1,2	1,4	1,6	1,9	1,4	4,0	61,3	2,9	2,9	1,5	1,2	2,5
	RS	2,5	5,8	2,6	6,6	1,5	5,8	5,3	2,9	1,8	2,6	2,5	1,3	1,8	1,7	5,1	1,3	2,2	1,6	2,7	1,9	2,5	4,5	72,2	3,5	2,2	1,9	2,7
	MS	0,6	0,6	0,2	0,2	0,1	0,3	0,4	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,1	0,2	0,1	0,3	1,0	0,7	0,4	0,1	58,1	0,7	0,3	0,4
	MT	1,4	0,8	1,9	0,4	0,3	0,3	0,5	0,2	0,1	0,3	0,2	0,1	0,1	0,3	0,6	0,1	0,5	0,3	0,2	0,9	1,8	0,2	0,1	0,6	58,1	0,3	0,3
	GO	1,6	1,7	0,7	1,2	1,8	1,8	7,2	1,3	1,0	0,6	0,7	0,4	0,3	1,1	0,9	0,3	1,3	2,0	1,0	1,1	0,6	0,3	0,3	0,9	1,8	64,3	5,2
	DF	3,5	3,9	1,0	3,6	0,6	3,8	6,2	0,2	1,4	0,4	0,6	1,4	0,7	1,4	2,7	0,7	0,7	0,6	0,7	0,4	0,6	0,7	0,6	0,6	1,1	0,7	54,5
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Author's elaboration from the database of model IMAGEM-B.

Figure 5 - Share of domestic trade in GRP of the state of origin (%).

