# EVALUATION OF THE FISCAL RECOVERY REGIME IN STATE OF RIO DE JANEIRO: A CGE ANALYSIS

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**Abstract**:

In recent years, the State of Rio de Janeiro (SRJ) has gone through a serious fiscal crisis that forced it to adhere to the Fiscal Recovery Regime (FRR), created by the Federal Government to help States in a serious situation of fiscal imbalance. In 2017, the SRJ joined the FRR and was required to implement a series of measures, in particular a fiscal adjustment to reduce government investment spending. The work assumes that a fiscal recovery policy that prioritizes government investments is more likely to generate promising results in the state's fiscal results than a policy that only aims to reduce government spending. Using the Computable General Equilibrium (CGE) methodology, the interregional matrix of the population arrangement of the State of Rio de Janeiro developed by The Regional and Urban Economics Lab at the University of Sao Paulo – NEREUS, and the structural lineage developed in the CGE model B-MARIA, an interregional CGE model was developed for the State of Rio de Janeiro and the rest of Brazil, the B-MARIA-RJ (*Brazilian Multisectoral And Regional/Interregional Analysis for Rio de Janeiro*). The result of the research was a new methodology for evaluating the impact of the Fiscal Recovery Regime on the economy of the SRJ and the rest of Brazil.

**Key-Words**: Fiscal Recovery Regime, State of Rio de Janeiro, B-MARIA-RJ, Computable General Equilibrium.

## 1. Introduction

It is known that governments cannot arbitrarily expand their expenditures, but that it is necessary that they have resources (their own or third parties') to make the expenditures. Thus, there is a budget constraint in the public sector with a balance between expenses and inflows of resources, in which, when expenses exceed resources (deficit), the government will need to seek financing, increasing its debt (Mercês and Freire, 2017). In the case where resources exceed expenses (surplus), the government retains an accumulation of resources (savings) that can be directed to other expenses, such as investments, personnel costs, etc., as pointed out by Mercês and Freire (2017): "State governments, like all other agents of the economy, cannot expand their spending arbitrarily, and it is necessary to have resources, their own or third-party resources, to fund them. Therefore, the problem appears when the government presents constant deficits over a period of time, which can result in several worrying scenarios, such as not being able to meet its debt obligations and its obligatory expenses given its net current revenue.

Knowing this, and in the middle of a stagnation in the Brazilian economy between the years 2015 and 2016, as can be seen in table 1.1, some Brazilian states presented the possibility of inability to pay their obligations by the governments. This occurrence led to a broad discussion of economic policy in Brazil, which culminated in the Complementary Law No. 101/2000 - Fiscal Responsibility Law (FRL), which establishes at the national level, parameters to be followed regarding the public spending of each federative entity (states and municipalities) Brazilian. Several public finance norms related to fiscal management were implemented through the Law, among them the definition that the Liquid Current Expenditure (LCE) cannot exceed the Liquid Current Revenue (LCR) in 200%, being this considered the "acceptable" limit within the new norm. It is worth noting that this metric is considered one of the parameters used to allow or not the entry of a Federative Unit in the FRR, as can be seen below.

| Year | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|
| GDP | 574.884.973 | 628.226.069 | 671.076.844 | 659.138.952 |

| Year | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| GDP | 640.401.206 | 671.605.668 | 758.859.047 | 779.927.917 |

Source: IBGE

**TABLE 1.1** – Gross Domestic Product at current prices, in thousands of reais, 2012-2019, Rio de Janeiro

It can be observed that in the midst of the deterioration of the fiscal balance of the Brazilian states, the state that reached the most worrying scenario was Rio de Janeiro, in which the ratio of liquid current expenses to liquid current revenue reached the highest level among the Federation units, exceeding the limit imposed by the Complementary Law no. 101/2000 - Fiscal Responsibility Law (FRL), which establishes, in a national regime, parameters related to public spending of each Brazilian federative entity (states and municipalities) to be followed. In this context, the discussion was directed to the entry of the state of Rio de Janeiro into the Fiscal Recovery Regime (FRR).

> No período entre 2015 e 2016, houve redução de 9,5% de receitas próprias em decorrência da crise econômica e de 2% das transferências oriundas da União. Além disso, no biênio 2015-2016 ocorreu a diminuição da arrecadação tributária de 17 estados da federação; dentre estes, Rio de Janeiro, Rio Grande do Norte e Espírito Santo apresentaram um arrefecimento na arrecadação superior a 10%. Os quatro estados do Grupo 1 (São Paulo, Rio de Janeiro, Minas Gerais e Rio Grande do Sul), que concentram o maior estoque de dívida, apresentaram resultados negativos na arrecadação tributária, o que comprometeu significativamente a estabilidade das finanças dessas unidades federativas.
>
> In the period between 2015 and 2016, there was a reduction of 9.5% in own revenues due to the economic crisis and 2% in transfers from the Union. In addition, in 2015-2016 there was a decrease in tax collection in 17 states of the federation; among them, Rio de Janeiro, Rio Grande do Norte, and Espírito Santo showed a decrease of more than 10%. The four states in Group 1 (São Paulo, Rio de Janeiro, Minas Gerais and Rio Grande do Sul), which concentrate the largest stock of debt, showed negative results in tax collection, which significantly compromised the stability of the finances of these federative units. (TORREZAN e PAIVA, 2021, p. 720)

Despite the state's entry into the FRR, Rio de Janeiro remained constantly in a low economic recovery, with the level of employment (table 1.2), establishments (table 1.3) and of its revenues not reaching results that could be interpreted as a recovery of previous capacities. An important issue to be pointed out is that, in addition to the above, the limitation of public spending was imposed in order to cope with the perceived fiscal imbalances, which was based

on the belief that the imbalances could be solved with a measure of limitation and penalty, a belief that is currently undergoing certain questioning.

> The debate over the deterioration of states' finances returned to the agenda of federal renegotiations in the 2015-2016 biennium. Mistakenly, the basic element for this discussion would be the fiscal and financial interference, which culminated in the deterioration of subnational public finances and the growing accumulation of liabilities. The strong economic slowdown between 2014 and 2017 would have been the trigger for the manifestation of these problems. The misunderstanding raised concerns the fact that the causes and consequences should be understood from a federative perspective and the solutions agreed on the basis of a cooperative federalism, not only scrutinized under the rigor of budgetary and accounting adjustment.. (TORREZAN e PAIVA, 2021, p. 720)

| Ano | Industry | Civil Constr. | Commerce | Services | Agropecuary | Total |
|---|---|---|---|---|---|---|
| **2013** | 20957 | 10576 | 104797 | 138742 | 7082 | 282154 |
| **2014** | 21269 | 11291 | 105948 | 142176 | 7167 | 287851 |
| **2015** | 20962 | 10986 | 105027 | 144206 | 7113 | 288294 |
| **2016** | 20237 | 9917 | 102993 | 144166 | 6887 | 284200 |
| **2017** | 19369 | 8938 | 100458 | 142508 | 6922 | 278195 |
| **2018** | 18622 | 8287 | 98386 | 141699 | 6730 | 273724 |
| **2019** | 17925 | 8300 | 94996 | 139279 | 6309 | 266809 |
| **2020** | 17337 | 8127 | 92633 | 136230 | 6018 | 260345 |

