Tax Policy and Re-location

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Abstract. Tax policy proposals usually do not take into account effects at sub-national levels. Even when their spatial consequences are taken into account, the available information and analytical tools are not well suited to produce relevant insights to the policymaker. Thus, sound methodological frameworks, built upon consistent regional data, are necessary. This paper deals with important methodological aspects in tax policy/reform studies: tax base endogeneity, changes in relative prices, and sectoral and regional substitution. These aspects can be quantitatively evaluated through inter-regional computable general equilibrium models. Short run and long run spatial considerations can be rigorously assessed, producing relevant information to regional planning.

1. Introduction

The discussion of regional (sub-national) impacts of regional (state level) tax policies on the Brazilian economy has often lacked a formal analytical framework. The debate has often focused on national implications considering economy-wide effects (e.g. Sampaio de Souza, 1993, 1996). The few incursions into sub-national issues have not gone further than exercises of well-educated speculation, nor presented an integrated interregional framework, treating the regions as isolated entities in aspatial dimensions (e.g. BNDES, 2001). Therefore, the role of regional trade as a transmission mechanism, which may enhance the effect of local policies, as regional economies are strongly connected, are not taken into account.

In this paper, a cost-competitiveness approach, based on relative changes in the sectoral and regional cost and demand structures, is adopted to isolate the likely effects of regional tax policies changes in Brazil. Cumulative causation appears through the operation of internal and external multipliers and interregional spillover effects in comparative-static experiments, such as those proposed here.

An interregional computable general equilibrium (CGE) model is employed to analyze the short run and long run regional effects of regional tax policies in Brazil, represented by simulations of

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changes in regional (state level) indirect taxes. The model produces estimates for two Brazilian regions, using the bottom-up approach (national results are obtained from the aggregation of regional results). An applied general equilibrium approach to study tax policy issues at the regional level is not new in the literature. Among others, Morgan *et al.* (1989) have analyzed tax effects on factor movements and regional production through a regional general equilibrium model of the United States, and Dixon and Rimmer (1999) have studied the impact of changes in indirect taxes in Australia with a dynamic general equilibrium model.

The specification of linkages between the national and regional economy represents an interesting theoretical issue in regional modeling. Two basic approaches are prevalent – top-down and bottom-up –, and the choice between them usually reflects a trade-off between theoretical sophistication and data requirements.

The top-down approach consists of the disaggregation of national results to regional levels, on an ad hoc basis. The disaggregation can proceed in different steps (e.g. country-state → state-municipality), enhancing a very fine level of regional divisions. The desired adding-up property in a multi-step procedure is that, at each stage, the disaggregated projections have to be consistent with the results at the immediately higher level. The starting point of top-down models are economy-wide projections. The mapping to regional dimensions occurs without feedback from the region; in this sense, effects of policies originating in the regions are precluded. In accordance with the lack of theoretical refinement in terms of modeling the behavior of regional agents, most top-down models are not as data demanding as bottom-up models.

In the bottom-up approach, agents' behavior is explicitly modeled at the regional level. A fully interdependent system is specified in which national-regional feedback may occur in both directions. Thus, analysis of policies originating at the regional level is facilitated. The adding-up property is fully recognized, since national results are obtained from the aggregation of regional results. In order to make such highly sophisticated theoretical models operational, data requirements are very demanding. To start with, an interregional input-output data base is usually required, with full specification of interregional flows. Data also include interregional trade elasticities and other regional parameters, for which econometric estimates are rarely available in the literature.

The strategy adopted in this paper utilizes an interregional computable general equilibrium (CGE) model to evaluate shifts in the economic activity and investment in the Brazilian economy due to regional tax policies. Endogenous tax base and relative price changes, due to changes in regional tax rates, can be modeled within this framework. Besides, input substitution, regional investment movements and labor markets implications are also taken into account in the analysis. An important advantage using these models is that economic agents do respond to relative prices changes, and therefore the tax base in the system is fully endogenous. Thus, this paper presents a methodology that tries to address this issue in the Brazilian case.

First- and Second-order Effects

Implications of regional tax policies in Brazil have focused on the so-called first-order effects, related to changes in indirect taxes imposed by regional governments. These studies drive the analysis towards the impact on tax revenues due to changes in tax rates. They often take *ad hoc* considerations about tax base changes, as they are not able to have it endogenously responding to the new tax rate structure.