		Destination																									
		RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
Origin	RO	81,8	1,6	2,5	0,2	0,2	0,1	0,1	0,2	0,0	0,3	0,2	0,1	0,2	0,1	0,2	0,6	5,8	1,5	5,0	29,7	5,3	1,0	3,1	0,5	4,2	0,9	4,4
	AC	7,1	118,3	0,9	0,1	0,7	0,2	0,1	0,5	0,0	0,1	0,2	0,1	0,3	0,1	0,6	0,4	1,2	0,2	1,8	7,4	0,8	0,3	0,9	0,2	0,4	2,0	0,7
	AM	1,3	0,3	95,4	0,6	3,2	0,1	0,2	2,3	0,2	1,4	0,3	0,4	1,1	0,3	0,5	2,1	2,8	0,8	3,7	44,7	2,8	1,6	3,5	0,6	1,8	1,8	0,9
	RR	2,5	0,7	8,4	88,0	3,4	0,2	0,4	1,2	0,1	0,3	0,3	0,4	0,7	0,2	1,8	1,1	3,8	0,5	3,8	21,2	2,5	0,9	3,0	0,4	0,7	5,9	1,5
	PA	0,1	0,1	1,6	0,0	107,7	0,8	0,4	6,1	1,1	3,0	1,0	0,6	2,0	7,8	1,4	3,0	4,6	1,2	5,6	10,4	10,9	0,5	3,8	0,1	0,3	1,4	1,2
	AP	0,1	0,1	1,4	0,0	2,7	108,9	0,2	0,7	0,2	0,6	0,5	0,2	0,9	0,3	0,4	2,0	5,0	0,5	3,6	12,7	1,5	0,5	1,9	0,1	0,2	0,3	0,8
	TO	0,1	0,4	0,9	0,1	2,7	0,2	38,3	8,6	0,6	1,0	1,0	0,2	4,0	0,6	0,9	1,4	5,9	0,6	8,3	29,7	2,5	1,7	15,6	0,6	1,8	28,1	5,2
	MA	0,6	0,1	0,5	0,0	5,5	0,6	0,3	115,1	2,5	1,1	0,7	0,5	0,9	0,9	0,9	1,8	2,6	0,6	2,7	12,2	1,3	0,7	1,2	0,3	0,4	1,4	0,6
	PI	0,3	0,2	0,7	0,1	2,5	1,3	0,4	14,1	109,8	17,7	1,4	0,5	1,2	1,6	1,6	2,4	6,5	0,6	9,9	6,6	0,8	0,7	1,8	0,2	0,4	0,6	1,2
	CE	0,4	0,3	0,6	0,1	1,9	0,8	0,5	3,4	2,3	116,4	6,4	1,9	3,6	1,1	0,8	3,0	2,6	0,5	3,2	15,2	1,5	0,7	2,5	0,4	0,5	0,6	3,3
	RN	0,1	0,0	0,1	0,0	0,7	0,1	0,1	0,6	0,2	3,5	110,6	4,8	8,0	0,5	0,3	1,8	2,4	0,2	13,2	9,8	1,5	0,3	0,9	0,1	0,1	0,2	0,4
	PB	0,3	0,3	0,4	0,0	0,6	0,4	0,2	0,4	0,3	3,5	3,3	82,4	12,7	0,8	0,4	2,6	5,2	0,8	6,6	20,2	2,4	2,2	2,7	0,1	0,2	0,8	1,0
	PE	0,2	0,3	1,0	0,1	2,8	0,7	0,2	1,7	0,9	3,7	5,4	6,4	110,8	2,8	1,8	4,8	1,3	0,4	3,3	15,9	1,2	0,7	2,0	0,1	0,2	0,8	1,2
	AL	0,5	0,3	0,4	0,0	1,6	0,7	0,3	4,8	1,8	6,1	3,1	2,5	11,7	120,7	4,0	19,9	3,2	0,5	2,8	16,0	0,8	0,5	2,8	0,2	0,3	0,5	0,7
	SE	0,3	0,2	0,7	0,1	1,5	0,3	0,1	3,5	1,0	1,2	1,0	0,8	3,0	4,8	82,2	32,3	3,7	1,1	7,7	11,8	2,0	0,5	6,7	0,3	0,3	2,0	0,4
	BA	0,2	0,2	0,9	0,1	1,2	0,2	0,2	1,2	0,8	1,9	1,2	0,8	3,1	1,0	1,9	122,6	4,0	4,2	4,5	19,9	3,7	0,9	3,4	0,2	0,3	0,5	1,6
	MG	0,4	0,3	0,7	0,1	1,0	0,3	0,3	0,8	0,1	0,8	0,5	0,3	1,0	0,2	0,3	2,1	129,2	7,0	12,9	29,3	2,6	2,0	4,0	0,5	0,7	1,8	2,4
	ES	0,4	0,3	1,2	0,1	0,9	0,3	0,3	1,4	0,1	0,5	0,7	0,3	0,6	0,7	0,4	2,8	7,2	109,9	13,2	26,0	3,4	0,7	7,0	0,3	0,3	0,5	1,3
	RJ	0,7	0,3	0,7	0,1	1,2	0,3	0,4	0,8	0,2	0,6	0,6	0,3	0,9	0,2	0,3	3,5	5,7	2,1	108,4	23,6	2,8	3,0	3,4	0,7	1,2	1,5	1,4
	SP	0,4	0,2	1,9	0,1	2,2	0,2	0,3	0,6	0,2	1,1	0,6	0,4	2,0	0,4	0,4	2,6	7,1	1,8	9,2	136,5	5,8	3,6	5,6	1,2	1,2	1,9	1,8
	PR	0,4	0,2	0,8	0,1	1,1	0,1	0,3	0,6	0,1	0,7	0,4	0,3	1,1	0,2	0,3	1,8	4,3	2,2	7,2	27,2	123,8	9,9	6,0	1,4	1,9	1,1	1,2
	SC	0,5	0,3	1,2	0,1	1,0	0,3	0,4	0,8	0,2	1,0	0,7	0,5	1,5	0,5	0,7	2,4	5,8	1,7	9,3	20,7	12,3	116,1	11,0	1,4	0,9	1,2	2,4
	RS	0,3	0,3	0,9	0,2	0,6	0,3	0,3	0,7	0,2	1,0	0,6	0,2	1,0	0,3	0,7	1,3	4,5	0,8	6,7	13,2	3,8	4,2	134,7	0,8	0,6	0,9	1,3
	MS	0,5	0,2	0,5	0,0	0,2	0,1	0,1	0,2	0,1	0,2	0,1	0,1	0,2	0,1	0,1	0,4	2,7	0,3	4,8	48,3	7,4	2,3	1,5	96,7	1,5	1,0	1,3
	MT	0,9	0,3	4,0	0,1	0,7	0,1	0,2	0,3	0,1	0,6	0,2	0,1	0,2	0,3	0,5	0,4	6,1	1,0	2,6	35,2	15,7	1,2	1,5	0,9	96,8	1,0	0,8
	GO	0,6	0,3	0,9	0,1	2,8	0,4	1,4	1,2	0,4	0,8	0,6	0,2	0,7	0,7	0,5	1,1	9,5	3,6	8,8	26,3	3,0	1,0	2,3	0,8	1,8	111,0	8,6
	DF	1,4	0,8	1,2	0,3	1,0	0,8	1,2	0,1	0,5	0,5	0,5	0,8	1,5	0,9	1,4	2,5	5,1	1,2	6,2	9,6	3,0	2,2	3,6	0,5	1,1	1,2	90,9