Source: RAIS/CAGED

**TABLE 1.2** - Number of Establishments by Major Sector IBGE, 2013-2020, Rio de Janeiro

| Ano | Industry | Civil Constr. | Commerce | Services | Agropecuary | Total |
|---|---|---|---|---|---|---|
| **2013** | 579507 | 300096 | 878036 | 2805399 | 23752 | 4586790 |
| **2014** | 583239 | 301354 | 891489 | 2840367 | 24931 | 4641380 |
| **2015** | 529768 | 261811 | 870248 | 2763232 | 23800 | 4448859 |
| **2016** | 476672 | 183392 | 841106 | 2635028 | 23283 | 4159481 |
| **2017** | 457035 | 155923 | 820833 | 2588243 | 22702 | 4044736 |
| **2018** | 443566 | 152237 | 814555 | 2584254 | 22869 | 4017481 |
| **2019** | 446271 | 154604 | 793940 | 2543185 | 22365 | 3960365 |
| **2020** | 433974 | 147854 | 762902 | 2400365 | 21942 | 3767037 |

Source: RAIS/CAGED

**TABLE 1.3** - Number of employment ties by major sector IBGE, 2013-2020, Rio de Janeiro

During the Regime, many questions were raised given the non-recovery of the state, and glimpsing the worrisome scenario of the fiscal crisis that Rio de Janeiro finds itself in, the fiscal recovery outlook does not look very promising. At the same moment, after the economic slowdown of the period from 2014 to 2016, while the state's GDP recovered, the same did not occur with its revenues and given the austerity measures of the Regime. The equivalent

occurred with the expenditures in the capital expenditure account; It can be seen that, from 2017 on, these expenditures presented one of the lowest levels in relation to the state revenues, this is due to the decrease in two of its sub-accounts, investment expenditures and debt amortization expenditures, as shown in table 1.4.

| no. | Expense Type | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| **1** | **Personnel Expenses and Social Charges** | 20.850,56 | 20.743,75 | 22.132,16 | 23.031,89 |
| **2** | **Interest and debt costs** | 2.931,17 | 3.232,68 | 3.834,76 | 2.729,72 |
| **3** | **Other Current Expenses** | 37.753,07 | 40.521,20 | 29.815,36 | 30.381,18 |
| **4** | **Capital Expenditure** | 10.128,36 | 11.206,66 | 10.195,75 | 4.689,25 |
| 4.1 | Investment Expenses | 7.078,10 | 7.666,20 | 6.701,74 | 2.674,28 |
| 4.2 | Expenses with Financial Investments | 217,45 | 90,26 | 43,30 | 28,03 |
| 4.3 | Debt Amortization Expenses | 2.832,81 | 3.450,20 | 3.450,71 | 1.986,95 |

| no. | Expense Type | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| **1** | **Personnel Expenses and Social Charges** | 41.992,72 | 44.338,00 | 45.032,52 | 43.799,76 |
| **2** | **Interest and debt costs** | 901,55 | 116,46 | 128,36 | 385,35 |
| **3** | **Other Current Expenses** | 23.142,45 | 20.204,02 | 19.709,39 | 18.829,11 |
| **4** | **Capital Expenditure** | 1.928,83 | 2.040,47 | 2.080,78 | 1.511,35 |
| 4.1 | Investment Expenses | 1.010,95 | 1.562,63 | 1.030,04 | 964,23 |
| 4.2 | Expenses with Financial Investments | 17,64 | 12,43 | 254,18 | 96,17 |
| 4.3 | Debt Amortization Expenses | 900,24 | 465,41 | 796,56 | 450,95 |

Source: Siconfi

**TABLE 1.4** – Expenditures at current prices, in millions of reais, 2013-2020, Rio de Janeiro

With respect to the expenses incurred by the State of Rio de Janeiro, it should be noted that the change in the account "Personnel Expenses and Social Charges" and the account "Other Current Expenses", present a significant change from 2016 to 2017, not necessarily because of the FRR, but because of an accounting change, in 2017, in which there was a change of criteria to adapt to the MCASP - Fiscal Year 2017 - 7th edition, item 4. 2.4.3, which classifies the social security expenses of "retirement, pensions, and retirements" in the group "Personnel Expenses and Charges", however, until 2016, these were classified under "Other Current Expenses". Also under "Other Current Expenses", in compliance with Determination no. 4 of TCE Case no. 102.203/16, the classification of the Assignment of Royalties Rights as expenses in the current year was changed, which until 2016 was classified as a revenue deduction.

In the capital expenditures account, we see that the investment expenditures account has dropped dramatically, while in the first three years it was around 7 billion, in the last years it was around 1 billion, representing a drop of about 6 billion, or 86%. The amortization

expenses account, as was to be expected, with the exemptions made available by the union, these expenses have reduced considerably, going from a value of about 3 billion to 450 million in the year 2020. As the capital expenditures account has not undergone any accounting changes so far, we can interpret the results as resulting mainly from the decisions regarding the strategies promoted by the FRR. And to demonstrate the structural change in the capital expenditure account, we can see the change in the proportion of the account in relation to intra and extra-budgetary current revenues, as shown in table 2.5. In 2016 the state is already experiencing a contraction of the account, however, from 2017 capital expenditures plummeted to a level around 2%.

In this sense, it is known that the use of economic incentive instruments to influence results in a given region is a recurrent strategy in government development policies, whether at the national or regional government level. Therefore, the study starts from the assumption that well-structured investments are able to assist the State of Rio de Janeiro in its fiscal recovery, especially when taking into account the indirect effects generated in the economy through these government investments, contrary to the approach implemented by the formulators of the Fiscal Recovery Regime, which focused essentially on a strategy of spending cuts.

Specifically, the hypothesis of this work considers that the expenditures in the investment expenditure account, in the capital expenditure account, play a key role in economic growth, since these expenses, when well structured, have great potential to lead to positive indirect effects, i.e., effects that offset the amount initially spent. Therefore, the question that arises is whether the exacerbated decrease in these expenditures that occurred in the face of the FRR austerity measures, as presented in table 1.4, incurs significant losses for the federal unit of the SRJ and for the rest of Brazil, or whether this fiscal recovery strategy imposed by the FRR is leading the state to the correct path to fiscal recovery, despite its unimpressive results of fiscal recovery, as detailed.

For an evaluation such as this, a model capable of interpreting all the effects, direct and indirect, of a policy of increased public spending is needed, in a way that comprehends the widest possible range of complexity of economic interaction. In other words, in short, we need a model that takes into consideration not only the direct effects of an increase in spending, such as the consumption of certain goods by the government, but also its indirect effects, such as the effects of increased income of households and producers, on the budgets of economic agents and on price changes in the economy, as well as the effects of these changes on maximizing

the utility of consumers and the income of producers, and then all the changes in tax collection given this new rearrangement of the economy.

Aiming to meet this demand, the present work develops an interregional computable General Equilibrium (CGE) model for the state of Rio de Janeiro, B-MARIA-RJ (Brazilian Multisectoral And Regional/Interregional Analysis for Rio de Janeiro), which uses as a basis the line of models initiated in the B-MARIA (Brazilian Multisectoral And Regional/Interregional Analysis) presented in the work of Haddad (1999), specifically using the interregional CGE model BM-MX (Haddad, 2020). The BM-MX model is a fully operational interregional computable general equilibrium model for Mexico designed for policy analysis. The model is structurally calibrated for 2013; a rather complete data set is available for that year for the estimation of the interregional input-output database, facilitating the choice of the base year (Haddad et al., 2020). The BM-MX model was developed in 2019 by The Regional and Urban Economics Lab at the University of Sao Paulo - NEREUS, Brazil, Instituto de Investigaciones en Medio Ambiente Xavier Gorostiaga, S.J. / Ibero, Puebla, Mexico and Centro ITAM de Energía y Recursos Naturales, Mexico. Research Team: Eduardo Amaral Haddad, Coordinator (USP); Inácio Fernandes de Araújo (USP), Maria Eugenia Ibarrarán (IIMA), Roy Boyd (IIMA), Alejandra Elizondo (IIMA), Pedro Liedo (CIERN), Mariana Menchero (CIERN) and Juan Carlos Belausteguigoitia (CIERN).