The procedure to estimate the impact of tax changes on tax revenue can be analyzed through the concepts of first- and second-order effects. If *BAS* is the tax base, *TAX* is the revenue obtained and *t* is the tax rate, then:

$$TAX = BAS * t$$

$$\Delta TAX = \underbrace{BAS * \Delta t}_{\text{first order effect}} + \underbrace{\Delta BAS * t}_{\text{second order effect}}$$

As mentioned earlier, simulations and models currently employed in Brazil take into account only first-order effects in their results; therefore they calculate effects of new tax rates on the same tax base, or in a new tax base estimated trough *ad hoc* assumptions. This type of analysis is valid only if second-order effects are negligible. In this paper, the CGE model simulations try to address this issue, measuring this effect.

In the regional context, substitution and competition aspects have to be considered. Increasing the tax on goods produced in one region of the country can positively affect other regions that produce similar goods due to a substitution effect. In the same way, the effect can be negative, if the region has some degree of production linkage (activity effect). Besides, a temporal dimension should also be considered, because in the long run production can be re-located. These aspects are taken into account through simulations based on an inter-regional CGE model for the Brazilian economy, as discussed bellow.

This paper has three parts, in addition to this introduction. In the second part, the methodology employed is explained. Simulations and results are discussed in the third part. Finally, the fourth part brings concluding remarks about the results.

2. Methodology

Table 1 brings selected indicators about the regionalization assumed in this paper. Sao Paulo is the biggest state in Brazil, if we consider its share on Gross Domestic Product, and concentrates more than 20% of total population. Domestic trade flows indicate the prominent role of Sao Paulo in the interregional system, with larger shares compared to the Rest of Brazil.[1] It is worth noting that interregional trade is much larger than foreign trade in both regions. Although this stylized fact is known in the literature, its consequences are usually not taken into account in the Brazilian case.

[1] Sao Paulo has the larger surplus on interregional trade among the 27 Brazilian states. For a study of the inter-state trade structure in Brazil, and its change over the period 1985-1997, see Domingues *et al.* (2002). Among others, Azzoni (2001) and Diniz (1999) have studied recent regional changes in the Brazilian economy.

Table 1 Selected Indicators, 1996

			Brazil	Sao Paulo	Rest of Brazil
	GDP share		-	35.76	64.24
	Population share		-	21.22	78.78
*Trade Flows**	*Foreign*	*Exports*	6.44	6.48	6.42
		Imports	7.71	7.00	8.11
	Domestic	*Exports*	-	42.55	14.83
		Imports	-	26.64	23.69

* GRP share in each region, GDP share for the national economy

In order to study first- and second-order effects of local tax policies in an integrated inter-regional system, an inter-regional CGE model for Sao Paulo state in Brazil is employed, the B-MARIA-SP Model. The **B**razilian **M**ultisectoral **A**nd **R**egional/**I**nterregional **A**nalysis Model - **S**ao **P**aulo is a fully operational interregional CGE model for Brazil. The model is based on the B-MARIA Model.[2] B-MARIA-SP contains over 140,000 equations, and it is designed for forecasting and policy analysis. Agents' behavior is modeled at the regional level, accommodating variations in the structure of regional economies. The model recognizes the economies of two Brazilian regions: Sao Paulo (state) and Rest of Brazil (residual). Results are based on a bottom-up approach – national results are obtained from the aggregation of regional results. The model identifies 42 sectors in each region producing 42 commodities[3], a single household in each region, regional governments and one federal government, and a single foreign consumer who trades with each region. Special groups of equations define government finances, accumulation relations, and regional labor markets. The model is calibrated for 1996[4], representing the economic structure after important macroeconomic policies in Brazil, such as the trade reform, initiated in 1990, and the stabilization plan (1994).

Next, the modules and specification of the B-MARIA-SP Model are summarized. We tried to pay attention on model features that are more important to the issues and simulations

[2] This model is based on the MONASH-MRF Model, which is the latest development in the ORANI suite of CGE models of the Australian economy. The complete specification of the B-MARIA model is available in Haddad and Hewings (1997).
[3] Sao Paulo sectoral shares on production are in Annex 1.
[4] The core database for the model was obtained from a inter-regional input-output matrix estimated in Haddad and Domingues (2000).

implemented in this paper. A full description of very similar models can be found in Haddad (1999) and Peter *et al.* (1996).