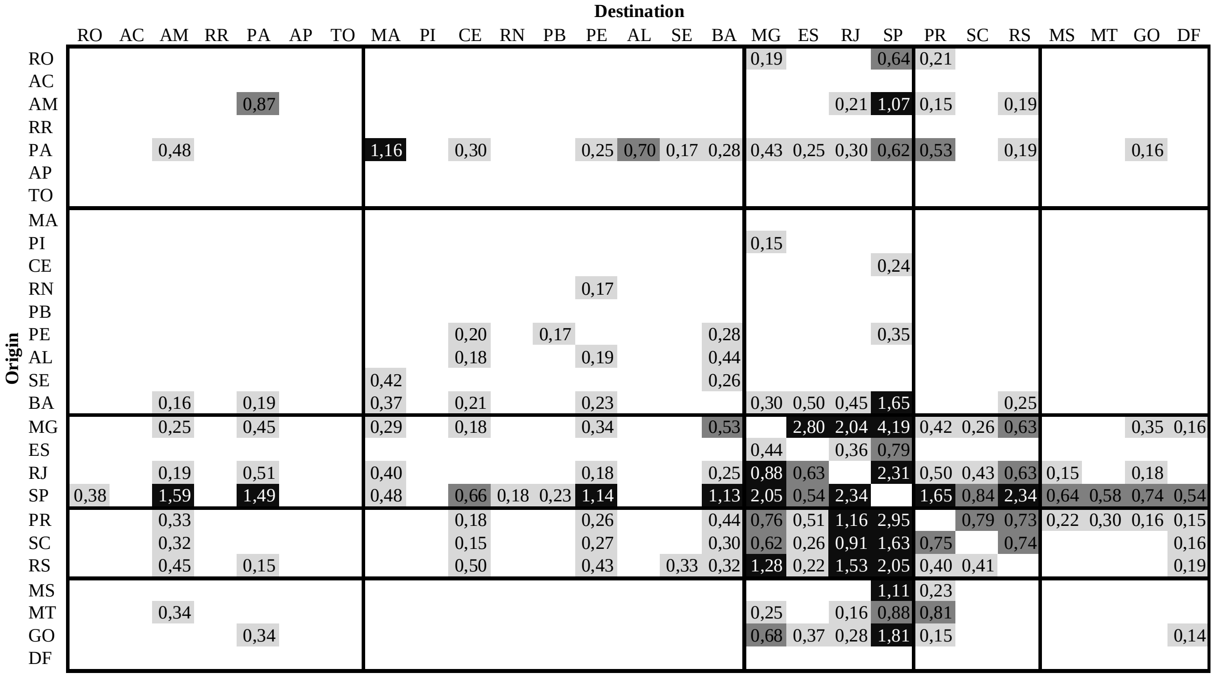
Source: Author's elaboration from the database of model IMAGEM-B.

Figure 6 – Transport margins on interstate domestic flows (% of the trade flow)