Throughout this paper, a simulation in the B-MARIA-RJ model will be presented and performed, aiming to interpret recent events regarding the reduction in spending committed by the government of the state of Rio de Janeiro (SRJ). In this scenario, the general objective of this work is to help evaluate the existing impacts, given the austerity measures implemented during the FRR. Specifically, it seeks to evaluate whether the spending of the state government of Rio de Janeiro, not made because of this Regime, is reflected in significant losses for the state government and the rest of the country, especially in the level of revenue.

The expected contributions, besides presenting a CGE model for the state of Rio de Janeiro and encouraging debate about the FRR, focus mainly on being able to assist the action strategy of the state of Rio de Janeiro and the FRR formulators in making decisions regarding the fiscal recovery of the Rio de Janeiro government. It is believed that the Regime has a large scope and that many issues need to be elaborated and debated, since it covers many other themes. However, in relation to the expenses committed by the state government, specifically, with the drop in investment expenses, it is expected to have results that clarify which is the best way for the state to recover.

## 2. Method and Database

The evaluation of public policies regarding the FRR for Rio de Janeiro presents itself as an arduous task, in which the various consequences of a possible definition of the regime's decision-making plan on the economy must be evaluated. To this end, an analytical framework capable of providing information with the highest level of understanding of economic interactions and their indirect effects is necessary, which the framework referring to CGE modeling proves capable of.

A partial equilibrium analysis, for the evaluation of questions of great amplitude and economic complexity, may lead to premature and even biased conclusions. In large part, this is due to the fact that a partial equilibrium analysis excludes the feedback effects associated with the endogenous adjustment of demand and supply curves of economic agents when a certain economic change occurs, as pointed out by Porsse (2005). In contrast, a general equilibrium analysis has the ability to provide this information of indirect effects, imperceptible in partial evaluations and necessary to better guide the decision-making of policy agents. Thus, a CGE model presents itself as the most adequate to verify a recovery in the level of capital expenditures (capital account) of the state government of Rio de Janeiro.

This dimension of analysis capability of Computable General Equilibrium models is related to the fact that these models strive to describe all parts of an economy and the interactions among the participants, simultaneously, as Burfisher (2016) states, "A computable general equilibrium (CGE) model is a system of mathematical equations that describes an economy as a whole and the interactions among its parts". Mechanisms are introduced that range from the firm's behavior in choosing input and output levels that maximizes the efficiency of firms, given the costs of inputs, their selling prices, and the technological constraints of their production processes, to the utility-maximizing behavior of consumers, which is at the mercy of their budget constraint. Finally, the model links all these issues to the macroeconomic behavior of an economy, from changes in the Gross Domestic Product (GDP), savings and investment, as well as the trade balance of the region under study and the fiscal revenues and expenditures of governments, keeping everything in an equilibrium system.

The CGE models are considered for the entire economy since they describe the fundamental principles of the actions of all producers and consumers in a given economy, as

well as the interactions between these agents, representing the behavior of firms' demand for inputs, hiring labor, and acquiring capital equipment. In this sense, it can be stated that the wealth of information obtained is related to the circular flow of income integrated in these models. This circular flow exposes the interrelationships between the agents in the model, especially when observed from the revenue and expenditure side (BURFISHER, 2016).

The CGE models developed for the Brazilian economy are diverse, ranging from models focusing on international economics to models focused on evaluating regions of the national territory. With regard to works that deal with fiscal issues, we can cite the work of Sousa (1993), who uses a CGE model of the Brazilian economy, using as base year the year 1980, from the Input-Output Matrix (IPM) , to measure different tax reform alternatives, observing the tax area from the perspective of protection structures. Fochezatto (2002), which presents a prototype regional CGE model, for the analysis of national and regional economic policies. This study (FOCHEZATTO, 2002) tests the validity of the model by simulating and analyzing the results of the economic impacts of a tax policy of restructuring the tax matrix, proposed by the government of the Brazilian State of Rio Grande do Sul.

Domingues and Haddad (2003) are another work of great significance for this topic. In order to quantitatively evaluate the endogeneity of the tax base in terms of changes in relative prices and input substitution at the sectoral and regional level, they developed the B-MARIA-SP model, which can evaluate the effects of changes in the tax system for the endogenous regions of the state of São Paulo and the rest of Brazil, using a 1996 database. The study by Porsse (2005), on the other hand, presents the inter-regional CGE model for the Brazilian economy, the B-MARIA-RS (Brazilian Multisectoral and Regional/Interregional Analysis for Rio Grande do Sul), which contains two integrated regions, Rio Grande do Sul and the Rest of Brazil, and the data used for calibration refer to the year 1998, to analyze the economic effects of regional tax competition. Besides these works, following the same CGE theme for tax analysis, without exhausting the subject, one can mention Fochezatto (2005), Lledo (2005), Santos (2006) and Braatz et al. (2015).

### 2.1 – Metodologia

A CGE model organizes in a computational structure the set of interdependence relations among the markets of an economic system from a referential equilibrium base

(benchmark), so that one can measure changes in endogenous variables for a new equilibrium generated by some exogenous change in the system (Porsse, 2005).

Following the representation elaborated by Dixon et al. (1992), one can exemplify the operation of a CGE model in the following way: considering that the equilibrium of a CGE model is found in a vector V, of length n, that gathers information about quantities, prices, taxes, parameters and technological coefficients, and that satisfies a system of equations

$$F(V) = 0 \tag{3.1}$$

where **F** is a nonlinear vector function of length m, which describes economic relationships representing the behavior of agents in the system (firms, households, government, and the external sector), as well as the equilibrium equations for the goods, labor, and other markets in the model. It is assumed that **F** s differentiable and that the number of variables, n, exceeds the number of equations m (**n>m**). Using function (3.1), consumer demands will be viewed as arising from utility maximization with budget constraint, zero profits will apply, and demands will equal supplies. In the same function, preferences and technologies are represented by differentiable utility and production functions.

Since the system represented by the function (3.1) can be very large and involve a wide variety of nonlinear functional forms, this can make the system computationally intractable. It is in this situation that linearization comes in with a key role. According to Johansen's (1960, apud Dixon et al. 1992) approach, this derives the function (3.1) into a system of linear equations, where the variables are percentage changes or changes in logarithms of the components of **V**.

