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2000

Exchange Rate *Versus* Tariff Policies in Brazil: Results from MIBRA-USP, an Interregional Applied General Equilibrium Model of the Brazilian Economy

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PAPER PRESENTED AT THE

47th NORTH AMERICAN MEETINGS OF THE RSAI

CHICAGO, ILLINOIS

NOVEMBER 9-12, 2000

FIRST DRAFT

Abstract

Since the beginning of the 1990's Brazil has been experienced an opening process in the economy, which in turn has caused structural changes in the productive structure. In this work it is made an evaluation of the different impacts caused by changes in the exchange rate and in the tariffs over the Brazilian economy and its 5 macro regions. The study is done through the use of an interregional applied general equilibrium model, the MIBRA-USP. The results show that either a devaluation of the exchange rate or an increase in tariffs can cause a rise in the employment level as well as in the economic activity. However, there are differences between the policies, among which it is called attention for the real consumption of the families that decreases with the exchange rate devaluation and increases with higher tariffs.

Key words: economic policy, interregional applied general equilibrium model

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1 - Introduction

The Brazilian Economy has changed throughout the 1990´s, but there is still a long way until the country can reaches the growth rates and the international productivity already being observed in the rest of the world. The economic stabilization plans adopted by the government during the 1990´s were used to direct the country towards modernity, but there is still a need for an effective adoption of structural adjustment in the tax collection system as well as in the social security system.

The economic stabilization plans, which main objective was inflation control, have begun with the "Cruzado" Plan in February 1986. At that time the inflation had surpassed the monthly rate of 16%. The expected success was not reached, generating other economic plans: a) Bresser plan (June/1987); b) Summer plan (January/1989); c) Collor I plan (March/1990); and d) Collor II plan (February/1991).

Since the successive economic plans had failed, the government adopted an orthodox position, just trying to avoid strong price increases. On July 1st, 1994, the Real plan was launched. Together with this Plan was implanted a Program of Immediate Action (PAI) that was successful in decreasing budget expenditures and in the conduction of the internal and external debts agreements.

Through the use of interest rates and exchange rates controls and trade liberalization policies, the government was successful in getting the prices stabilization in the early months of the Real plan implementation, and at the same time there was a growth in the GDP and an improvement in the trade balance. Some time after the Real plan have being implemented it was verified a currency valorization, as a result of the great capital inflows attracted by the high internal interest rates and, as a consequence, after a long time period of surplus in the external trade balance, the first deficit was verified in November of 1994.

Because of the trade liberalization and the exchange valorization, the imports raised, especially of capital goods, in this way avoiding growth rates in the economy that could lead to a rise in prices. This situation led to monthly average deficits of US$ 1,076 million in the trade balance, pressing the government to make changes in the economic policy (increase in the interest rates and a more restrictive credit policy). This caused a deep decrease in industrial production and investment (these ones had been increasing since 1993). In São Paulo State, the main economic State in Brazil, the employment level and real wage were reduced, respectively, by 10% and 6,4%, between April 1995 and March 1996 (Levy and Hahn, 1996).

The economic slow down, the devaluation in the exchange rate and an increase in tariffs help to reduce the trade balance deficit. There was an increase in the monthly export average from US$ 3,7 billions on the second semester of 1995 to US$ 4 billions on the first semester of 1996. The possibility of higher growth rates for exports, as an induction factor for growth recuperation, is being considered still nowadays and it is also associated with the public deficit reduction through specific policy adoption.

Brazil presents large social and economic differences across its several regions and sectors, which makes more difficult the comprehension and elaboration of policies able to increase the economic growth and development. In this sense, this paper objective is to present an interregional and multi-sector model for Brazil, the MIBRA-USP[6]. An interregional model was chosen because, according to Haddad and Hewings (1999), Brazilian Economy "is not homogeneous internally, presenting strong variations across regions, sectors and income groups".

The MIBRA-USP pretend to be a tool that can be used in a better understanding of the economy behavior. The results of the model can be used by the policy makers to design better national and regional policies. In this paper, the MIBRA-USP is used to: a) make a evaluation of the different impacts caused by changes in the exchange rate and in the tariffs over the Brazilian economy and its 5 macro regions, b) compare the differences between the two policies.