	Destination																										
Origin	RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
RO	0,4	0,3	1,6	1,8	4,4	0,3	1,3	0,6	4,7	3,0	3,7	4,6	3,7	5,3	4,0	3,4	5,3	10,6	3,8	3,8	6,5	8,2	5,4	4,9	0,6	3,3	0,3
AC	0,0	0,1	0,7	0,7	0,1	0,1	0,1	0,2	2,9	1,4	0,6	0,1	0,4	2,4	0,3	0,3	1,5	1,1	0,3	0,2	0,2	0,3	0,1	0,2	0,3	0,1	0,2
AM	1,4	1,2	0,8	2,3	17,3	2,8	1,8	1,4	1,5	2,7	3,7	2,4	2,8	2,1	1,6	3,5	2,3	3,9	3,2	1,2	2,5	3,6	2,9	2,6	0,9	1,2	2,6
RR	0,4	0,5	1,3	0,3	0,3	0,5	0,9	3,5	1,1	3,2	1,6	0,7	0,9	1,5	0,2	1,1	0,5	4,0	0,7	0,3	0,3	0,4	0,5	1,4	1,0	0,1	0,3
PA	11,6	1,3	16,6	3,8	1,2	0,9	4,2	11,2	3,3	5,4	4,3	4,6	6,1	4,5	4,8	4,5	4,7	10,1	3,0	3,1	2,3	4,6	2,5	3,9	3,3	5,4	2,7
AP	4,3	2,1	13,1	4,5	1,6	0,2	2,4	1,2	3,8	4,7	3,9	4,0	3,8	4,2	4,7	2,8	1,7	10,6	2,3	1,7	1,6	1,9	1,3	4,9	5,1	5,5	2,2
TO	1,8	0,3	3,6	0,7	1,0	0,4	0,5	2,0	3,1	3,8	4,3	1,1	0,3	3,8	1,5	1,9	1,1	3,7	0,6	1,0	1,5	1,3	0,1	1,2	0,6	0,4	0,2
MA	1,4	0,8	3,1	1,8	1,8	1,1	0,8	0,4	0,7	2,4	2,4	0,7	1,3	0,9	0,5	1,5	1,5	2,3	1,7	1,0	1,5	1,3	0,9	2,3	1,6	0,8	1,4
PI	2,9	1,9	6,6	2,6	1,2	0,9	1,0	1,4	0,5	0,8	1,5	2,0	1,4	0,4	0,2	1,7	4,8	1,4	1,0	1,5	1,0	0,7	0,7	2,2	1,9	2,3	0,4
CE	1,5	0,6	3,2	0,7	2,0	0,5	0,9	0,4	0,7	0,5	0,7	1,2	1,5	0,6	0,6	1,4	2,1	2,1	2,3	0,8	1,4	1,6	1,7	2,4	1,9	1,6	0,4
RN	1,6	1,4	4,9	5,6	20,9	0,8	3,8	14,8	3,0	4,4	0,2	1,4	2,4	3,1	2,6	1,0	1,2	9,8	0,9	0,6	1,2	1,3	1,4	4,8	2,4	0,7	0,2
PB	0,6	0,6	2,2	2,2	0,8	0,2	1,7	1,8	1,2	2,2	0,6	0,2	0,8	2,0	2,6	0,3	0,8	1,0	1,2	0,7	2,2	1,5	0,4	1,0	0,5	0,4	1,1
PE	1,5	2,7	4,1	0,9	1,2	0,3	1,0	1,6	1,0	2,0	0,8	0,7	0,3	0,5	0,8	2,3	1,2	1,2	0,9	0,9	0,9	1,3	1,1	1,2	1,5	2,0	0,2
AL	1,5	1,2	2,1	3,3	4,4	2,6	3,9	4,0	2,0	4,1	2,6	2,5	2,0	0,5	1,5	3,0	3,9	3,1	3,9	0,6	3,2	1,0	2,4	3,2	2,4	2,6	1,4
SE	3,0	1,9	8,1	9,3	10,7	3,1	5,3	17,5	0,8	2,0	2,0	2,1	2,6	0,6	0,4	1,0	1,7	16,2	0,9	1,3	1,6	1,4	0,4	3,5	2,8	1,7	1,4
BA	2,0	0,9	3,4	3,5	3,5	0,6	2,0	7,3	0,9	2,4	0,7	0,8	1,6	1,0	0,8	0,5	1,7	3,3	2,3	1,7	0,8	2,5	1,6	2,2	1,4	1,3	0,4
MG	1,9	0,9	3,5	1,6	4,4	0,5	1,8	4,5	2,4	2,6	1,2	2,3	3,4	1,7	1,2	2,5	0,5	4,7	1,8	1,4	1,7	1,3	1,7	2,0	1,4	2,0	0,5
ES	2,4	1,1	3,4	1,6	4,0	0,6	2,4	5,3	2,7	3,9	1,0	1,9	3,5	2,1	1,7	2,3	3,2	1,1	1,3	1,3	1,9	2,1	0,6	2,0	1,6	1,4	0,6
RJ	1,1	0,3	1,9	0,8	3,7	0,2	0,5	4,7	1,1	1,8	0,3	0,5	1,7	0,5	0,3	0,7	1,3	2,8	0,3	0,8	1,4	1,1	1,5	1,8	0,9	1,1	0,2
SP	2,6	1,1	2,2	3,5	2,0	1,2	1,2	2,5	1,4	1,9	1,0	1,4	1,7	1,0	1,0	1,4	0,8	0,9	0,8	0,5	0,9	0,7	1,3	1,5	1,4	1,2	0,7
PR	3,2	2,7	5,1	3,4	1,7	1,6	2,2	2,9	3,4	3,8	2,8	3,1	3,4	2,8	3,0	3,3	2,3	3,1	2,4	1,4	0,6	1,1	1,6	2,1	2,2	2,0	1,4
SC	2,7	1,3	5,3	2,7	2,7	1,9	2,0	2,7	2,9	3,7	1,8	3,1	4,0	3,1	3,2	2,8	2,4	3,8	2,3	1,7	1,4	0,7	1,5	1,9	2,7	2,2	1,3
RS	2,2	0,9	4,9	1,4	2,4	2,2	1,3	2,4	3,6	6,0	1,5	2,2	4,6	2,6	4,7	2,8	3,1	3,7	3,1	1,7	1,2	1,1	0,6	1,2	1,5	1,4	1,4
MS	2,4	1,5	4,6	2,2	1,9	1,1	2,5	1,7	4,0	5,5	3,0	2,3	3,7	3,3	3,3	2,5	3,0	3,7	1,1	1,9	2,9	2,9	0,8	0,6	1,1	1,6	0,4
MT	5,9	2,2	4,9	1,6	4,8	0,6	3,6	1,1	4,7	7,4	3,2	4,1	6,6	4,4	5,9	4,0	2,7	6,0	4,3	1,7	3,9	5,2	5,1	2,3	0,6	2,3	1,0
GO	5,6	2,0	5,5	3,0	5,5	2,0	2,0	5,3	4,6	6,2	4,3	4,8	6,5	4,4	3,3	2,7	3,1	4,6	1,5	2,9	2,3	2,2	1,8	2,6	1,8	0,5	0,6
DF	0,0	0,0	1,2	0,2	0,1	0,0	1,3	0,4	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,5	0,2	0,2	0,0	0,1	0,0	0,0	0,0	0,8	0,4	0,5	0,0

Source: Author's elaboration from the database of model IMAGEM-B.

Figure 7 - Most relevant trade flows for national GDP growth (short-run simulations, % change impact multiplied by 10^4)