Moving on to the more computational part, using the synthesis elaborated by Porsse (2005), to understand the system in terms of calibration. Given the initial solution **V***, a new solution of the system can be defined from exogenous perturbations. Consider **Y** and **X** the vectors of endogenous and exogenous variables, respectively, with **Y**, **X**∈**V***, which enables us to rewrite the system described in (3.1) as:

$$F(\boldsymbol{Y}, \boldsymbol{X}) = 0 \tag{3.2}$$

Considering the initial solution and applying full differentiation to (3.2), one has:

$$F_{\boldsymbol{Y}}(\boldsymbol{V}^*)d\boldsymbol{Y} + F_{\boldsymbol{X}}(\boldsymbol{V}^*)d\boldsymbol{X} = 0 \tag{3.3}$$

Solving the system (3.3) for dY gives:

$$d\boldsymbol{Y} = \boldsymbol{B}(\boldsymbol{V}^*)d\boldsymbol{X} \tag{3.4}$$

Where:

$$\boldsymbol{B}(\boldsymbol{V}^*) = -F_{\boldsymbol{Y}}^{-1}(\boldsymbol{V}^*)F_{\boldsymbol{X}}(\boldsymbol{V}^*) \tag{3.5}$$

It is assumed that $-F_Y^{-1}(\boldsymbol{V}^*)$ exists. Solutions can be obtained in the form of rates of change by expressing d**Y** and d**X** as small percentage changes.

Since $\mathbf{B}(\boldsymbol{V}^*)$ is a matrix of the first-order partial derivatives of F, obtained via linear approximation, the calculated solutions to the system also consist of an approximation of the "true" solution. This specificity of solving the system is recognized as linearization errors. There are some numerical integration methods with step resolutions that can reduce the range of these errors, leading to more accurate results.

To finish the more technical description of a CGE model, we should point out that it essentially consists of a set of commands that define, according to the database, the sets (i,j,n,k) and the parameters existing in the model (such as the elasticities, which is one of the two components of the database), as well as the endogenous and exogenous variables and the economic equations of the model.

In this way, the existing mechanism through the system developed in a CGE model proves to be wide-ranging, being able to point out how changes in demand and/or supply of a given good can lead to changes in employment and wages, and thus in income and household spending, also contributing to changes in the prices of other goods and services in the economy, such as inputs used in the good under analysis, as well as the price of competing products, paying attention to the fact that CGE models also take into account the demand of all the other agents in the economy, such as the government, investors, and the foreign market.

### 2.2 – Modelo B-MARIA-RJ

The model presented in this paper, B-MARIA-RJ (Brazilian Multisectoral And Regional/Interregional Analysis for Rio de Janeiro), is based on an inter-regional CGE model in order to evaluate two regions, the rest of Brazil and the state of Rio de Janeiro. This, specifically, is based on the interregional CGE model for Mexico (BM-MX Interregional CGE Model for Mexico), made available by the NEREUS (*Núcleo de Economia Regional e Urbana da Universidade de São Paulo*), corresponding to the work of Haddad (2020). The model follows the line of those developed from the B-MARIA model (Haddad, 1999) - Brazilian Multisectoral And Regional/Interregional Analysis.

B-MARIA-RJ was calibrated from the database made available in the Population Arrangement files for the state of Rio de Janeiro, in the year 2015. Moreover, to complete the calibration, it was necessary to complement the database in 3 points: first, the regions "Municipality of Rio de Janeiro", "Rest of the Population Arrangement of Rio de Janeiro" and "Rest of Rio de Janeiro" were aggregated to form the region that corresponds to the "State of Rio de Janeiro". The region corresponding to the "Rest of Brazil" was kept; the second point, adds specific data of the committed expenses of the state of Rio de Janeiro for the year 2015, made available by SICONFI; the third, used sectoral adaptations of the elasticities of the B-MARIA-RS model (PORSSE, 2005).

The B-MARIA-RJ model is an inter-regional bottom-up CGE model for comparative statics simulations, with amplitude of two regions, the state of Rio de Janeiro (SRJ) and the Rest of Brazil. The greater detailing of expenditures for the region corresponding to the state of Rio de Janeiro makes the simulations directed to this region capable of providing relevant information for the effects of shocks on expenditures in the state, in the same way that it has the ability to demonstrate the effects on the rest of the country. Transactions with foreign countries are modeled from transactions with a single foreign region. In the model are 22 sectors and 22 commodities, corresponding to table 3.1.

B-MARIA-RJ presents three primary inputs, capital, labor and other costs, and also presents seven use categories: intermediate consumption, investment demand, household consumption, exports, consumption by the Rio de Janeiro state government, consumption by the Federal Government and other governments, and changes in inventories. The model works with two margins, transportation and trade, and adopts the assumption of perfect competition in all markets. The data used to calibrate the model refer to 2015.

The central part of the model is in the absorption matrix, the module that encompasses the transaction flows of the six user categories, the intermediate consumption and final demand, as well as the remuneration of the production factors. The main structural observation of this module is in BAS5 and BAS6, in which the first refers only to the demand of the Rio de Janeiro State government and the second refers to the demand of the federal government and other States and municipalities governments.

| | Sectors | | Sectors |
|---|---|---|---|
| 1 | Agriculture | 12 | Communication |
| 2 | Cattle Raising | 13 | Financial Activity |
| 3 | Food Production | 14 | Furnish Activity |
| 4 | Machines and Equipment | 15 | Scientific Activity |
| 5 | Other Industries | 16 | Administrative Activity |
| 6 | Electricity | 17 | Public Management |
| 7 | Water | 18 | Education |
| 8 | Construction | 19 | Health |
| 9 | Commerce | 20 | Arts and Culture |
| 10 | Transportation | 21 | Other Services |
| 11 | Lodging | 22 | Domestic Services |

Source: Own Elaboration

**TABLE 2.1** – B-MARIA-RJ Modelo Sectors

Referring to the demand of the governments in the B-MARIA-RJ model, this is segmented into two spheres: one comprising the Rio de Janeiro State government, understood as the regional sphere, and another comprising the other governments of the country (federal government, other state governments, and the municipal governments of Brazil).

With regard to the behavior of government demand, the consumption of public goods by governments is determined by a constant proportion of private regional consumption, in the case of the Rio de Janeiro State government, and of private national consumption (aggregate of the other regions of the country), in the case of the others. On the other hand, the behavior of governments with regard to their productive activities, in their state-owned companies, is understood as a cost-minimizing behavior, occurring in a similar way to the optimization decisions of the private sector.

The model operates with only one configuration for comparative statics exercises, allowing only short-term economic policy simulations. It is worth noting that this structure allows the inclusion of another configuration for comparative statics exercises (long run),

through definitions of the relationship between investments and capital stock, defined in the capital accumulation and investment module.

The model closures for the simulation performed considered the regional population and wages to be fixed (meaning that changes in the demand for labor will be adjusted through the level of employment), where variables related to population and wages are exogenous. Since the model is only set up for short-term comparative statics exercises, no adjustments through labor migration between the two regions in the model will occur in the simulations performed.

Besides this there are several exogenous variables in the model, and with the intention of demonstrating some possibilities for simulations, one can highlight other exogenous variables, such as consumer tastes, the current capital stock, in the same way as the variables related to the demand of the government of the state of Rio de Janeiro, variables that make it possible to carry out a simulation of the impact on the increase in government spending.

As a numeraire, the chosen price variable was the exchange rate (natphi), which means that the evaluation of an exchange rate policy is not able to obtain information about trade surplus or inflation target, since it is not possible to define exchange rate policy by exogenous or endogenous form.

After calibrating the model and defining the numeraire, a test was performed to check for possible computational and database balancing errors. A homogeneity test was implemented by means of a 1% shock to the model's numeraire (exchange rate). The expected result is that all nominal variables increase by 1%, and all other variables (real variables) remain unchanged. The results of this test, for model B-MARIA-RJ confirmed the homogeneity in the model.