CGE Core Module

The basic structure of the CGE core module comprises three main blocks of equations determining demand and supply relations, and market clearing conditions. In addition, various regional and national aggregates, such as aggregate employment, aggregate price level, and balance of trade, are defined here. Nested production functions and household demand functions are employed; for production, firms are assumed to use fixed proportion combinations of intermediate inputs and primary factors are assumed in the first level while, in the second level, substitution is possible between domestically produced and imported intermediate inputs, on the one hand, and between capital, labor and land, on the other. At the third level, bundles of domestically produced inputs are formed as combinations of inputs from different regional sources. The modeling procedure adopted in B-MARIA-SP uses a constant elasticity of substitution (CES) specification in the lower levels to combine goods from different sources.

The treatment of the household demand structure is based on a nested CES/linear expenditure system (LES) preference function. Demand equations are derived from a utility maximization problem, whose solution follows hierarchical steps. The structure of household demand follows a nesting pattern that enables different elasticities of substitution to be used. At the bottom level, substitution occurs across different domestic sources of supply. Utility derived from the consumption of domestic composite goods is maximized. In the subsequent upper-level, substitution occurs between domestic composite and imported goods.

Equations for other final demand for commodities include the specification of export demand and government demand. Exports are divided into two groups: traditional and non-traditional exports (services). The former faces downward sloping demand curves, indicating that traditional exports are a negative function of their prices in the world market. Non-traditional exports form a composite tradable bundle, in which commodity shares are fixed. Demand is related to the average price of this bundle.

One feature presented in B-MARIA-SP refers to the government demand for public goods. The nature of the input-output data enables the isolation of the consumption of public goods by both the federal and regional governments. However, productive activities carried out by the public sector cannot be isolated from those by the private sector. Thus, government entrepreneurial behavior is dictated by the same cost minimization assumptions adopted by the private sector. This is not a very strong assumption for the Brazilian case because the liberalization process of the 1990's offers some enhanced credibility for this assumption. Public good consumption is set to maintain a (constant) proportion with regional private consumption, in the case of regional governments, and with national private consumption, in the case of the federal government.

Other definitions in the CGE core module include: tax rates, basic and purchase prices of commodities, tax revenues, margins, components of real and nominal GRP/GDP, regional and national price indices, money wage settings, factor prices, and employment aggregates.

Government Finance Module

The government finance module incorporates equations determining the gross regional product (GRP), expenditure and income side, for each region, through the decomposition and modeling of its components. The budget deficits of regional governments and the federal government are also determined here. Another important definition in this block of equations refers to the specification of the regional aggregate household consumption functions. They are defined as a function of household disposable income, which is disaggregated into its main sources of income, and the respective tax duties.

Capital Accumulation and Investment Module

Capital stock and investment relationships are defined in this module; however, only the comparative-static version of the model produces reliable results, restricting the use of the model to short run and long run policy analysis. When running the model in the comparative-static mode, there is no fixed relationship between capital and investment. The user decides the required relationship on the basis of the requirements of the specific simulation.

Foreign Debt Accumulation Module

This module is based on the specification proposed in ORANI-F (Horridge *et al.*, 1993) in which the nation's foreign debt is linearly related to accumulated balance-of-trade deficits. In summary, trade deficits are financed by increases in the external debt.

Labor Market and Regional Migration Module

In this module, regional population is defined through the interaction of demographic variables, including interregional migration. Links between regional population and regional labor supply are provided. Demographic variables are usually defined exogenously, and together with the specification of some of the labor market settings, labor supply can be determined together with either interregional wage differentials or regional unemployment rates. In summary, either labor supply and wage differentials determine unemployment rates, or labor supply and unemployment rates determine wage differentials.

Closures

B-MARIA-SP can be configured to reflect short run and long run comparative-static, as well as forecasting simulations. At this stage, two basic closures for alternative time frames of analysis in single-period simulations are available. A distinction between the two closures relates to the treatment of capital stocks encountered in the standard microeconomic approach to policy adjustments. In the short run closure, capital stocks are held fixed, while, in the long run, policy changes are allowed to affect capital stocks.