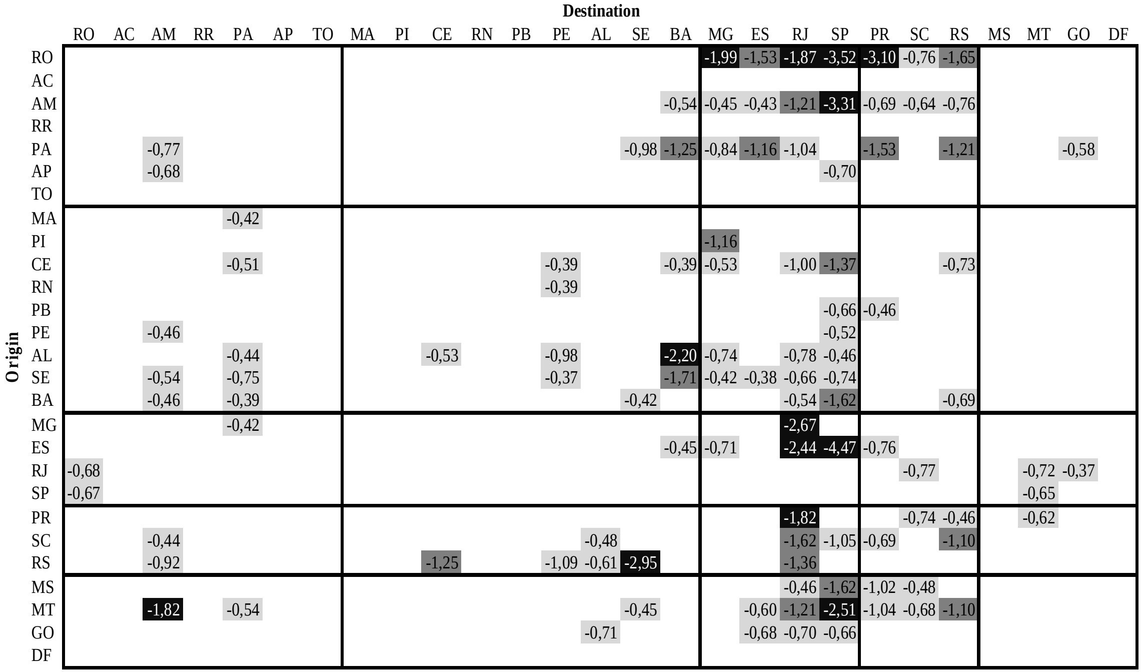
Destination

Origin	RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
RO																	0,19			0,64	0,21						
AC																											
AM					0,87														0,21	1,07	0,15		0,19				
RR																											
PA			0,48					1,16		0,30			0,25	0,70	0,17	0,28	0,43	0,25	0,30	0,62	0,53		0,19			0,16	
AP																											
TO																											
MA																											
PI																	0,15										
CE																				0,24							
RN													0,17														
PB																											
PE										0,20		0,17				0,28				0,35							
AL										0,18			0,19			0,44											
SE								0,42								0,26											
BA			0,16		0,19			0,37		0,21			0,23				0,30	0,50	0,45	1,65			0,25				
MG			0,25		0,45			0,29		0,18			0,34			0,53		2,80	2,04	4,19	0,42	0,26	0,63			0,35	0,16
ES																	0,44		0,36	0,79							
RJ			0,19		0,51			0,40					0,18			0,25	0,88	0,63		2,31	0,50	0,43	0,63	0,15		0,18	
SP	0,38		1,59		1,49			0,48		0,66	0,18	0,23	1,14			1,13	2,05	0,54	2,34		1,65	0,84	2,34	0,64	0,58	0,74	0,54
PR			0,33							0,18			0,26			0,44	0,76	0,51	1,16	2,95		0,79	0,73	0,22	0,30	0,16	0,15
SC			0,32							0,15			0,27			0,30	0,62	0,26	0,91	1,63	0,75		0,74				0,16
RS			0,45		0,15					0,50			0,43		0,33	0,32	1,28	0,22	1,53	2,05	0,40	0,41					0,19
MS																				1,11	0,23						
MT			0,34														0,25		0,16	0,88	0,81						
GO					0,34												0,68	0,37	0,28	1,81	0,15						0,14
DF																											

Source: Author's elaboration. Results from 702 simulations, one for each pair origin-destination. Values of impacts multiplied by 10^4.

Legend:
- □ **Low or zero impact**
- ░ **Average impact**
- ▒ **High impact**
- ■ **Strong Impact**

Figure 8 - Most relevant trade flows for reduction of regional inequality (short-run simulations, % change on GINI index multiplied by 10^2)