It is worth mentioning that all the model operationalization is implemented by means of the GEMPACK software, and the simulations were performed by means of the Gragg method (PORSSE, 2005). The Gragg method, used to treat the problem of linearization errors, consists of dividing the exogenous shocks into p+1 equal parts, calculating the results at each step following Johansen's approach. The Gragg method considers the previous starting point, to define the direction of the correction to reach the solution (PORSSE, 2005).

Specifically, for the evaluation of changes in revenue, from the work of Haddad (1999), one can say that Total Revenue is equal to indirect taxes, plus direct taxes, plus interest received, plus federal transfers between regions, and plus other revenues. However, in this

model (B-MARIA-RJ), only the collection of indirect taxes is found. Thus, identifying the total tax collection generated by a given shock is impractical with B-MARIA-RJ, but the indirect tax collection is completely available from its results. And taking into account the statement by Siqueira et.al (2001), stating that "In Brazil, indirect taxes account for more than half of the total tax revenue", it is believed to be possible to obtain promising results for the question of the paper through answers about indirect revenue.

For the implementation of the simulation, a shock was performed in which it was assumed that the government of Rio de Janeiro would increase its expenditures by 267.5 million, such shock was applied to variable x5a (regional government demand), directed only to the region of the state of Rio de Janeiro, in 4 distinct sectors; with a 30% shock on the Other Industries sector, another of 80% on the Communication sector and two more shocks of 1% on the Education and Health sectors. In the next chapter we can verify the results of these shocks.

## 3. Results

The result of these shocks relative to the benchmark (represented in Annex), on state government demand follows the sectoral distribution expressed in table 4.1, corresponding to a total increase in state government demand of 267.5 million. These values can also be acquired by subtracting the MDATA UPDATE by the MDATA benchmark (Annex 5).

| Sectors | Variation Generated | % Change |
|---|---|---|
| Agriculture | - 15.045,00 | 0,00% |
| Cattle Raising | - | 0,00% |
| Food Production | - | 0,00% |
| Machines and Equipment | - | 0,00% |
| Other Industries | 59.688.629,00 | 30,09% |
| Electricity | - | 0,00% |
| Water | 201.446,00 | 0,04% |
| Construction | 1.239.747,00 | 0,03% |
| Commerce | 250.336,00 | 0,07% |
| Transportation | 989.746,00 | 0,02% |
| Lodging | 89.600,00 | 0,03% |
| Communication | 60.802.436,00 | 80,51% |
| Financial Activity | 6.067.383,00 | 0,07% |
| Furnish Activity | - | 0,00% |
| Scientific Activity | 113.251,00 | 0,04% |
| Administrative Activity | 9.174,00 | 0,04% |
| Public Management | 12.992.188,00 | 0,04% |
| Education | 66.578.125,00 | 1,04% |
| Health | 58.354.004,00 | 1,09% |
| Arts and Culture | 64.393,00 | 0,04% |
| Other Services | 130.219,00 | 0,14% |
| Domestic Services | - | 0,00% |
| Total | 267.555.632,00 | |

Source: Own Elaboration

**TABLE 3.1 –** Sectoral Distribution of the Demand Shock in the Rio de Janeiro State Government

The 267.5 million expansion occurred in variable xa5, corresponding to the demand of the Rio de Janeiro state government (see Annex 3 and 4), implemented by means of the Gragg method (PORSSE, 2005) to correct the linearization errors, the results were obtained in percentage variation rates. In order to facilitate visualization, some of the data presented will also be in monetary values.

In the results on GDP that follow, to generate the monetary results from the percentage variations, we used the GDP at current prices for the year 2015, through the SIDRA (*Sistema IBGE de Recuperação Automática*), where the GDP for the state of Rio de Janeiro was 659.14 billion, and for Brazil it was 5,995.79 billion (Rest of Brazil, GDP of 5,336.65). In summary, the effects on the real GDP, in total, are positive, despite a loss for the Rest of Brazil. As expected, the result within the federative unit is expressive, totaling an increase of 110.5 million, given that the expenditures made have caused a great impact within the internal structure of the state, and that through indirect effects caused in the interaction between the

economic sectors of the regions, this result has been formalized. The interesting finding is shown when the balance in the state is positive, but in the rest of the country there is a significant loss, which corroborates the model's structure, which considers the effects of the increase in prices of goods, given the increase in their demand. In this case, it can be said that the increase in the state government's demand for goods, raised the price in sufficient magnitude, so that, considering the maximizing behavior of the economy and its restrictions, the GDP of the rest of the country faced a loss of 11.53 million. Despite this, it can be said that the total GDP of the country achieved an increase of 98.95 million.

| Region | | GDP | % |
|---|---|---|---|
| **SRJ** | | 110.478.279,74 | 0,0168 |
| **Rest of Brazil** | - | 11.527.159,78 | -0,0002 |
| **Total** | | 98.951.119,96 | |

Source: Own Elaboration

**TABLE 3.2 –** Result in Gross Domestic Product of the State of Rio de Janeiro and Rest of Brazil in 2015 Values

Below can be seen the percentage variation in the total level of employment in the Brazilian economy. It is expected that jobs would move more towards the region (SRJ) and towards the sectors where government spending was directed, and in the results this occurs explicitly, where the state obtained the highest results, as well as the sectors that received the shocks are among those that showed the most increase in employment. However, one can see that for the rest of Brazil, in most sectors, it presents personnel losses, following the same trend that occurred in the GDP scenario. And since the model has no adjustment by means of a change in migration, it is understood that the decrease in employment in the sectors represents either a transition of employment between sectors in a region (sectorial reallocation of labor in the search for maximization), or layoffs, due to the need for some sector to adapt to a new budget constraint.

Specifically, in SRJ, the Other Industries sector presented the twelfth largest result, with an increase of 0.01%, while the Communications sector, with the fourth largest result, presented an increase of 0.026% and the Education and Health sectors presented the largest results, 0.177% and 0.204% respectively. It can be observed that the Other Industries sector, despite suffering an incentive similar to the others, presented the worst result in terms of employment when compared to the other encouraged sectors, which indicates that this sector

presents itself as more capital-intensive than its peers. The domestic services sector presented the third highest result, with a variation of 0.0262%, which means that in terms of employment, this sector, among the non-encouraged sectors, was the one that benefited most from the shocks generated. In the aggregate, the unemployment level faced a change of 0.04948% in SRJ and -0.0007% in the rest of Brazil.

| Sectors | State of Rio de Janeiro | Rest of Brazil |
|---|---|---|
| Agriculture | -0,0019 | -0,0028 |
| Cattle Raising | -0,0028 | -0,0026 |
| Food Production | 0,0021 | -0,0096 |
| Machines and Equipment | -0,0018 | -0,0025 |
| Other Industries | 0,0106 | -0,0010 |
| Electricity | 0,0124 | 0,0064 |
| Water | 0,0166 | 0,0072 |
| Construction | 0,0063 | -0,0002 |
| Commerce | 0,0194 | 0,0005 |
| Transportation | -0,0037 | -0,0035 |
| Lodging | 0,0124 | -0,0003 |
| Communication | 0,0259 | 0,0046 |
| Financial Activity | 0,0070 | -0,0008 |
| Furnish Activity | 0,0196 | 0,0079 |
| Scientific Activity | -0,0306 | -0,0178 |
| Administrative Activity | 0,0126 | -0,0002 |
| Public Management | 0,0001 | -0,0002 |
| Education | 0,1770 | 0,0009 |
| Health | 0,2048 | 0,0044 |
| Arts and Culture | -0,0029 | -0,0049 |
| Other Services | 0,0123 | 0,0003 |
| Domestic Services | 0,0262 | 0,0025 |

Source: Own Elaboration

**TABLE 3.3** – Percentage Variation in Employment by Sector

It should be noted that there are several factors within the model that can influence the level of employment. Among them, one should mention the real salary of workers, deflated by CPI, for the state of Rio Grande do Sul decreased by 0.01853%, while for the rest of Brazil it increased by 0.02082%. This information is not at the sectoral level, however, it corroborates with the increase in the level of employment in SRJ, since, given the decrease in wage costs in SRJ, the trend is for an increase in the level of employment in the region, while with the opposite, the trend is for a decrease. However, this should be, in the most optimistic way, interpreted as a facilitator for increased employment in the SRJ, not the reason.