Short run In addition to the assumption of interindustry and interregional immobility of capital, the short run closure would include fixed regional population and labor supply, fixed regional wage differentials, and fixed national real wage. Regional employment is driven by the assumptions on wage rates, which indirectly determine regional unemployment rates. These assumptions describe the functioning of the regional labor markets as close as possible to the Brazilian reality. Firstly, changes in the demand for labor are met by changes in the unemployment rate, rather than by changes in the real wage. This seems to be the case in Brazil, given the high level of disguised unemployment in most of the areas of the country; excess supply of labor has been a distinct feature of the Brazilian economy. Secondly, labor's interregional immobility in the short run suggests that migration is not a short-term decision. Finally, nominal wage differentials in Brazil are persistent, reflecting the geographical segmentation of the workforce (Savedoff, 1990). On the demand side, investment expenditures are fixed exogenously – firms cannot reevaluate their investment decisions in the short run. Household consumption follows household disposable income, and government consumption, at both regional and federal levels, is fixed (alternatively, the government deficit can be set exogenously, allowing government expenditures to change). Finally, since the model does not present any endogenous-growth-theory-type specification, technology variables are exogenous.

Long run A long run (steady-state) equilibrium closure is also available in which capital and labor are mobile across regions and industries. The main differences from the short run are encountered in the labor market and the capital formation settings. In the first case, aggregate employment is determined by population growth, labor force participation rates, and the natural rate of unemployment. The distribution of the labor force across regions and sectors is fully determined endogenously. Labor is attracted to more competitive industries in more favored geographical areas. While in the same way, capital is oriented towards more attractive industries. This movement keeps rates of return at their initial levels.

3. Simulations and results

In this section, regional effects of local tax policies are analyzed through simulation exercises. The basic simulation imposes an additional 1% differential in indirect taxes on flows from Sao Paulo to the Rest of Brazil, compared to the indirect taxes charged on flows from the Rest of Brazil to Sao Paulo. Therefore, the indirect tax charged on Sao Paulo goods rises compared to the tax charged on goods from the other region. This simulation is implemented in two different environments (closures): short and long run. The basic difference in these two scenarios is that in the short run capital stock is hold constant, while in the long run investment responds to sectoral and regional differences in capital return, suggesting movements of re-location of economic activity.

Increasing the indirect tax on goods produced in Sao Paulo implies that these goods become more expensive to local producers and to producers in the Rest of Brazil. And also these goods are more expensive to the final demand in both regions. The additional revenue collected by the government, created by the tax increase, is totally absorbed in additional consumption and investment by the government (federal and regional) keeping the marginal budget equilibrium. A summary of these tax changes is shown on Table 2. As can be seen, tax base in both regions responds to the indirect tax changes in Sao Paulo. It decreases in Sao Paulo and increases in the Rest of Brazil, although in the short run there is a small decrease in the tax base in the Rest of Brazil (in real terms).

Table 2 Tax Base and Indirect Tax Rates
(R$ millions 1996)

	Sao Paulo			*Rest of Brazil*		
	Tax Base	*% Chg.*	*Rate*	*Tax Base*	*% Chg.*	*Rate*
Base Year	424,970	-	6.80%	805,966	-	5.34%
Short Run	419,687	-1.24%	7.81%	805,202	-0.09%	5.34%
Long Run	395,412	-5.78%	7.84%	815,461	1.27%	5.34%