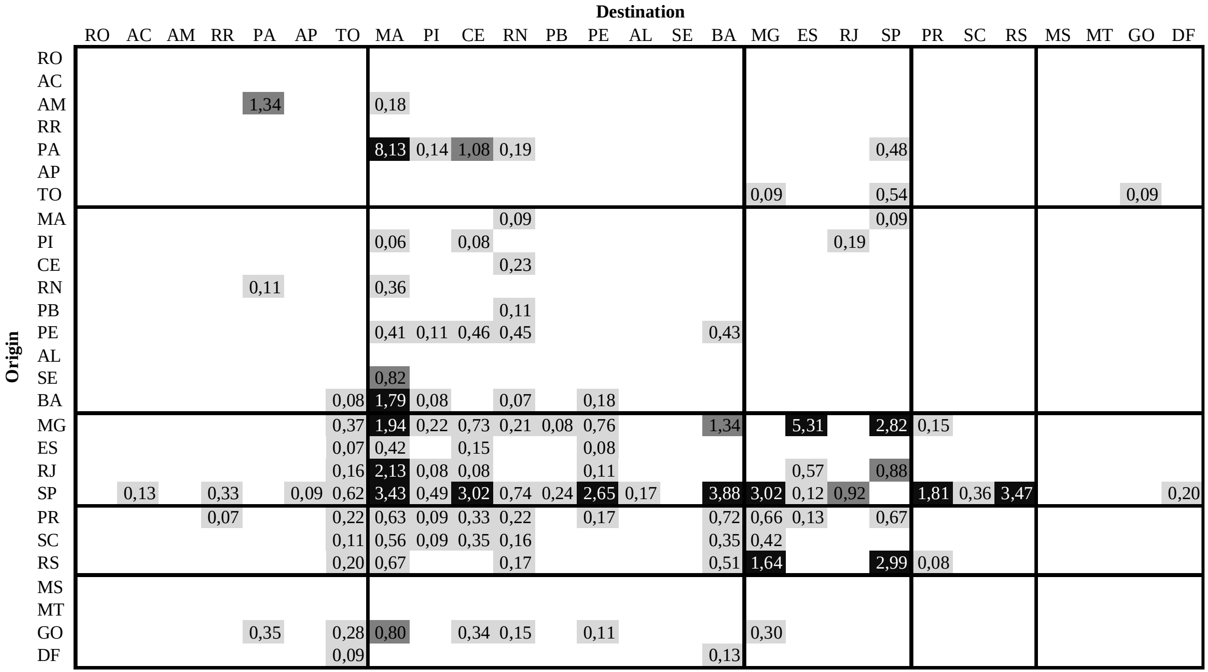


	Destination																										
Origin	RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
RO																	-1,99	-1,53	-1,87	-3,52	-3,10	-0,76	-1,65				
AC																											
AM																-0,54	-0,45	-0,43	-1,21	-3,31	-0,69	-0,64	-0,76				
RR																											
PA			-0,77												-0,98	-1,25	-0,84	-1,16	-1,04		-1,53		-1,21			-0,58	
AP			-0,68																	-0,70							
TO																											
MA					-0,42																						
PI																	-1,16										
CE					-0,51								-0,39			-0,39	-0,53		-1,00	-1,37			-0,73				
RN													-0,39														
PB																				-0,66	-0,46						
PE			-0,46																	-0,52							
AL					-0,44					-0,53			-0,98			-2,20	-0,74		-0,78	-0,46							
SE			-0,54		-0,75								-0,37			-1,71	-0,42	-0,38	-0,66	-0,74							
BA			-0,46		-0,39										-0,42				-0,54	-1,62			-0,69				
MG					-0,42														-2,67								
ES																-0,45	-0,71		-2,44	-4,47	-0,76						
RJ	-0,68																					-0,77			-0,72	-0,37	
SP	-0,67																								-0,65		
PR																			-1,82			-0,74	-0,46		-0,62		
SC			-0,44											-0,48					-1,62	-1,05	-0,69		-1,10				
RS			-0,92							-1,25			-1,09	-0,61	-2,95				-1,36								
MS																			-0,46	-1,62	-1,02	-0,48					
MT			-1,82		-0,54										-0,45			-0,60	-1,21	-2,51	-1,04	-0,68	-1,10				
GO														-0,71				-0,68	-0,70	-0,66							
DF																											

Source: Author's elaboration. Results from 702 simulations, one for each pair origin-destination. Values of impacts multiplied by 10^2.

Legend:
- ☐ Low or zero impact
- ░ Average impact
- ▓ High impact
- ■ Strong Impact

Figure 9 - Most relevant trade flows for increase of regional inequality (short-run simulations, % change impact multiplied by 10^4)



