FUNDAÇÃO GETULIO VARGAS
ESCOLA DE ECONOMIA DE SÃO PAULO

BRUNO TEBALDI DE QUEIROZ BARBOSA

MODELLING BRAZILIAN REGIONAL FORMAL LABOR MARKET USING GLOBAL VAR APPROACH

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Dissertação apresentada à Fundação Getulio Vargas - Escola de Economia de São Paulo, como requisito para obtenção do título de Mestre em Economia

Área: Macroeconomia Financeira

Orientado: Prof. Dr. Emerson Marçal

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I DEDICATE THIS PAPER TO

My wife, whose encouragement allowed me to pursue my studies.

My parents, who always believed in me.

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RESUMO

A avaliação das variáveis econômicas é uma parte importante das análises macroeconômicas regionais. No entanto, o aumento da integração dos mercados levou a uma maior interdependência financeira e econômica entre as regiões. Portanto, este artigo usa a metodologia de vetor autoregressivo global (GVAR), que pode enfrentar a maldição da dimensionalidade. Focando no mercado de trabalho brasileiro, tem dois objetivos principais: primeiro, estabelecer um modelo levando em conta as interdependências entre as regiões. Em segundo lugar, estimar a elasticidade regional do emprego em relação à atividade econômica do país. Para este fim, é aplicada a chamada técnica GVAR, que considera as interdependências entre várias regiões e suas dinâmicas temporais em uma estrutura multivariada. O modelo é estimado no nível mesorregional brasileiro, com 137 mesorregiões distintas. O modelo final mostrou-se estável com 128 regiões, 2 relações de cointegração e, e 9 regiões com 1 relação de cointegração. Concentrando-se nas principais regiões brasileiras clássicas (Norte, Nordeste, Sudeste, Sul, Central), estima-se que a região mais sensível é o Sul, seguido pela região Nordeste e Sul, enquanto as regiões Norte e Central não são afetadas. Uma relação de longo prazo também é estimada indicando um crescimento natural de 694 mil empregos por ano no Brasil.

Palavras Chave: GVAR, Global VAR, mercado de trabalho, mesorregiões, emprego, desemprego, elasticidade

ABSTRACT

The assessment of economic variables is an important part of regional macroeconomic analyses. However, increasing integration of the markets has led to greater financial and economic interdependence between regions. Therefore, this paper uses the global vector autoregressive (GVAR) methodology, which can tackle the curse of dimensionality. Focusing in the Brazilian labor market, it has two main objectives: firstly, establishing a model accounting for the interdependencies between regions. Secondly, estimate the regional elasticity of employment in respect to the economic activity of the country. To this end, it is applied the so-called GVAR technique, which considers the interdependencies between several regions and their temporal dynamics in a multivariate framework. The model is estimated at the Brazilian mesoregion level, with 137 distinct mesoregions. The final model proved to be stable with 128 regions, 2 cointegration relationship and, and 9 regions having 1 cointegration relation. Focusing on the classical major Brazilian regions (North, Northeast, Southeast, South, Central) it is estimated that the most sensitive region is the South followed by the Northeast and the South region, while the Northern and Central regions are mostly unaffected. A long-run relationship is also estimated indicating a natural growth of 694 thousand jobs per year in Brazil.

Keywords: GVAR, Global VAR, labor market, mesoregions, employment, unemployment, elasticity

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SUMMARY

1 INTRODUCTION

The evaluation of economic variables such as gross domestic product, inflation, demand, or unemployment is an important part of the macroeconomic analysis, which usually refers to a specific region or country. However, the increasing integration of financial markets has led to greater financial and economic interdependence among regions.

Analyzing the patterns of variables like production, inflation, and interest rates are one of the key features in economic modeling, and a greater level of interdependence between economies requires more adequate modeling. Hence, it is necessary to account for the cointegration between internal variables as well as external variables. Therefore, macroeconomic analyzes must consider the interdependencies observed in regional markets and economies accounting for the domestic variables as well as foreign variables.

Okun's law states that the unemployment rate is associated directly with the actual gross domestic product, with the relationship varying from country to country, and the period under consideration. The Phillips curve, in its turn, also establishes a relationship between the unemployment rate and the change in the inflation rate. Therefore, an estimate of employment and unemployment, and consequently the labor market, is an important task in a macroeconomic analysis.