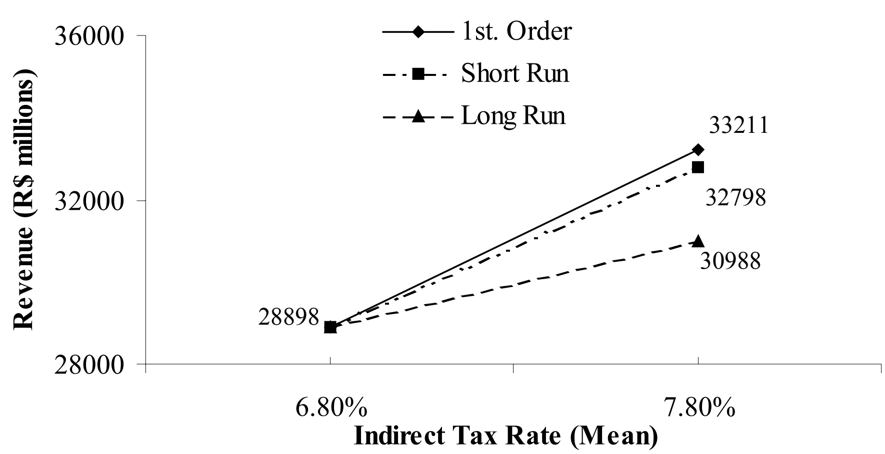
Table 3 presents first- and second-order effects calculated from the results presented above, for Sao Paulo. In both the short run and the long run, the first-order effect is the same, because it captures the new tax rate at the original tax base. Second-order effects, in the short run, capture intraregional changes in the tax base as the Sao Paulo economy adjusts to the new relative prices produced by tax changes. In the long run, second-order effects are bigger because inter-regional investment flows imply an important reduction on Sao Paulo tax base (-5.78%); therefore the smaller tax revenue in long run than in the short run. The second-order effect (approximately US$ 2 billions in 1996 prices) is not unimportant, it represents almost 0.64% of Sao Paulo GRP.

Table 3. Tax Base Changes in Sao Paulo
(R$ millions 1996)

	1st. Order	*2nd. Order*	*Total*
Short Run	4.291	-359	3.932
Long Run	4.291	-2,010	2.281

Finally, Figure 1 shows total revenue from indirect taxes with the original tax rate (6.80%) and the new one (7.81%). It illustrates findings from Table 2. Tax rate changes generate increasing tax revenue, but at different degrees, depending on the simulation environment. Increased revenue is smaller when we take into account second-order effects in the short run, originated from intraregional resources movements; in the long run inter-regional changes in investment and capital bring additional negative effect to the trend of increasing revenue.[5]

Figure 1. Total Revenue, Indirect Taxes in Sao Paulo (1996)



[5] Figure 1 can be considered a particular local approximation of the Laffer Curve.

Inter-regional and Foreign Trade Changes

The simulation exercise produces a competitive loss to Sao Paulo economy relative to the Rest of Brazil. The overall effect on domestic and foreign terms of trade will depend on the final composition of flows and their relative price changes.

Table 4 shows the percentage changes in domestic and foreign terms of trade. These coefficients come from the difference between exports and imports price indexes. These results show the gains or losses of Brazilian regions in the national economy, and of the national economy in the foreign trade, due to the increased indirect taxes in Sao Paulo. Symmetric results in the domestic trade are expected, as Sao Paulo exports are imports in the Rest of Brazil, and vice-versa.

Comparing the short and long run results, domestic terms of trade impacts change signal. Sao Paulo has a short run gain, and a long run loss; the Rest of Brazil goes in the opposite direction. In the short run there is little scope for inter-regional production substitution, therefore the activity level effect is more important. In the long run we can observe the expected terms of trade loss in Sao Paulo, resulting from relatively more expensive regional exports (6.32%) than imports (2.56%). Although the contraction in Sao Paulo economic activity is bigger in the short run than in the long run, inter-regional changes in regional production imply larger changes in regional supply, and therefore on relative prices.

These results also make clear that there is an overall competitive loss in foreign trade due to increased indirect tax in Sao Paulo. The national results are aggregation of regional outcomes, depending on regional shares in Brazilian foreign trade. As can be seen, there is an indirect effect of increased costs in Sao Paulo to goods traded by the Rest of Brazil, as the exports from this region also become more expensive. This suggests the prominent role of regional trade as a transmission mechanism, which may enhance the effect of local policies as regional economies are deeply connected.

Table 4. Terms of Trade

(Base Year % Change)

	Short Run	*Long Run*
Domestic		
Sao Paulo	-0.527	3.690
Rest of Brazil	0.527	-3.690
Foreign		
Sao Paulo	0.552	6.910
Rest of Brazil	0.132	2.987
Brazil	0.283	4.369

The impact on aggregated trade flows are shown in Tables 5 and 6. Indirect tax increase in Sao Paulo decreases the inter-regional trade volume, in both closures. Not only Sao Paulo regional exports decrease (competitive loss), but also its regional imports. This last effect is due to the decrease on Sao Paulo economic activity. The overall impact on Sao Paulo regional trade balance is negative, however its position as a surplus region in domestic trade does not change.