The paper is divided in three sections, besides the introduction: the section 2 brings a brief introduction to interregional applied general equilibrium models and there applications, besides the theoretical structure of MIBRA-USP; the section 3 shows the results and then in section 4 we have the conclusions.

2 - Methodological Reference

Regional modeling has gone through a lot of changes in the last decades, starting with the Input-Output analysis, where the main concern was related to the regional economy data integrity, passing by the social accounts matrices, and demo-economic models, to the current integrated models (in general I-O and econometrics) and those of computable general equilibrium models which take the regional I-O like a core component for the modeling (West and Jensen, 1997).

The Computable General Equilibrium Models, based upon the Walrasian general equilibrium theory, have added price-effects and flows equilibrium to the traditional I-O models (Najberg et al., 1995).

The Applied General Equilibrium (AGE) Models can be applied to a region or a group of regions. The B-Maria Model (Haddad, 1999) was the first interregional AGE model applied to the Brazilian economy, and it is based on the MONASH-MRF model constructed for the Australian Economy, which in turn follows the ORANI-F model, a national model of the Australian Economy.

Some trends may be mentioned related to the recent evolution of interregional general equilibrium models in other countries. Isard et al. (1998) has made a survey of these works.

Isard et al. (1998) explain about the requirements over the searches related to a better elaboration of economies of scale questions, what is considered as a determinant factor to the entrepreneurial behavior, particularly on the transport sector. They comment that the studies of

[6] To a better description of MIBRA-USP see Casimiro Filho et al, 2000.

Jones and Whalley (1989), Walley and Trela (1989) and Elbers (1992) have tried to incorporate in a more efficiently way the transport issue on the economy. According to this author, Ando and Shibata (1997) have tried to build an interregional model for China and they also recognized the transport relevance to the development of different regions, as well as the freight costs importance for price determination in these regions.

Basically the general equilibrium models admit the evaluation of macroeconomics policies impacts with effects on regional development using simulation of these policies. Haddad (1999) gives examples of the utility of interregional models in the impacts of tariff barriers elimination effects; taxes policies and others evaluations.

Najberg et al. (1995) present examples of papers that have applied AGE models to verify the impact of economic policies on the economy. They mentioned Adelman and Robinson (1978) who investigated the implications of different growth strategies over income distribution for South Korea. They also mentioned that the AGE models were used to analyze the restriction effects of Balance of Payment over production structure and over the foreign trade of developing countries.

The above authors studied a real devaluation of exchange rate on the current transaction of Balance of Payment and an increase in the tariffs to explain the potential capability of those AGE models to measure impacts of economic policy changes. They concluded that those models are useful to give a direction in choosing the instruments of economic policy and to evaluate the Economy answers to external shocks, i.e., to give subsidies for analysis involving the efficient resources allocation. Trade liberalizing impacts, as well as sector investments reallocation, fiscal adjustments and structural reforms on production, employment and foreign trade can be investigated through the present approach, because of the flexibility to admit several sectors desegregation, production factors and regions desegregation.

Another relevant application of interregional models is for migration studies and, especially labors mobility. According to West and Jensen (1997), the regional market effective independence degree issue and the interregional relationship across those markets have not yet been conveniently studied and it is not possible to make final conclusions at this moment. A more proper and possible conclusion discussed is that independent markets in relation to the price determination seems not to exist, and the national pressures seems to be the dominant power in the labor regional markets, although these ones are well defined.

Haddad and Hewing (1999) applied the B-Maria model to make comparisons of expected answers to economic policies shocks in the short and long run. Peter (1997) proposed static-comparative closures to the MONASH-MRF model. For the short run, in the supply side, it can be assumed that regional population and labor supply, regional wages differentials and national real wage are all held fixed on a pre-defined level. According to him, the assumptions about wage rates are enough to the regional employment determination by the model application. Regional unemployment rates are free to vary according to changes in regional employment. Fixing the national real wage means that the nominal wage rate is linked to the national consumer price index.

The above model also admits long run closures. By the supply side, in labor market, shocks are assumed not to affect the aggregate employment. In the long run, aggregate employment is determined by demography variables, labor share rates and the by the natural employment rate. Long run shocks can affect the regional employment distribution, but not the national one. In the long run, capital reallocation effects are admitted. About land and technology assumptions, they are the same of short run ones.