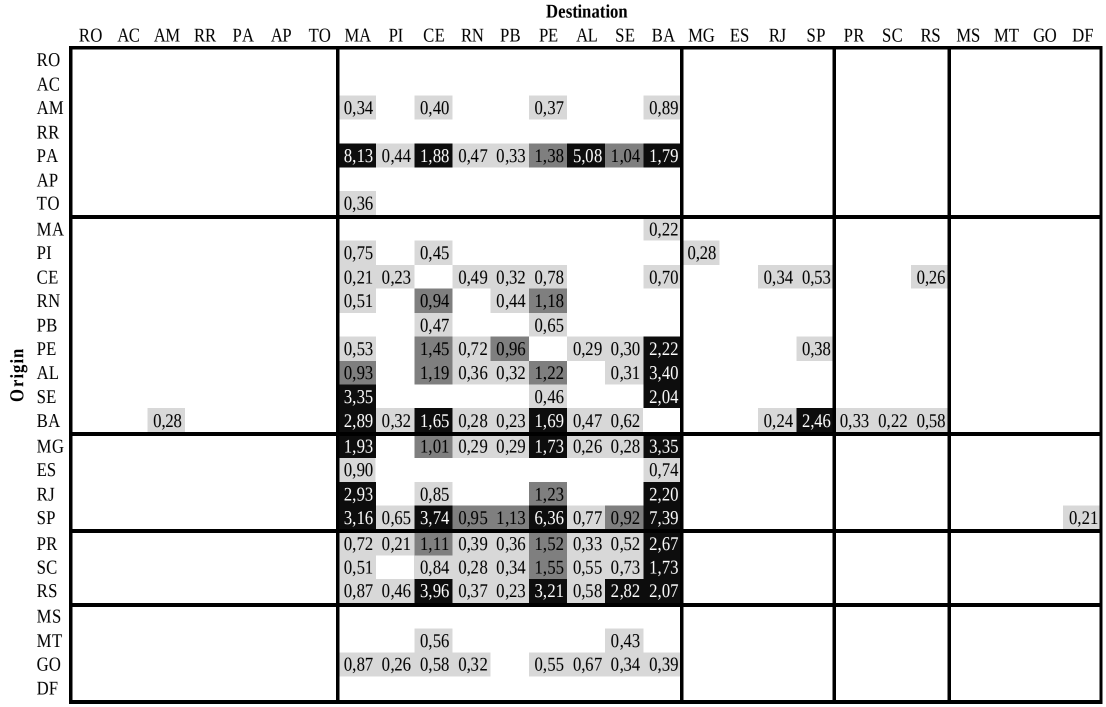
Destination

Origin	RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
RO																											
AC																											
AM					1,34			0,18																			
RR																											
PA								8,13	0,14	1,08	0,19									0,48							
AP																											
TO																	0,09			0,54						0,09	
MA											0,09									0,09							
PI								0,06		0,08									0,19								
CE											0,23																
RN					0,11			0,36																			
PB											0,11																
PE								0,41	0,11	0,46	0,45					0,43											
AL																											
SE								0,82																			
BA							0,08	1,79	0,08		0,07		0,18														
MG							0,37	1,94	0,22	0,73	0,21	0,08	0,76			1,34		5,31		2,82	0,15						
ES							0,07	0,42		0,15			0,08														
RJ							0,16	2,13	0,08	0,08			0,11					0,57		0,88							
SP		0,13		0,33		0,09	0,62	3,43	0,49	3,02	0,74	0,24	2,65	0,17		3,88	3,02	0,12	0,92		1,81	0,36	3,47				0,20
PR				0,07			0,22	0,63	0,09	0,33	0,22		0,17			0,72	0,66	0,13		0,67							
SC							0,11	0,56	0,09	0,35	0,16					0,35	0,42										
RS							0,20	0,67			0,17					0,51	1,64			2,99	0,08						
MS																											
MT																											
GO					0,35		0,28	0,80		0,34	0,15		0,11				0,30										
DF							0,09									0,13											

Source: Author's elaboration. Results from 702 simulations, one for each pair origin-destination. Values of impacts multiplied by 10^2.

Legend:
- □ **Low or zero impact**
- ░ **Average impact**
- ▒ **High impact**
- ■ **Strong Impact**

Figure 10 - Most relevant flows for the growth of GDP in the Northeast (short-run simulations, % change impact multiplied by 10^4)



	Destination																										
Origin	RO	AC	AM	RR	PA	AP	TO	MA	PI	CE	RN	PB	PE	AL	SE	BA	MG	ES	RJ	SP	PR	SC	RS	MS	MT	GO	DF
RO																											
AC																											
AM								0,34		0,40			0,37			0,89											
RR																											
PA								8,13	0,44	1,88	0,47	0,33	1,38	5,08	1,04	1,79											
AP																											
TO								0,36																			
MA																0,22											
PI								0,75		0,45							0,28										
CE								0,21	0,23		0,49	0,32	0,78			0,70			0,34	0,53			0,26				
RN								0,51		0,94		0,44	1,18														
PB										0,47			0,65														
PE								0,53		1,45	0,72	0,96		0,29	0,30	2,22				0,38							
AL								0,93		1,19	0,36	0,32	1,22		0,31	3,40											
SE								3,35					0,46			2,04											
BA			0,28					2,89	0,32	1,65	0,28	0,23	1,69	0,47	0,62				0,24	2,46	0,33	0,22	0,58				
MG								1,93		1,01	0,29	0,29	1,73	0,26	0,28	3,35											
ES								0,90								0,74											
RJ								2,93		0,85			1,23			2,20											
SP								3,16	0,65	3,74	0,95	1,13	6,36	0,77	0,92	7,39											0,21
PR								0,72	0,21	1,11	0,39	0,36	1,52	0,33	0,52	2,67											
SC								0,51		0,84	0,28	0,34	1,55	0,55	0,73	1,73											
RS								0,87	0,46	3,96	0,37	0,23	3,21	0,58	2,82	2,07											
MS																											
MT										0,56					0,43												
GO								0,87	0,26	0,58	0,32		0,55	0,67	0,34	0,39											
DF																											

Source: Author's elaboration. Results from 702 simulations, one for each pair origin-destination. Values of impacts multiplied by 10^4.

Legend:

□	**Low or zero impact**
░	**Average impact**
▓	**High impact**
■	**Strong Impact**

REFERENCES

ADAMS, P. D.; HORRIDGE, M.;PARMENTER, B. R. *MMRF-GREEN: A dynamic, multi-sectoral, multi-regional model of Australia*. Australia: Monash University, Centre of Policy Studies, Impact Project 2000.

CASTRO, N.; CARRIS, L.; RODRIGUES, B. Custos de transporte e a estrutura espacial do comércio interestadual brasileiro. *Revista Pesquisa Planejamento Econômico*, Rio de Janeiro, v. 29, n. 3, p. 347-400, dez. 1999.

CENTRO DE DESENVOLVIMENTO E PLANEJAMENTO REGIONAL. Cenário Tendencial do Modelo Econômico de Projeções Territoriais – Período 2007/2027. In____: *Relátorio Interno PPA 2008-2011*. Belo Horizonte: Cedeplar/UFMG, 2007. Relatório.

DIXON, P. B.; PARMENTER, B. R.; SUTTON, J.;VINCENT, D. P. *Orani, a multisectoral model of the Australian economy*. Amsterdam: North-Holland Pub. Co. 1982.