Table 6 shows the impact on foreign trade. The competitive loss on trade is evident from the decrease on exports and increase on imports. In the short run there is a small contraction in Sao Paulo imports, due to the (negative) activity effect mentioned earlier. In the long run the foreign trade deficit in Sao Paulo grows almost three times (as GRP share). This also happens in the Rest of Brazil, but at a small degree, due to the composition of its foreign trade and a small decrease on its exports. Its worth noting that the decrease on domestic imports in the Rest of Brazil happens along with an increase on foreign imports; therefore this region is able to substitute away from domestic to foreign goods due to the increased taxes in Sao Paulo.

Table 5. Inter-regional Flows
(R$ millions, 1996)

		Sao Paulo			*Rest of Brazil*			*Total*		
		R$	*% Chg.*	*% GRP*	*R$*	*% Chg.*	*% GRP*	*R$*	*% Chg.*	*% GRP*
Base Year	*Exports*	134008	-	42.55	83902	-	14.83	217910	-	24.75
	Imports	83902	-	26.64	134008	-	23.69	217910	-	24.75
	Balance	50106	-	15.91	-50106	-	-8.86	-	-	-
Short Run	*Exports*	133730	-0.21	42.75	83658	-0.29	14.78	217387	-0.002	24.73
	Imports	83658	-0.29	26.75	133730	-0.21	23.62	217387	-0.002	24.73
	Balance	50072	-0.07	16.01	-50072	0.07	-8.84	-	-	-
Long Run	*Exports*	128593	-4.04	43.63	82178	-2.05	14.28	210771	-0.033	24.22
	Imports	82178	-2.05	27.88	128593	-4.04	22.34	210771	-0.033	24.22
	Balance	46415	-7.37	15.75	-46415	7.37	-8.06	-	-	-

Table 6. Foreign Trade
(R$ millions, 1996)

		Sao Paulo			*Rest of Brazil*			*Brazil*		
		R$	*% Chg.*	*% GRP*	*R$*	*% Chg.*	*% GRP*	*R$*	*% Chg.*	*% GRP*
Base Year	*Exports*	20401	-	6.48	36303	-	6.42	56704	-	6.44
	Imports	22033	-	7.00	45850	-	8.11	67883	-	7.71
	Balance	-1631	-	-0.52	-9548	-	-1.69	-11179	-	-1.27
Short Run	*Exports*	20149	-1.24	6.44	36264	-0.11	6.41	56412	-0.51	6.41
	Imports	21977	-0.25	7.03	45958	0.24	8.12	67935	0.08	7.72
	Balance	-1829	12.10	-0.58	-9695	1.54	-1.71	-11523	3.08	-1.31
Long Run	*Exports*	17579	-13.84	5.96	32931	-9.29	5.72	50509	-10.92	5.74
	Imports	22210	0.81	7.54	48268	5.27	8.39	70478	3.82	8.00
	Balance	-4631	183.89	-1.57	-15338	60.64	-2.67	-19969	78.63	-2.27

Sectoral Effects: Investment and Re-location in the Long Run

The aggregated results discussed above come from changes in each regional economic agent modeled (producers, households, government and investors). An interesting feature to analyze is the long run shifts on investment (capital creation) at the sectoral level. These results suggest regional changes on investment and likely re-location of economic activity.

Figure 2 and Table 7 shows the results for capital creation for 16 sectors in both regions.[6] It is worth noting that sectoral impacts are not uniform, but in all of these sectors capital creation in the Rest of Brazil is larger. National sectoral outcomes are also heterogeneous, but the overall impact is negative. These results suggest a movement towards re-location of economic activity away from Sao Paulo.[7]

A detailed sectoral analysis goes beyond the scope of this paper. We can illustrate the model results looking at the automobile industry (S15). At the national level, we can observe a decrease on activity (-2.37%), but at regional level there is an expansion in the Rest of Brazil (0.71%) and contraction in Sao Paulo (-3.34%). In this sector, household consumption is the most important source of demand; results show that the relative price of domestic good to the imported one has risen 4.26% in Sao Paulo and 3.03% in the Rest of Brazil. In both regions the import shares of automobile goods increase (9.45% in Sao Paulo and 12.43% in the Rest of Brazil). Therefore, domestic consumption substitutes away from domestic production in both regions, but the Rest of Brazil region can obtain a small increase on automobile exports to Sao Paulo due to competitive gains. As a result, capital returns on the automobile sector decrease in Sao Paulo and rises in the Rest Brazil.[8]

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[6] We have selected sectors with location quotients larger than 1 in Sao Paulo.