Thus, at the macroeconomic level, domestic and international market dynamics influence the labor market through many channels such as: productivity, participation rates, and gross domestic product. On the other hand, at the microeconomic level, the labor market can be viewed as the interactions between individual firms and employees. The price set by firms affect the wages of the workers and therefore the number of employed workers. The relationship between labor supply and labor demand influences the hours the employee works and compensation received in wages, salary and benefit, consequently affecting the labor market as a hole.

Therefore, an adequate model of the labor market should not only account for the influence in the macroeconomic level, but also account for the influences in the microeconomic level.

However, when analyzing and organizing data in a microeconomic level, accounting for the interdependences between the various variables, the number of coefficients grow exponentially and the curse of dimensionality arises turning the model unfeasible for estimation through conventional methods.

According to Chudik and Pesaran (2011), two approaches have been suggested to handle the curse of dimensionality: (i) shrinkage of the parameter space and (ii) shrinkage of the data. Chudik and Pesaran (2011) approached the curse of dimensionality by shrinking the parameter space as the number of endogenous variables tends to infinity. In this configuration, the infinite-dimensional vector autoregressive could be well approximated by a set of finite-dimensional small-scale models, and can be estimated separately in a consistent manner, which is the global vector autoregressive (GVAR) model, proposed by Pesaran, Weiner and Schuermann (2004). The GVAR methodology, which account for domestic variables as well as foreign variables, provides a model with not only the temporal effect, but also the regional effect.

Therefore, this paper proposes to use a novel approach for dealing with the curse of dimensionality when modeling the labor market. To use the GVAR methodology to model the labor market at a regional level, accounting for interdependencies among regions as well as among global macroeconomic variables. The GVAR methodology eliminate the curse of dimensionality and provides a parsimonious model for the labor market, and since the all variables are treated as endogenous, the GVAR allows for the global variables to be affected by the regional variables through a feedback channel.

Focusing on the Brazilian labor market, this paper aims at twofold. Firstly, establishing a model for the Brazilian labor market, at a regional level, which accounts for the interdependencies between the Brazilian regions. In order to achieve that, a global vector autoregressive methodology, as proposed by Pesaran, Weiner and Schuermann (2004), is to be used. Secondly, once the baseline model has been established, we estimate the regional elasticity of employment in respect to the economic activity of the country.

Therefore, the labor market was modeled using the GVAR methodology by and the monthly employment and unemployment data from the Brazilian regions. The period of the study was from 2004 through 2016. The analysis of the model lead to the conclusion that the Brazilian Northeast and South region are the most elastic, the Southeast region, the most developed in

the country having an intermediate elasticity while the North and Central region are the least elastic.

This study is divided into sections as follows: section 2 is a brief literature review regarding previous works related to the purpose of this paper; section 3 presents the methodology used in the study; section 4 defines the models used in the paper; section 5 describes the data used with a brief description of sources and characteristics; section 6 reports the results of the study; and section 7 contains the final considerations.

2 LITERATURE REVIEW

This section presents a brief literature review of previous works related to the objective of this paper, as well as theoretical and methodological contributions to the multiple equation in time-series models, primarily the global autoregressive model.

Firstly, focusing on the Brazilian labor market, Oliveira and Carneiro (2001) analyzed the fluctuations in the employment level of several Brazilian states compared to national employment. The purpose of their study was to verify whether it is possible to establish a long-term relationship between state employment and nationwide employment. To achieve this the authors applied a cointegration analysis, a methodology proposed by Engle and Granger (1987), as well as the model of unrestricted error correction as proposed by Pesaran et al (1996).

The authors used a database that included a comprehensive coverage of the labor market in the Brazilian states, using monthly data from the Annual Report of Social Information (RAIS from the Portuguese *Relação Anual de Informações Sociais*) from 1985 through 1996. The results obtained from the unrestricted error correction method were consistent with those obtained with the more traditional method of co-integration analysis based on the Engle and Granger method (1987). The results lead to the conclusion that employment fluctuations in most states follow a common trend with respect to employment at the national level.

They analyzed the hypothesis that the formal labor market presents a differentiated behavior between the metropolitan and non-metropolitan Brazilian areas. The objective of their study was to analyze the fluctuations in the labor market of metropolitan and non-metropolitan Brazilian areas.