DOMINGUES, E. P. *Dimensão regional e setorial da integração brasileira na Área de Livre Comércio das Américas.* (Tese de Doutorado). Departamento de Economia/IPE, Universidade de São Paulo, São Paulo, 2002. 222 p.

DOMINGUES, E. P.; VIANA, F. D. F.; OLIVEIRA, H. C. *Investimentos em infra-estrutura no Nordeste: projeções de impacto e perspectivas de desenvolvimento*. Discussion Paper 319. Belo Horizonte: Cedeplar. 2007.

FERREIRA FILHO, J. B. S.; HORRIDGE, M. J. *Economic Integration, Poverty and Regional Inequality in Brazil.* 7th Annual Conference on Global Economic Analysis. Washington, 2004. 43 p.

FERREIRA FILHO, J. B. S.; HORRIDGE, M. J. The Doha Development Agenda and Brazil: Distributional Impacts. *Review of Agricultural Economics*, v. 28, p. 362, 2006.

GALVÃO, O. A. Comércio interestadual por vias internas e integração regional no Brasil. In: ENCONTRO NACIONAL DE ECONOMIA, 21., 1993, Belo Horizonte. *Anais…* Belo Horizonte: ANPEC, 1993. v.1.

GUILHOTO, J. J. M. *Um modelo computável de equilíbrio geral para planejamento e análise de políticas agrícolas (PAPA) na economia brasileira*. (Tese de Livre-Docência). ESALq, Universidade de São Paulo, Piracicaba, 1995. 258 p.

GUILHOTO, J. J. M.;SESSO FILHO, U. A. Estimação da Matriz Insumo-Produto a Partir de Dados Preliminares das Contas Nacionais. *Economia Aplicada*, v.9, n.2. 2005.

HADDAD, E. A. *Regional inequality and structural changes: lessons from the Brazilian experience*. Aldershot: Ashgate. 1999.

HADDAD, E. A. *Retornos Crescentes, Custos de Transporte e Crescimento Regional*. Tese de Livre Docência. Departamento de Economia, Universidade de São Paulo. São Paulo, 2004.

HADDAD, E. A.;DOMINGUES, E. P. EFES - Um modelo aplicado de equilíbrio geral para a economia brasileira: projeções setoriais para 1999-2004. *Estudos Econômicos*, v.31, n.1, p.89-125. 2001.

HADDAD, E. A.;HEWINGS, G. J. D. Market imperfections in a spatial economy: some experimental results. *The Quarterly Review of Economics and Finance*, v.45, p.476-496. 2005.

HADDAD, E. A.; HEWINGS, G. Analytically Important Transportation Links: A Field of Influence Approach to CGE Models. ENCONTRO NACIONAL DE ECONOMIA, 35., Recife. *Anais*... Recife: ANPEC, 2007.

HADDAD, E. A.; PEROBELLI, F. S. Integração regional e padrão de comércio dos estados brasileiros. In: KON, Anita (Org.). U*nidade e fragmentação*: a questão regional no Brasil. São Paulo: Perspectiva, 2002. p. 221-246.

HADDAD, P. R. Tendências recentes do comércio internacional e suas implicações para a economia de minas. *Cadernos BDMG*. Belo Horizonte, n.6, p. 4 - 63, fev. 2003.

HERTEL, T. W. *Global Trade Analysis: modeling and applications*. New York: Cambridge University Press. 1997.

HEWINGS, G. J. D.; SONIS, M.; JENSEN, R. Fields of influence of technological change in input-output models**.** *Papers in Regional Science*, Volume 64, Issue 1, Pages 25 - 36. 2005.

HORRIDGE, M. ORANI-G: a General Equilibrium Model of the Australian Economy. *Working Paper OP-93*. Cops/Impact: Centre of Policy Studies, Monash University 2000. www.monash.edu.au/policy/elecpapr/op93.htm

HORRIDGE, M.; MADDEN, J.; WITTWER, G.. The impact of the 2002-2003 drought on Australia. *Journal of Policy Modeling*, v.27, n.3, 2005/4, p.285-308. 2005.

KRUGMAN, P. *Geography and trade*. Cambridge: The MIT Press, 1991. *apud* CASTRO, N.; CARRIS, L.; RODRIGUES, B. Custos de transporte e a estrutura espacial do comércio interestadual brasileiro. *Revista Pesquisa Planejamento Econômico*, Rio de Janeiro, v.29, n.3, p.347-400, dez. 1999.

PETER, M. W.; HORRIDGE, M.; MEAGHER, G. A.; PARMENTER, B. R. *The theoretical structure of Monash-MRF*. Australia: Monash University, Centre of Policy Studies, Impact Project**:** 121 p. 1996.

SANTOS, F. B. T., A Construção Econômica Recente. In: CHIARI, J. R. P. *Minas Gerais do século XXI*. Belo Horizonte: BDMG, 2002. v.1, p. 1-45.

VASCONCELOS, J. R. D.;OLIVEIRA, M. A. D. *Análise da matriz por atividade econômica do comércio interestadual no Brasil - 1999*. TEXTO PARA DISCUSSÃO N° 1159. Rio de Janeiro, p.216. 2006.