[7] If the shocks were reversed (1% decrease in Sao Paulo indirect taxes) we would observe the opposite result. This appears to bring support to the competition among Brazilian states for new investments in recent years; however other considerations (such as strategic and government budget imbalances) should be taken into account to analyze these policies.

[8] Capital gains or losses (net of depreciation) are compared to the overall capital return in the economy.

Figure 2. Sectoral Capital Creation in the Long Run

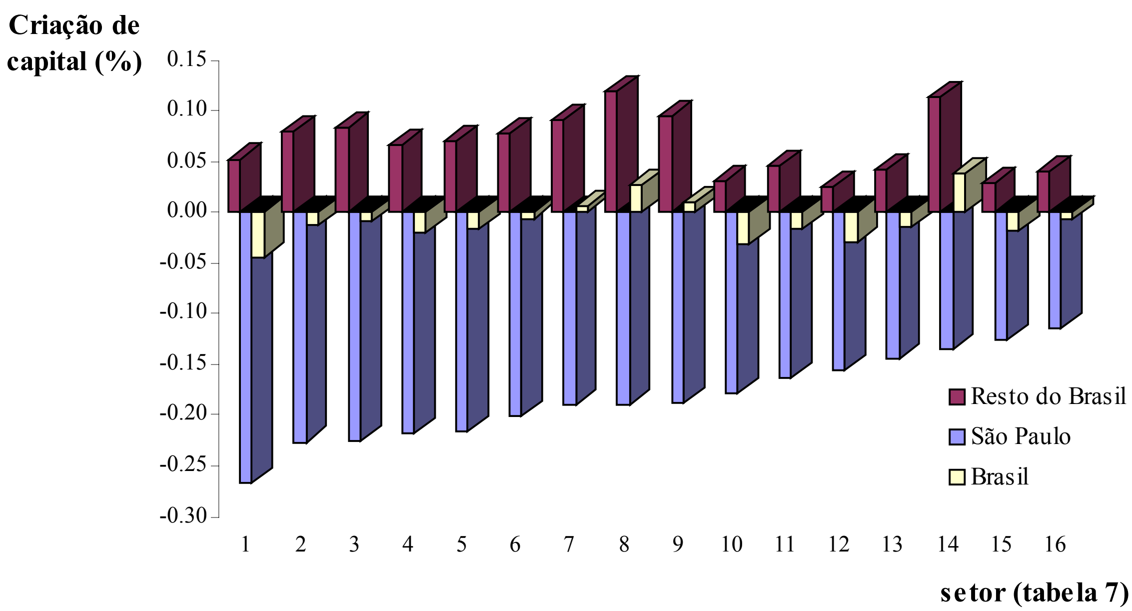

Table 7. Capital Creation, long run (% Change)

Sector	*Sao Paulo*	*Rest of Brazil*	*Brazil*
1 Textiles	-0.268	0.052	-0.045
2 Rubber	-0.227	0.079	-0.013
3 Other food products and beverages	-0.226	0.084	-0.010
4 Chemicals	-0.218	0.066	-0.020
5 Other Chemicals	-0.216	0.070	-0.017
6 Communication	-0.201	0.078	-0.006
7 Plastics	-0.190	0.090	0.005
8 Dairy Products	-0.190	0.120	0.026
9 Pharmaceuticals and Veterinary	-0.188	0.095	0.009
10 Machinery	-0.179	0.031	-0.032
11 Electronic Equipment	-0.163	0.046	-0.017
12 Other Trans. Equipment and parts	-0.156	0.025	-0.030
13 Paper Products and Printing	-0.145	0.042	-0.014
14 Sugar	-0.134	0.114	0.039
15 Automobile	-0.126	0.029	-0.018
16 Electrical Equipment	-0.115	0.040	-0.007