Peter et al (1996) discussing the MONASH-MRF, points out that a feature that distinguishes the short and long run approaches is the industry capital treatment. Short run simulations suppose fixed capital stocks.

A results static-comparative interpretation for MONASH-MRF suits for political analysis. Though the Government planners and the entrepreneurs need production, prices and other variable forecasts to subsidize their investment decision (Peter et al., 1996).

2.1 - MIBRA-USP: general characterization and proposals

In common with the conventional AGE models, in the MONASH-MRF the demand and supply curves of products, capital and labor, are determinate by the optimum behavior of agents in the market. In this model, each regional economy had a treatment similar to the treatment of a unique region in the MONASH model, but considering the inter-regional linkages.

The multi-regional forecast model, MONASH-MRF, is an AGE regional model of the Australian economy. The model recognizes eight regions, including the six States and two Territories.

The model's equations are presented in five modules:

- The AGE core module
- The government finance module
- The capital and investment module
- The debt accumulation module
- The labor market & regional migration module

The AGE core module consists of the equations and variables of the original ORANI model with a regional subscript added (see Dixon, Parmenter, Sutton and Vincent (DPSV), 1982 for the original version of ORANI). This module is separated into four main equation blocks determining: (a) consumer demands (b) producer and consumer prices (c) market clearing conditions (d) macroeconomic variables as summations of microeconomic variables.

The government finance module incorporates equations determining: a) gross products of each region from the income and expenditure sides; and, b) sources of income and various expenditure accounts for regional and federal governments as defined in the State Finance Statistics of the Australian Bureau of Statistics (ABS).

The capital & investment and debt accumulation modules are added to make endogenous: (a) changes in total investment and capital stock over a forecast period; and, (b) the accumulation of foreign debt. The capital accumulation section of the capital & investment module is based on one of three alternative treatments implemented in the MONASH model. The entire debt accumulation module is based on ORANI-F (see Horridge, Parmenter and Pearson, 1993).

The labor market & regional migration module defines equations determining regional population by taking into account: a) natural growth; b) inter-regional migration; and, c) foreign migration. Regional labor supply is linked to regional population via accounting identities that allow for shifts in the relationship between regional population and the regional population of working age and the workforce-participation rate. The module also includes equations defining changes in regional unemployment rates.

The choice of the model used in this paper is based on some evidence, like Peter et al. (1996) that argue that the equation system of MONASH-MRF presented in a linear form (percentage changes) have some economic and computational advantages. The linear systems are easily resolved, what allow more complex models, with thousands of equations. Moreover, the size of the model can be reduced with substitution of secondary variables.

MIBRA-USP is an interregional and multi-sector model. Belongs to the Johansen-Orani class of models, with the structural equations in a linear form (percentage changes) and the results in growth rates. It is based on the MONASH-MRF model, using in this first stage of development only the AGE core module.

On the one hand, the B-Maria model, divided Brazil in 3 main regions: North, Northeast and Central-South (rest of Brazil). On the other hand, MIBRA-USP considers five regions, because there are clearly economic and social differences among the Brazilian regions. The data base year for the B-Maria model is 1985 while for the MIBRA-USP it is for 1995.

The supply and demand curves of products are determined by the optimum behavior of the agents in the competitive market. This optimum behavior also determines the demand curves of labor and capital. The decision of production and consume are functions of prices variations, so the equilibrium is a Walrasian type.

In the model, each sector has only one product and produce only one type of capital, with only one class of work. There are two margins: transportation and commerce. The margins are very important variables, specially the transportation margin, since they allow very detail analyses of the impact of the infrastructure over the others sectors of the economy.

The results are based in a *bottom-up* approach, but there are situations for the use of a hybrid model (with the *top-down* approach). The first approach allows the aggregation of regional results in national ones. This approach make easy the analyze of regional polices, but demand a big database, since its necessary to make the specification of the regional flows.

The equations of the model are divided in the following groups:

- Demands by industries for intermediate inputs-User 1
- Primary factor demands, prices and supplies
- Demands by industries for capital creation, User 2
- Household demands for commodities, User 3
- Tax rates
- Purchasers' prices of commodities
- Tax revenues
- Demands for exports
- Demands for commodities for regional Other expenditure
- Margin usage of commodities
- Supply equals demand for domestic & imported commodities
- Basic prices
- Components of regional GDP, real and nominal
- National GDP, real and nominal and its components
- Regional and national price indices
- Money wage settings
- Miscellaneous definitions of factor prices
- Employment Aggregates

2.2 - I-O Data Base

For the model construction, the I-O matrix of 1995 was used as database (see Guilhoto, 1998). The sectors and industries used are presented into Table 1. The agents of the model are: a) industries; b) households (one household for each region); c) government (only one); and , d) exports.