Kretzmann and Cunha (2009) analyzed employment and unemployment data from the Ministry of Labor and Employment through the General Records of Employed and Unemployed Persons (CAGED from the Portuguese: *Cadastro Geral de Empregados e Desempregados*), using monthly data from 1996 through 2007. Kretzmann and Cunha (2009) used cointegration analysis through the traditional method proposed by Engle-Granger, as well as the method proposed by Pesaran et al. (1996), which allows for the analysis of stationary and non-stationary series. The two methods produced the same results, suggesting that the metropolitan and non-

metropolitan areas are not co-integrated, producing thus a difference in the generation of formal employment where metropolitan and non-metropolitan Brazilian areas are compared, except for the state of Pernambuco. Consequently, the authors conclude that employment fluctuations in the states, when analyzed individually, support the hypothesis that there are changes in the formal labor market in the different regions, where the non-metropolitan areas seem to be, in most states, the most dynamic. In other words, during the 1996-2006 period, the authors concluded that there was greater change in the generation of employment in non-metropolitan regions of the Brazilian territory.

Secondly, Pesaran, Weiner and Schuermann (2004) introduced the Global Vector Autoregressive (GVAR) methodology by means of a study that modeled 11 different regions using data from 1979 through 1999. This methodology was improved by Dees, di Mauro, Pesaran and Smith (2007) with the collaboration of the European Central Bank.

Schanne (2015) in turn analyzed the regional labor market in Germany with a focus on forecasting regional labor markets. His study had two objectives, the first one being to establish the GVAR structure, as proposed by Pesaran et al. (2004), which consists of the technique that evaluates spatio-temporal dynamics in a multivariate configuration; Second, to use the developed GVAR model to execute a forward-looking analysis of the German economy accounting for spatial co-development of regional labor markets in Germany.

The GVAR model allows both the analysis of strong cross-section dependence and weak cross-section dependency. Consequently, Schanne (2015) concludes that the data indicate semi-strong cross-section dependence and has consistent results since Germany is a polycentric economy, in contrast with the United Kingdom or France (places where there are clearly dominant regions). The final model used in his study is a basic GVAR specification, which is a model in first differences without imposing cointegration relations, and did not include a dominant region.

In his forecasting experiment, Schanne (2015) estimated the basic GVAR model and GVAR models with leading indicators; he then used these models as a predictive forecasting tool for three and twelve months forward – forecasting the level of unemployment in the regional divisions according to the federal employment agency of Germany. For comparison purposes, each indicator was estimated by a VAR in differences and a VAR in level (with lag order

increased by one lag). The accuracy of the prediction was evaluated by comparing the absolute mean of prediction errors (percentage) and by the Diebold-Mariano test.

Finally, Schanne (2015) concluded that there is significant improvement in the accuracy of predictions when considering the interdependence between regions, emphasizing that the degree of improvement depends on the variables and the horizon.

3 METHODOLOGY

This section will present and describe the global vector autoregressive methodology, which is the main methodology used on this paper. It is assumed that the reader is familiarized with the vector autoregressive (VAR) methodology as well as the vector error correction model (VECM) and its terminology.

Chudik and Pesaran (2011), considered the curse of dimensionality in the case of large linear dynamic systems. To deal with the curse they proposed to shrink the parameter space in the limit as the number of endogenous variables tends to infinity. Chudik and Pesaran shows that by shrinking the parameter space the infinite-dimensional VAR could be well approximated by a set of finite-dimensional small-scale models that can be consistently estimated separately, which is in the spirit of global VAR (GVAR) models proposed in Secondly, Pesaran, Weiner and Schuermann (2004). Therefore, Chudik and Pesaran concludes that the GVAR approach can be used as an approximation to an IVAR featuring all macroeconomic variables. This is true for stationary models as well as for systems with variables integrated of order one.

The GVAR model is a compact model that combines individual vector error correcting models in which domestic variables are related to individual-specific foreign variables in a consistent manner. This compact model relies exclusively on observables, which typically include macroeconomic aggregates and financial variables.

3.1 Global vector autoregressive

The global vector autoregressive (GVAR) methodology was originally proposed by Pesaran, Weiner and Schuermann (2004) as a practical approach to construct a coherent global model of the world economy. The model consisted of 11 different regions using data from 1979 through 1999. The work driving force was the need to model risk management for financial institutions. The authors constructed a compact global macroeconomic model capable of generating

forecasts for a basic set of macroeconomic factors for the regions, taking into account the interconnections and interdependencies between domestic and international factors.

In the traditional Vector Autoregressive (VAR) methodology, an unrestricted VAR(p) model, with k endogenous variables covering N countries, consistently has a large number of unknown parameters of the order $p \cdot (kN - 1)$, requiring thus a more parsimonious solution. Therefore, Pesaran et al (2004) proposed the use of a model where firstly the error correction models specific to each region is estimated, with the domestic macroeconomic variables related to the corresponding foreign variables; secondly the models from each region are then combined to generate forecasts for all variables. In short, the GVAR model combines VECM models of each region, so that domestic variables are related to regionally specific foreign variables in a consistent manner. Therefore, the model is able to take into account the interdependencies between economic regions in the analysis.