The model does not contain a framework capable of exposing changes in the level of economic establishments, but it does present information about changes in economic activities, which can serve as an indicator similar to the one presented in chapter 1, table 1.2. Turning to the results of economic activity, as can be seen in table 3.4, one sees in all sectors and regions, a strong similarity with the results of the level of employment, expressed in table 3.3, which, as expected, represents a strong correlation between the level of activity and employment in the sector. Dealing with the results, the tenth most benefited, the Other Industries sector presented an increase of 0.0045%, while the fourth, the Communications sector had an improvement of 0.014%, while the first and second sectors, the Education and Health sectors presented an increase of 0.169% and 0.163%, respectively. Again the third most benefited sector was Household Services, reinforcing the correlation between the results of table 3.4 and those of table 3.3.

| Sectors | State of Rio de Janeiro | Rest of Brazil |
|---|---|---|
| Agriculture | -0,0005 | -0,0006 |
| Cattle Raising | -0,0007 | -0,0007 |
| Food Production | 0,0009 | -0,0065 |
| Machines and Equipment | -0,0012 | -0,0021 |
| Other Industries | 0,0046 | -0,0005 |
| Electricity | 0,0026 | 0,0011 |
| Water | 0,0054 | 0,0030 |
| Construction | 0,0015 | -0,0001 |
| Commerce | 0,0118 | 0,0003 |
| Transportation | -0,0025 | -0,0020 |
| Lodging | 0,0070 | -0,0002 |
| Communication | 0,0142 | 0,0022 |
| Financial Activity | 0,0040 | -0,0003 |
| Furnish Activity | 0,0005 | 0,0001 |
| Scientific Activity | -0,0155 | -0,0074 |
| Administrative Activity | 0,0099 | -0,0001 |
| Public Management | 0,0001 | -0,0002 |
| Education | 0,1693 | 0,0008 |
| Health | 0,1638 | 0,0032 |
| Arts and Culture | -0,0021 | -0,0028 |
| Other Services | 0,0085 | 0,0001 |
| Domestic Services | 0,0262 | 0,0025 |

Source: Own Elaboration

**TABLE 3.4 –** Percentage Variation in the Level of Economic Activity by Sector

Now, moving on to the evaluation of the governments' acquisition of resources, we see in table 3.5 the increase in indirect tariff revenue by final demand category and region. The scenario shows a total gain in terms of indirect tax revenue of 217.98 million, which means that, if we consider the indirect effects on the economy, government spending, in indirect tax revenues alone, reaches 81.47% of the expenditure of 267.5 million. Specifying, with respect to indirect revenues alone, the gain, with a shock of 267.5 million in government demand, there is a multiplicative effect of these expenditures of 0.815. This value is not fixed and, in other words, if the proportion of the shock and/or the sectoral distribution of the shock changes, by a significant amount, the result can be completely different, both for less and for more.

An important detail, is that the state of Rio de Janeiro is not the biggest beneficiary of this policy, quite the contrary, while the rest of the country would receive most of the increase in revenue generated by the spending undertaken in the territory of Rio de Janeiro, by its government, which presents, through the indirect effects factors in economic interaction, the great dependence of the economy of Rio de Janeiro, to the rest of the country, given that most of the indirect benefits overflowed to other regions. In summary, with these expenditures and this sectoral distribution structure, the state would benefit the rest of the country more than it would benefit itself; in summary, the state, with this shock, would reach a revenue of 58.81 million, while the rest of the country would obtain 159.16 million.

| Indirect Tax | State of Rio de Janeiro | Rest of Brazil | Total |
|---|---|---|---|
| Total | 58.817.859,00 | 159.161.451,67 | 217.979.310,67 |
| On intermediate consumption | 23.942.715,85 | 62.594.475,15 | 86.537.191,00 |
| On the investments | 1.410.493,44 | 8.018.066,92 | 9.428.560,36 |
| On household consumption | 29.128.680,54 | 88.176.280,53 | 117.304.961,07 |
| On Exports | - 862,06 | - 7.238,99 | - 8.101,05 |
| On the consumption of the SRJ govt. | 4.184.455,84 | - | 4.184.455,84 |
| On the consumption of the remaining govt. | 127.351,20 | 377.047,71 | 504.398,91 |

Souce: own elaboration

**TABLE 3.5** – Indirect Tax Gains for the State of Rio de Janeiro and Rest of Brazil

Thus, considering what was stated about the weight of indirect taxes on tax collection in the Brazilian economy in Siqueira et at. (2001), and taking into account that the model does not capture the remaining components of government revenue, it is possible to interpret that the gains in revenue may be greater than the expenditures incurred by the government. Since we can take into consideration that the increase in indirect tax revenues would represent only

50% of the total increase in tax revenues, this would lead to a tax revenue of 435.96 million, representing a multiplier effect of 1.63. However, we cannot affirm that this proportion would extend to this specific case. Thus, going to a conservative conclusion, one can state that it is perfectly possible to increase the state's revenue, given an increase in its spending, as long as one takes into account the indirect effects of these expenditures through a methodology capable of identifying them, providing an analytical framework for strategic planning of economic policies.

It is important to stress, finally, that one cannot use these findings to project different results with a larger increase in government spending, since the model does not have linear results. That is, if we doubled the increase in state government spending from 267.5 to 535 million, the total gain for the regions would not double from 217.97 to 435.94 million. To gather results from another shock, it is necessary to run another simulation in the B-MARIA-RJ model.

When it comes to factors of production, aggregate payments to capital increased by 0.0318% in total (771,339,059.20) and aggregate payments to labor increased by 0.0324% (864,986,314.40). There are many other variations concerning nominal prices, but there is no significant variation in real prices, and in possession of the results presented so far, it is concluded that, for the purpose of the present research, the results exposed are suficiente.

## 4. Final Remarks

During the study, a basic exposition of the FRR was made, its functionalities and possible disadvantages, as well as the description of the B-MARIA-RJ model developed throughout the work, and likewise, the simulation of an increase of 267.5 million in the demand of the Rio de Janeiro state government.

The main point to note is that the main objective of achieving results that prove that an increase in federal government spending can generate increases in tax revenue in the state of Rio de Janeiro was confirmed. Specifically, the indirect taxes presented better than expected results, in which the total collection in the face of an increase in government spending, presents full capacity to exceed the resources directed to the increase in government demand.