Table 1 - Sectors in the MIBRA-USP model

N.	Sectors
1	Agriculture
2	Mining and Non-metallic minerals
3	Metallurgy
4	Mechanics
5	Electronic material
6	Transportation material
7	Wood, Furniture, Cellulose, Paper
8	Chemistry and Druggist
9	Textile, Clothes and Footwear
10	Food and Beverage
11	Others industries
12	Communications
13	Civil construction
14	Commerce
15	Transportation
16	Services

Figure 1 shows the structure of the model, an absorption matrix where the rows are the products bought by the agents, identified in the columns. The model takes into account six regions of product source: a) North (N); b) Northeast (NE); c) Center West (CW); d) Southeast (SE); e) South (S); and f) imports. The first five regions are also destiny regions.

Figure 1 – MIBRA-USP absorption matrix

			1					2					3					4	5				
			Production					Investment					Consume					X	Goverment				
			N	NE	CW	SE	S	N	NE	CW	SE	S	N	NE	CW	SE	S		N	NE	CW	SE	S
		Size	16	16	16	16	16	16	16	16	16	16	1	1	1	1	1	1	1	1	1	1	1
INPUTS	N	16	**BAS1**					**BAS2**					**BAS3**					**BAS4**	**BAS5**				
	NE	16																					
	CW	16																					
	SE	16																					
	S	16																					
	I	16																					
MARGINS	N	16	**MAR1**					**MAR2**					**MAR3**					**MAR4**	**MAR5**				
	NE	16																					
	CW	16																					
	SE	16																					
	S	16																					
	I	16																					
	N	16																					
	NE	16																					
	CW	16																					
	SE	16																					
	S	16																					
	I	16																					
TAXES	N	16	**TAX1**					**TAX2**					**TAX3**					**TAX4**	**TAX5**				
	NE	16																					
	CW	16																					
	SE	16																					
	S	16																					
	I	16																					
W		1	**LABR**																				
K		1	**CPTL**																				
L		1	**LAND**																				
O		1	**OCTS**																				

I – Number of commodities – 16
J – Number of industries– 16
M – Number of labor classes - 1
Q – Number of regions – 5
R – Number of commodities used as margin - 2
S – 6: 5 regions + 1 imports
X – exports 1

W - labor
K - capital
L - land
O – other costs

2.3 – Coefficients and parameters of the model

The coefficients and parameters of the MONASH-MRF model, relevant to MIBRA-USP came from three different sources: I-O date base, algebraic calculation and from literature.

The values of these coefficients came from Guilhoto (1995). The Frisch parameters were calculated using the work by Lluch, Powell and Williams (1977). The regional GDP of Silva and Medina (1999) was used to estimate these parameters.

2.4 – Reduction and closure of the model

The original model had 95.185 equations and 97.100 variables, consequently 1.915 exogenous variables. With the objective of reduce the equation numbers some variables were omitted or substituted. The final result is a system with 20.915 equations and 22.467 unknown variables, becoming necessary then the choice of 1.552 exogenous variables to close the model. The variables omitted or substituted may change, according to the simulation pretended.

The choice of exogenous variables can't be randomize, to avoid inconsistency. For example, if a price is choose to be exogenous, then the corresponded quantity must be endogenous (Guilhoto, 1995).

3 - Results

In this section, we show how MIBRA-USP can be used to better understand the economic behavior. The results are came from the following simulations: a) a devaluation of exchange rate (increase of 10% on the exchange rate); b) increase of 10% on tariffs.

We used *General Equilibrium Modelling Package* (GEMPACK) to make the simulations. The solutions came from Gragg method with 2, 4 and 6 steps (Harrison e Pearson, 1998).

3.1 – Devaluation of exchange rate

The exchange rate is one of the most important variables of the economy. Here, the exchange rate is defined as the price in national currency of one foreign unity. So, a increase of the exchange rate is equivalent to a devaluation of the national currency.