4. Final Remarks

The analysis above provides important insights to the debate on regional tax policies in the country. B-MARIA-SP simulations have supported the argument that second-order (general equilibrium) effects are important to the outcomes of regional policies. Contrary to general beliefs, which have often taken into account only first-order considerations, regional tax policies are likely to produce important shifts in the composition and structure of the tax base, in the region and outside the region. Our results have shown that second-order (general equilibrium) effects are not negligible in the Brazilian case; if they are not taken into account policy analysis can lead to inappropriate conclusions.

The results have shown that interregional trade plays an important role as a transmission mechanism. This points out that interregional feedbacks should not be neglected in order to have a better understanding of how regional economies are affected, both in the domestic and foreign markets. For example, in the less developed Brazilian regions, the performance of more developed states plays a crucial role, probably more important than the dynamics of foreign trade.

Finally, as a methodological note, the B-MARIA-SP model, proposed and implemented here, has proved worthwhile. Despite its requirement of an extensive amount of data, it has produced consistent results, which provided interesting insights into regional inequality in a federative system. A more detailed regional specification, which would include a larger number of Brazilian states, still remains to be implemented, but data availability to date have precluded this alternative.

Annex 1. Sectoral Indicators in the B-MARIA-SP Model

Table 8. Sao Paulo Shares on Production

	Sector	Regional	National	Sectoral
S1	Agriculture	0,0462	0,0526	0,2608
S2	Mining	0,0009	0,0051	0,0556
S3	Petroleum and Gas	0,0002	0,0018	0,0397
S4	Nonmetallic minerals	0,0075	0,0090	0,2487
S5	Steel	0,0060	0,0170	0,1044
S6	Nonferrous Metals	0,0060	0,0075	0,2388
S7	Other Metal Products	0,0111	0,0116	0,2835
S8	Machinery	0,0160	0,0097	0,4885
S9	Electrical Equipment	0,0192	0,0119	0,4779
S10	Electronic Equipment	0,0212	0,0180	0,3485
S11	Cars, Trucks and Buses	0,0581	0,0266	0,6489
S12	Other Transport Equipment and parts	0,0294	0,0138	0,6336
S13	Wood Products and Furniture	0,0091	0,0117	0,2303
S14	Paper Products and Printing	0,0300	0,0146	0,6122
S15	Rubber	0,0053	0,0043	0,3729
S16	Chemicals	0,0120	0,0083	0,4266
S17	Petroleum Refining	0,0098	0,0252	0,1152
S18	Other Chemicals	0,0143	0,0107	0,3962
S19	Pharmaceuticals and Veterinary	0,0281	0,0148	0,5653
S20	Plastics	0,0078	0,0052	0,4445
S21	Textiles	0,0137	0,0139	0,2939
S22	Clothing	0,0156	0,0137	0,3391
S23	Footwear	0,0049	0,0070	0,2081
S24	Coffee	0,0022	0,0065	0,1024
S25	Processed Vegetables	0,0072	0,0272	0,0783
S26	Meat Packing Plants	0,0081	0,0228	0,1061
S27	Dairy Products	0,0231	0,0102	0,6727
S28	Sugar	0,0116	0,0058	0,5949
S29	Vegetable Oil Mills	0,0047	0,0136	0,1036
S30	Other Food Products	0,0365	0,0339	0,3203
S31	Other Manufacturing	0,0061	0,0068	0,2640
S32	Electric, Gas and Sanitary Services	0,0301	0,0219	0,4095
S33	Construction	0,0373	0,0374	0,2966
S34	Trade	0,0946	0,0748	0,3761
S35	Transport	0,0204	0,0439	0,1384
S36	Communications	0,0111	0,0099	0,3340
S37	Financial Services	0,0684	0,0483	0,4203
S38	Personal Services	0,0560	0,0792	0,2100
S39	Business Services	0,0132	0,0102	0,3821
S40	Real State	0,1007	0,1096	0,2731
S41	Public Administration	0,0918	0,1171	0,2330
S42	Community Services	0,0043	0,0067	0,1889
	Total	1.0000	1.0000	0.2972

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