In this sense, it is concluded that the current formalization existing in the FRR, at least as far as the high levels of fiscal austerity are concerned, presents itself not only as a "bitter

pill", but a pill that leads to unnecessary irreversible damage. With this, it is necessary that the NFRR, currently in the process of being ratified, take into consideration the indirect effects that occur through government spending. If the FRR is maintained, it is expected that the state will face a long road of fiscal imbalance, low economic growth, and dismantling of the existing economic structure.

It is also hoped that this work can contribute to other research in the area, such as studies that more accurately evaluate which sectoral distribution of spending by the Rio de Janeiro state government leads to greater direct and indirect gains for the Rio de Janeiro and national economies, helping the state to resume its role of assisting in the country's economic growth and development. Another objective is that, based on this work, more work can be done on CGE for fiscal evaluations in the state of Rio de Janeiro. It is believed that this is a powerful tool, with high potential to provide information for economic planning, and it is hoped that this study has enabled the advancement of the use of this tool in the state.

Finally, we hope to be able to assist the decisions of public policy makers regarding the decisions related to the measures committed to the fiscal recovery of the state of Rio de Janeiro, so that those who are committed to this goal, observe the importance of government investments in a certain degree and direction. It is also relevant to point out that, just as unplanned and misallocated expenses can result in a simple waste of public resources, well-directed expenses, with investment purposes in specific sectors and with planning and goals, can not only show considerable results, but can be the difference between stagnation and economic development and growth.

## References


BRAATZ, J.; GONÇALVES, R. R.; PINTO, G. P.; MORAES, G. I. Proposta de reestruturação tributária e orçamentária para o RS – uma análise em Equilíbrio Geral Computável. Perspectiva Econômica, vol. 11, n. 2, p. 95-114, 2015.

BURFISHER, Mary. Introduction to Computable General Equilibrium Models. New York, NY: Cambridge University Press, [2016] | Earlier edition: 2011.

DIXON, Peter; RIMMER, Maureen T. Forecasting and policy analysis with a dynamic CGE model of Australia. Centre of Policy Studies (CoPS), 1998.

DOMINGUES, E. P. Dimensão regional e sensorial da integração brasileira na área livre de comércio das Américas. São Paulo: FEA/USP, 2002, 223 p.

FOCHEZATTO, Adelar. Testando um modelo de equilíbrio geral computável para a economia gaúcha: impactos da reestruturação tributária. In: Encontro de Economia Gaúcha, 1, Ensaios FEE, v. 23, p. 371-398, Porto Alegre-RS, Porto Alegre.
2002.

_____. Modelos de equilíbrio geral aplicados na análise de políticas fiscais: uma revisão da literatura. Análise – Revista de Administração da PUCRS, v. 16, n. 1, 2005.

HADDAD, Eduardo A. Regional inequality and structural changes: lessons from the Brazilian Economy. Ashgate: Aldershot, 1999.

_____. Guide for the BMMX Interregional CGE Modelo for mexico Using Customized RunGEM: (Disponível no site do NEREUS, http://www.usp.br/nereus/wp-content/uploads/BMMX_ICGE_guide_2020_v2.pdf), versão de 13 de janeiro de 2020.

HADDAD, Eduardo et al. Interstate input-output model for Mexico, 2013. Análisis Económico, v. 35, n. 90, 2020.

LLEDO, Victor Duarte. Tax Systems under Fiscal Adjustment: A Dynamic CGE Analysis of the Brazilian Tax Reform. IMF Working Paper, WP/05/142. 2005.

MERCÊS, G.; FREIRE, N. Crise fiscal dos Estados e o caso do Rio de Janeiro. Geo UERJ: v. 31, p. 64-80, Rio de Janeiro, 2017.

PORSSE, A. Competição tributária regional, externalidades fiscais e federalismo no Brasil: uma abordagem de equilíbrio geral computável. Tese (Doutorado em Economia) – Porto Alegre, FEA/UFRGS, 2005.

SANTOS, Cárliton Vieira dos. Política tributária, nível de atividade econômica e bem-estar: lições de um modelo de equilíbrio geral inter-regional. 2006. Tese de Doutorado. Universidade de São Paulo.

SIQUEIRA, Rozane Bezerra de. A Incidência Final dos Impostos Indiretos no Brasil: Efeitos da Tributação de Insumos. Revista Brasileira de Economia: v. 55, p. 513-544, 2001.

TORREZAN, R.; PAIVA, C (2021). A crise fiscal dos estados e o Regime de Recuperação Fiscal: o déjà vu federativo, Revista de Administração Pública. 55 (3): 716-735. Maio.

## Annex

**Annex I** - BAS1 benchmark in millions

| Sectors | UF_RJ | Rest_BR | IMP | Total |
|---|---|---|---|---|
| Agriculture | 2.050,88 | 251.245,25 | 8.856,38 | 262.152,51 |
| Cattle Raising | 80.202,20 | 70.188,00 | 48.053,15 | 198.443,35 |
| Food Production | 2.245,48 | 153.625,61 | 6.632,77 | 162.503,87 |
| Machines and Equipment | 2.574,97 | 172.172,83 | 97.698,13 | 272.445,92 |
| Other Industries | 122.697,37 | 949.126,44 | 226.916,76 | 1.298.740,57 |
| Electricity | 20.461,91 | 164.104,60 | 3.329,99 | 187.896,50 |
| Water | 5.749,15 | 32.525,85 | 8,99 | 38.284,00 |
| Construction | 13.631,48 | 92.190,91 | 601,53 | 106.423,92 |
| Commerce | 32.290,40 | 398.572,59 | 6.827,36 | 437.690,35 |
| Transportation | 42.757,66 | 312.024,42 | 15.834,08 | 370.616,15 |
| Lodging | 7.005,47 | 42.343,47 | 15.735,57 | 65.084,52 |
| Communication | 30.951,53 | 151.578,02 | 9.297,01 | 191.826,57 |
| Financial Activity | 26.090,75 | 285.045,12 | 15.593,17 | 326.729,05 |
| Furnish Activity | 9.416,08 | 66.616,12 | 539,07 | 76.571,27 |
| Scientific Activity | 49.455,37 | 289.615,96 | 76.306,23 | 415.377,56 |
| Administrative Activity | 30.173,96 | 169.891,55 | 5.828,00 | 205.893,51 |
| Public Management | 2.338,52 | 22.767,49 | 76,21 | 25.182,22 |
| Education | 2.252,56 | 11.271,12 | 96,51 | 13.620,19 |
| Health | 2.545,41 | 18.916,71 | 63,22 | 21.525,34 |
| Arts and Culture | 1.457,27 | 5.797,34 | 995,24 | 8.249,85 |
| Other Services | 3.281,75 | 18.462,94 | 3,05 | 21.747,75 |
| Domestic Services | - | - | - | - |
| Total | 489.630,18 | 3.678.082,35 | 539.292,44 | 4.707.004,97 |
| ALL COM | ALL SOURCE | | Sum REGDEST | |