The increase of the exchange rate improve the returns of exports and the cost of imports, making the external trade balance more favorable. With the increase of exports, the economy will produce more exported products, increasing the employment, the prices, and diminishing the real consumption of families.

Tables 2 and 3 show how the principals macroeconomics variables are changed in national and regional level, respectively. The increase in the exchange rate and the consequent increase in domestic prices, made the consumption index of prices grow, and the real consumption of families decrease.

Table 2 – Impact of a increase of 10% in the exchange rate over the principal national macroeconomic variables

Description	Value (%)
Real GDP	-0,14
Aggregate nominal wages	0,01
Real wages	-1,92
Consumption index of prices	1,96
Imported index of prices	10,00
Interregional index of prices	1,25

Table 3 – Impact of a increase of 10% in the exchange rate over the principal regional macroeconomic variables

Description	North	NE	CW	SE	South	Brazil
Real consumption of families	-0,91	-0,09	-0,79	-1,56	-0,95	-1,18
Export volume	9,23	-5,7	-0,84	5,81	0,69	3,6
Import volume	1,13	-2,14	-1,11	-0,73	-1,27	-0,79
Employee	0,02	0	0,01	-0,03	0,01	-0,01
Regional/national rate of consumption	0,26	1,09	0,39	-0,39	0,23	-

Tables 4 and 5 present the impacts over the employment and the level of activity, respectively. The sectors that usually import, like Transportation Material, Commerce and Transports shows decrease on the level of activity and employee. The opposite can be observed in sectors that usually export or compete with the foreign products: Mining, Wood, Furniture, Cellulose, Paper, and Textile, Clothes and Footwear.

In Tables 6 and 7 can be observed that the variables may have different behaviors according to the regions. For example, the prices for the Wood, Furniture, Cellulose, Paper sector: 3.42% - North; 0,08% - Northeast; - 3,63% - Central West; - 1,12% - Southeast; and, - 1,24% - South.

Table 4 – Impact of a increase of 10% in the exchange rate over employee Regions and Brazil

Sector	Change in Employment (%)					
	Brazil	**North**	**NE**	**CW**	**SE**	**South**
Agriculture	0,14	-0,19	0,18	0	0,10	0,28
Mining and Non-metallic minerals	3,00	0,93	-0,71	-0,06	4,94	0,54
Metallurgy	-1,21	0,34	-2,80	-0,37	-1,16	-1,56
Mechanics	0,46	0,95	-0,04	-0,49	0,82	-0,39
Electronic material	2,63	2,09	1,78	1,28	2,92	1,89
Transportation material	-2,64	-2,70	-2,85	-1,87	-2,74	-0,91
Wood, Furniture, Cellulose, Paper	1,63	5,17	0,29	-0,11	1,75	0,61
Chemistry and Druggist	0,39	-0,12	-1,17	-0,88	0,70	-0,34
Textile, Clothes and Footwear	6,73	7,09	4,38	5,72	7,73	6,00
Food and Beverage	-0,22	-0,81	-0,12	-0,14	-0,21	-0,20
Others industries	0,34	0,91	-0,81	-0,31	0,48	-0,05
Communications	2,49	0,42	1,02	2,00	2,91	2,85
Civil construction	-0,01	-0,02	0,02	-0,04	0	-0,07
Commerce	-3,41	-2,82	-3,54	-3,03	-3,27	-3,85
Transportation	-3,93	-2,77	-4,44	-4,31	-3,73	-4,26
Services	0,27	-0,11	0,94	0,26	0,12	0,39

Table 5 – Impact of a increase of 10% in the exchange rate over the level of activity Regions and Brazil

Sector	Change in Level of activity (%)					
	Brazil	**North**	**NE**	**CW**	**SE**	**South**
Agriculture	0,12	-0,16	0,21	0,03	0,13	0,31
Mining and Non-metallic minerals	1,79	0,94	-0,69	-0,05	4,95	0,55
Metallurgy	-0,85	0,35	-2,79	-0,36	-1,14	-1,54
Mechanics	0,33	0,97	-0,03	-0,48	0,83	-0,38
Electronic material	2,60	2,10	1,79	1,29	2,93	1,90
Transportation material	-2,29	-2,68	-2,83	-1,86	-2,72	-0,90
Wood, Furniture, Cellulose, Paper	0,64	5,19	0,31	-0,09	1,76	0,63
Chemistry and Druggist	0,32	-0,10	-1,15	-0,86	0,72	-0,32
Textile, Clothes and Footwear	6,26	7,10	4,38	5,72	7,73	6,01
Food and Beverage	-0,20	-0,79	-0,10	-0,12	-0,19	-0,19
Others industries	0,22	0,92	-0,79	-0,30	0,49	-0,03
Communications	1,80	0,43	1,03	2,02	2,92	2,87
Civil construction	0,01	0	0,04	-0,02	0,02	-0,06
Commerce	-3,36	-2,80	-3,52	-3,01	-3,25	-3,83
Transportation	-3,87	-2,75	-4,42	-4,29	-3,71	-4,25
Services	0,31	-0,09	0,96	0,28	0,14	0,41

Table 6 – Impact of a increase of 10% in the exchange rate over prices

Sector	Change in Prices (%)					
	North	NE	CW	SE	South	Foreign
Agriculture	1,07	0,71	0,55	1,17	1,17	10
Mining and Non-metallic minerals	4,38	3,59	1,03	3,34	1,99	10
Metallurgy	0,40	9,62	0	0,33	-0,03	10
Mechanics	0,78	0,75	0,32	3,86	4,13	10
Electronic material	-0,77	1,07	0,55	1,62	1,77	10
Transportation material	2,34	1,12	0,11	4,41	1,24	10
Wood, Furniture, Cellulose, Paper	3,42	0,08	-3,63	-1,12	-1,24	10
Chemistry and Druggist	-0,81	-1,63	-1,84	-0,66	-0,94	10
Textile, Clothes and Footwear	-6,11	-3,39	-6,12	-10,33	-3,02	10
Food and Beverage	2,99	2,09	0,45	1,29	2,08	10
Others industries	1,00	0,49	0,06	1,76	1,31	10
Communications	0,44	-0,22	0,15	-0,94	-0,45	10
Civil construction	2,04	1,77	4,85	0,86	3,23	10
Commerce	3,52	4,52	0,86	2,60	3,44	10
Transportation	0,75	1,21	1,83	4,44	4,53	10
Services	1,86	1,73	1,48	1,71	1,75	10

Table 7 – Impact of a increase of 10% in the exchange rate over import volume

Sector	Change in import volume (%)				
	North	NE	CW	SE	South
Agriculture	16,75	-6,08	-8,43	-13,67	-7,65
Mining and Non-metallic minerals	0,08	-1,78	-0,81	0,22	-0,53
Metallurgy	1,05	-1,11	-0,54	-1,04	-0,96
Mechanics	1,31	-0,03	0,44	0,26	0,23
Electronic material	1,76	-3,51	-1,10	-0,38	-1,49
Transportation material	-0,09	4,52	0,95	-0,06	-3,35
Wood, Furniture, Cellulose, Paper	4,86	-2,62	-1,33	-0,03	-1,17
Chemistry and Druggist	0,39	-1,17	-0,91	0,07	-0,71
Textile, Clothes and Footwear	2,32	-7,02	0,39	3,17	3,41
Food and Beverage	-1,10	-1,36	-1,58	-2,26	-1,81
Others industries	-0,04	-0,69	-0,42	-0,55	-0,56
Communications	0,57	1,13	1,94	2,87	2,82
Civil construction	0	0	0	0	0
Commerce	-2,25	-2,34	-3,1	-2,38	-2,95
Transportation	-8,79	-8,17	-6,57	-6,21	-6,04
Services	-0,92	0,26	-0,05	0,03	-0,05

3.2 – Increase in tariffs

A increase in tariffs decrease the imports since the prices of the imported goods (in national currency) also increase. The national goods became less expansive. The change in relatives prices (Table 8), make the family consumption higher (Table 9).