Source: Own Elaboration

**Annex II** – BAS1 Update in millions

| Sectors | UF_RJ | Rest_BR | IMP | Total |
|---|---|---|---|---|
| Agriculture | 2.050,77 | 251.233,85 | 8.856,07 | 262.140,69 |
| Cattle Raising | 80.204,02 | 70.188,02 | 48.053,34 | 198.445,38 |
| Food Production | 2.246,19 | 153.629,06 | 6.632,70 | 162.507,95 |
| Machines and Equipment | 2.575,12 | 172.182,02 | 97.698,45 | 272.455,59 |
| Other Industries | 122.748,20 | 949.264,43 | 226.941,99 | 1.298.954,62 |
| Electricity | 20.468,90 | 164.150,75 | 3.331,42 | 187.951,07 |
| Water | 5.751,85 | 32.536,56 | 9,00 | 38.297,41 |
| Construction | 13.637,01 | 92.211,48 | 601,54 | 106.450,03 |
| Commerce | 32.316,18 | 398.679,72 | 6.828,42 | 437.824,32 |
| Transportation | 42.767,90 | 312.045,73 | 15.834,39 | 370.648,01 |
| Lodging | 7.008,53 | 42.350,39 | 15.739,77 | 65.098,69 |
| Communication | 31.014,79 | 151.749,91 | 9.309,07 | 192.073,77 |
| Financial Activity | 26.109,34 | 285.123,01 | 15.593,66 | 326.826,01 |
| Furnish Activity | 9.421,83 | 66.644,75 | 539,44 | 76.606,02 |
| Scientific Activity | 49.467,98 | 289.669,31 | 76.330,92 | 415.468,22 |
| Administrative Activity | 30.190,08 | 169.938,52 | 5.830,70 | 205.959,30 |
| Public Management | 2.339,67 | 22.772,48 | 76,21 | 25.188,36 |
| Education | 2.253,56 | 11.274,20 | 96,55 | 13.624,31 |
| Health | 2.549,80 | 18.923,95 | 63,27 | 21.537,02 |
| Arts and Culture | 1.457,76 | 5.798,62 | 995,61 | 8.252,00 |
| Other Services | 3.287,17 | 18.468,21 | 3,05 | 21.758,44 |
| Domestic Services | - | - | - | - |
| Total | 489.866,67 | 3.678.834,97 | 539.365,56 | 4.708.067,19 |
| ALL COM | ALL SOURCE | | Sum REGDEST | |

Source: Own Elaboration

**Annex III** – BAS5 benchmark in millions

| Sectors | UF_RJ | Rest_BR | IMP | Total |
|---|---|---|---|---|
| Agriculture | 311,21 | - | - | 311,21 |
| Cattle Raising | - | - | - | - |
| Food Production | - | - | - | - |
| Machines and Equipment | - | - | - | - |
| Other Industries | 198,37 | - | - | 198,37 |
| Electricity | - | - | - | - |
| Water | 477,56 | - | - | 477,56 |
| Construction | 3.784,86 | - | - | 3.784,86 |
| Commerce | 351,42 | - | - | 351,42 |
| Transportation | 5.061,32 | - | - | 5.061,32 |
| Lodging | 265,23 | - | - | 265,23 |
| Communication | 75,52 | - | - | 75,52 |
| Financial Activity | 9.087,33 | - | - | 9.087,33 |
| Furnish Activity | - | - | - | - |
| Scientific Activity | 297,30 | - | - | 297,30 |
| Administrative Activity | 24,66 | - | - | 24,66 |
| Public Management | 34.033,77 | - | - | 34.033,77 |
| Education | 6.371,59 | - | - | 6.371,59 |
| Health | 5.366,08 | - | - | 5.366,08 |
| Arts and Culture | 180,94 | - | - | 180,94 |
| Other Services | 90,89 | - | - | 90,89 |
| Domestic Services | - | - | - | - |
| Total | 65.978,05 | - | - | 65.978,05 |
| ALL COM | ALL SOURCE | | Sum REGDEST | |

Source: Own Elaboration

**Annex IV** – BAS5 Update in millions

| Sectors | UF_RJ | Rest_BR | IMP | Total |
|---|---|---|---|---|
| Agriculture | 311,19 | - | - | 311,19 |
| Cattle Raising | - | - | - | - |
| Food Product | - | - | - | - |
| Machines and | - | - | - | - |
| Other Industr | 258,06 | - | - | 258,06 |
| Electricity | - | - | - | - |
| Water | 477,76 | - | - | 477,76 |
| Construction | 3.786,10 | - | - | 3.786,10 |
| Commerce | 351,67 | - | - | 351,67 |
| Transportatio | 5.062,31 | - | - | 5.062,31 |
| Lodging | 265,32 | - | - | 265,32 |
| Communicati | 136,32 | - | - | 136,32 |
| Financial Act | 9.093,40 | - | - | 9.093,40 |
| Furnish Activ | - | - | - | - |
| Scientific Act | 297,41 | - | - | 297,41 |
| Administrativ | 24,67 | - | - | 24,67 |
| Public Manag | 34.046,76 | - | - | 34.046,76 |
| Education | 6.438,17 | - | - | 6.438,17 |
| Health | 5.424,43 | - | - | 5.424,43 |
| Arts and Cult | 181,00 | - | - | 181,00 |
| Other Service | 91,02 | - | - | 91,02 |
| Domestic Ser | - | - | - | - |
| Total | 66.245,61 | - | - | 66.245,61 |
| ALL COM | ALL SOURCE | | Sum REGDEST | |

Source: Own Elaboration

**Annex V** – MDATA benchmark and update in millions

| Header | Name | MDATA *Benchmark* | MDATA UPDATE |
|---|---|---|---|
| BAS1 | Intermdiate consumption - basic values | 4.707.005,00 | 4.708.067,00 |
| BAS2 | Investment demand - basic values | 1.017.617,00 | 1.017.859,00 |
| BAS3 | Household demand - basic values | 3.413.032,00 | 3.414.129,00 |
| BAS4 | Export demand - basic values | 767.032,00 | 766.916,00 |
| BAS5 | RJ-State government demand - basic values | 65.978,00 | 66.246,00 |
| BAS6 | Federal and other governments demand - basic values | 1.117.915,00 | 1.118.197,00 |
| BAS7 | Change in stocks - for balancing purposes | 20.087,00 | 20.091,00 |
| MAR1 | Demands for margins: user 1 | 31.371,00 | 31.380,00 |
| MAR2 | Demands for margins: user 2 | 4.920,00 | 4.922,00 |
| MAR3 | Demands for margins: user 3 | 34.336,00 | 34.348,00 |
| MAR4 | Demands for margins: user 4 | 3.972,00 | 3.971,00 |
| MAR5 | Demands for margins: user 5 | - | - |
| MAR6 | Demands for margins: user 6 | - | - |
| TAX1 | TAX1 | 364.263,00 | 364.350,00 |
| TAX2 | TAX2 | 51.780,00 | 51.789,00 |
| TAX3 | TAX3 | 422.161,00 | 422.278,00 |
| TAX4 | TAX4 | 99,00 | 99,00 |
| TAX5 | TAX5 | 194,00 | 198,00 |
| TAX6 | TAX6 | 1.883,00 | 1.884,00 |
| LABR | Total regional labor payments, by sector | 2.672.020,00 | 2.672.885,00 |
| CPTL | Total regional capital payments, by sector | 2.424.832,00 | 2.425.603,00 |
| LAND | Total regional land payments, by sector | - | - |
| OCTS | other costs, by sector | 58.749,00 | 58.766,00 |
| MAKE | MAKE table | 10.226.869,00 | 10.226.869,00 |
| TARF | Import tariffs | 50.486,00 | 50.493,00 |
| VALK | Asset value of capital stocks | 13.920.123,00 | 13.923.407,00 |

Source: Own Elaboration