Table 8 – Impact of a increase of 10% in tariffs over the principal national macroeconomic variables

Description	Value (%)
Real GDP	-0,05
Aggregate nominal wages	0
Real wages	0,03
Consumption index of prices	-0,03
Imported index of prices	0
Interregional index of prices	0,24

Table 9 – Impact of a increase of 10% in tariffs over the principal regional macroeconomic variables

Description	North	NE	CW	SE	South	Brazil
Real consumption of families	0,17	-0,22	-0,01	0,17	0,03	0,08
Export volume	-3,43	1,85	-0,05	-2,61	-0,57	-1,73
Import volume	-0,79	0,16	0,10	-0,15	0,03	-0,13
Employee	0,02	0,02	0,01	0,02	0,02	0,02
Regional/national rate of consumption	0,09	-0,30	-0,09	0,09	-0,05	-

The increase in tariffs should increase the production of national goods (to substitute the imported goods). But, this increase is only observed in some sectors (Tables 10 and 11). We also can see differences between the regions.

With the increase in tariffs, a decrease in relatives prices was expected (Table 12). Some sector had a different behavior. It's important to say, that this cannot be seeing as a inconsistency of the model, since the model is interregional and multi-sector, and shows the structural differences of the economy. This differences can also be observed in Table 13, were some sectors had an increase in import volume. A possible explanation is the increase in families consumption.

Table 10 – Impact of a increase of 10% in tariffs over employee - Regions and Brazil

Sector	Change in Employee (%)					
	Brazil	**North**	**NE**	**CW**	**SE**	**South**
Agriculture	-0,16	-0,01	-0,38	-0,09	-0,13	-0,14
Mining and Non-metallic minerals	-0,95	-0,65	0,36	-0,23	-1,54	-0,29
Metallurgy	-0,36	-0,24	-0,68	-0,07	-0,36	-0,28
Mechanics	-0,08	-0,36	-0,01	0,15	-0,2	0,23
Electronic material	-1,18	-1,08	-0,79	-0,69	-1,25	-0,98
Transportation material	0,66	0,7	0,78	0,38	0,67	0,52
Wood, Furniture, Cellulose, Paper	-0,51	-1,88	-0,02	0	-0,53	-0,16
Chemistry and Druggist	0,21	0,24	0,68	0,37	0,14	0,25
Textile, Clothes and Footwear	-1,34	-1,24	-0,57	-1,05	-1,61	-1,21
Food and Beverage	0,04	0,22	0,07	0,02	0,02	0,04
Others industries	-0,53	-1,03	0,04	-0,23	-0,58	-0,38
Communications	-1,57	-0,71	-0,73	-1,4	-1,8	-1,73
Civil construction	-0,01	-0,05	-0,01	-0,01	0	0
Commerce	1,08	0,75	1,03	0,99	1,09	1,19
Transportation	0,86	0,71	0,99	1,11	0,77	1,01
Services	0,04	0,21	-0,2	-0,03	0,08	0,05

Table 11 – Impact of a increase of 10% in tariffs over the level of activity - Regions and Brazil

Sector	Change in Level of activity (%)					
	Brazil	**North**	**NE**	**CW**	**SE**	**South**
Agriculture	-0,14	-0,01	-0,38	-0,1	-0,13	-0,14
Mining and Non-metallic minerals	-0,64	-0,65	0,36	-0,23	-1,54	-0,29
Metallurgy	-0,25	-0,24	-0,68	-0,07	-0,36	-0,28
Mechanics	-0,11	-0,36	-0,01	0,15	-0,2	0,23
Electronic material	-1,16	-1,08	-0,8	-0,69	-1,25	-0,98
Transportation material	0,62	0,7	0,78	0,38	0,67	0,52
Wood, Furniture, Cellulose, Paper	-0,17	-1,88	-0,02	0	-0,53	-0,16
Chemistry and Druggist	0,21	0,24	0,68	0,37	0,14	0,25
Textile, Clothes and Footwear	-1,24	-1,24	-0,57	-1,05	-1,61	-1,21
Food and Beverage	0,03	0,22	0,06	0,02	0,02	0,03
Others industries	-0,52	-1,03	0,04	-0,23	-0,58	-0,38
Communications	-1,28	-0,71	-0,73	-1,4	-1,8	-1,73
Civil construction	0	-0,05	-0,01	-0,01	0	0
Commerce	1,07	0,74	1,03	0,99	1,09	1,19
Transportation	0,87	0,71	0,99	1,11	0,77	1,01
Services	0,03	0,21	-0,2	-0,03	0,08	0,05

Table 12 – Impact of a increase of 10% in tariffs over prices

Sector	Change in Prices (%)					
	North	**NE**	**CW**	**SE**	**South**	**Foreign**
Agriculture	-0,42	0,01	-0,22	-0,44	-0,19	10
Mining and Non-metallic minerals	-0,98	-0,5	0,05	-0,15	0,08	10
Metallurgy	0,05	0,99	0,01	-0,06	-0,03	10
Mechanics	-0,11	-0,11	-0,01	-0,57	-0,63	10
Electronic material	1,23	0,76	0,13	0,5	0,35	10
Transportation material	-0,26	0,04	-0,01	-0,42	-0,11	10
Wood, Furniture, Cellulose, Paper	-0,87	0,04	0,16	0,5	0,75	10
Chemistry and Druggist	-0,67	0,06	-0,4	-0,4	0	10
Textile, Clothes and Footwear	0,6	1,34	1,41	1,54	0,91	10
Food and Beverage	-0,57	0,39	0,06	0,05	0,26	10
Others industries	-0,04	0,24	0,17	0,98	0,73	10
Communications	-0,01	0,88	0,21	1,11	0,83	10
Civil construction	0,87	0,94	1,67	0,42	1,43	10
Commerce	-0,71	-0,89	-0,22	-0,63	-0,38	10
Transportation	-0,28	0,06	-0,28	-0,77	-0,47	10
Services	0,32	0,67	0,3	0,22	0,36	10

Table 13 – Impact of a increase of 10% in tariffs over import volume

Sector	Change in import volume (%)				
	North	**NE**	**CW**	**SE**	**South**
Agriculture	-7,45	1,37	1,2	1,09	1,28
Mining and Non-metallic minerals	0,07	0,16	0,33	-0,01	0,13
Metallurgy	-0,75	-0,36	-0,14	-0,29	-0,19
Mechanics	-0,73	-0,11	-0,4	-0,65	-0,71
Electronic material	-1,03	0,2	-0,25	-0,5	-0,23
Transportation material	-1,04	-3,62	-0,71	-0,88	-0,38
Wood, Furniture, Cellulose, Paper	-1,7	-0,29	-0,28	-0,29	-0,01
Chemistry and Druggist	-0,13	0,12	0,3	0,11	0,22
Textile, Clothes and Footwear	-0,81	0,54	-0,31	-0,89	-0,82
Food and Beverage	-0,57	-0,2	-0,03	0,13	0,09
Others industries	-0,81	-0,3	-0,29	-0,44	-0,35
Communications	-0,79	-0,81	-1,34	-1,77	-1,7
Civil construction	0	0	0	0	0
Commerce	0,58	0,62	1,04	0,82	1,08
Transportation	2,57	1,97	1,7	1,49	1,49
Services	0,21	-0,28	-0,02	0,03	0,03

3.3 – Devaluation of the exchange rate *versus* increase in tariffs

The two policies cause similar impacts over some of the principal macro economic variables. In this sense the government could use any one of them. But there are differences in the results that must be taken in consideration.

In the Real Plan, for example, where the main intention was the control of prices, an increase in tariffs seems to be a more appropriate policy, since the devaluation of exchange rate, would generate an increase the prices.

4 – Conclusions

Brazil presents large social and economic differences across its several regions and sectors, which makes more difficult the comprehension and elaboration of policies able to retake the economic growth and development. In this sense, this paper objective is to propose an interregional and multi-sector model for Brazil, the MIBRA-USP The preliminary results show that the model can be used in helping the choice of economic policies that will led to growth and development of Brazil and its regions.

The Brazilian Government used a devaluation of the exchange rate as a policy to keep the Real Plan and the economy under control. In this case, the results of MIBRA-USP shows that the real consumption of families decreased, with an increase in prices and a decrease in employment.

On the other hand, if the government had used a policy of increasing the tariffs, the real consumption of families would have increased with a decrease in prices and an increase in employment. We can say that this choice would have been more appropriate. But, an increase in tariffs can be seeing as a barrier to imported goods. Other countries could complain about this kind of policy, which could have had a negative impact on the openness process of the Brazilian economy. One negative impact could be over the modernization of the Brazilian industries, as the use of barriers could bring restrictions over the use of new and modern technologies from other countries. However, this is left for future studies.

MIBRA-USP can be a important tool to analyze the impacts of macro economic policies over the national and regional development. Still, the model requires a better calibration and the implementation of the modules left out, work that is being under way.

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