Subsequently Dees, di Mauro, Pesaran and Smith (2007) improved the GVAR model with the cooperation of the European Central Bank. It then became the modeling chosen for the present study. This version of the GVAR model included 26 countries (covering 90% of world production), with the euro area being considered as one sole economy with estimates from 1979 to 2003.

The version of the GVAR model that will be presented in this study is based on that of Dees, di Mauro, Pesaran and Smith (DEES, MAURO, PESARAN, 2007), which was estimated for 26 countries, with the euro area treated as one sole economy.

The GVAR model can be summarized as a two-step procedure. In the first stage, specific models of each region are estimated conditioned to external influences of the other regions. That is, the models are represented as VAR models, which have domestic variables and foreign variables, the latter being treated as weakly exogenous. In the second step, the VAR models of each region are grouped into one single global VAR model. The GVAR model, as well as any VAR model, can be used for analyzing shocks in the economy, and predictions.

3.1.1 Specific models for each region

For the specific models used in the first stage of the GVAR methodology, consider a panel with N elements, each element showing k_i variables observed during periods $t = 1, 2, \cdots, T$. Within this panel structure the following variables are defined: x_{it} as a vector $k_i \times 1$ of domestic variables for the element i in period t; x_{it}^* as a vector $k^* \times 1$ of foreign variables; and u_{it} as an error vector. Thus, following the notation of Chudik and Pesaran (2011), the specific models of each element consist of a set of domestic and foreign variables. Specifically, for any i element:

$$x_{it} = a_{i0} + a_{i1}t + \sum_{j=1}^{p_i} \Phi_{ij} x_{i,t-j} + \Lambda_{i0} x_{it}^* + \sum_{l=1}^{q_i} \Lambda_{il} x_{i,t-l}^* + u_{it} \qquad (1)$$

where Φ_{ij} is an array of lag coefficients for lag *j* associated with domestic variables and Λ_{il} is an array of lag coefficients for lag *l* associated with foreign variables.

The GVAR model treats the foreign variables as weighted averages of the domestic variables of each corresponding element, and the weights are specific to each element. Therefore, the foreign variables of each element i can be computed as a weighting of the domestic variables of each element in the panel. A weighting vector W_{ij}, where $j = 1, 2, \cdots, N$ is defined as a set of weights with the following characteristics: $W_{ii} = 0$ and $\sum_{j=1}^{N} W_{ij} = 1$. Thus, the foreign variables can be defined as:

$$x_{it}^* = \sum_{j=0}^{N} W_{ij} x_{jt} \qquad (2)$$

The weights are predetermined and are used to capture the importance of region *j* for the economy of region i.

From the domestic variables and the foreign variables (estimated from the weighting previously mentioned), VECM models are estimated separately for each region, considering that in the VECM models the foreign variables x_{it}^* are treated as weakly exogenous. The use of the VECM

models allows both the co-integration between domestic variables, and between domestic and foreign variables.

3.1.2 Global model

Although the estimation is done individually, element-by-element, the GVAR model is solved considering all variables as endogenous to the system. Thus, from the specific model of each element, Z_{it} is defined as:

$$Z_{it} = \begin{bmatrix} x_{it} \\ x_{it}^{*} \end{bmatrix}$$

Making the substitution in the equation of the specific models:

$$A_{i0} Z_{it} = a_{i0} + a_{i1} t + \sum_{l=1}^{p} A_{il} \, Z_{i,t-l} + \varepsilon_{it} \tag{3}$$

Where $p = \max_i \{p_i, q_i\}$, $A_{io} = [I_{k_i} \quad -\Lambda_{i0}]$, $A_{il} = [\Phi_{il} \quad \Lambda_{il}]$ for $l = 1, 2, \cdots, p$. And define $\Phi_{il} = 0$ for $l > p_i$, and $\Lambda_{il} = 0$ for $l > q_i$.

Let $x_t = (x_{0t}', x_{1t}', \cdots, x_{Nt}',)'$ be a vector $k \times 1$ of all the variables in the panel, where $k = \sum_{i=1}^{N} k_i$, W_i can be defined as being a matrix of dimension $(k_i + k_i^*) \times 1$ of known constants defined in terms of the individual weights W_{ij}. Therefore, the variables of the specific models are defined as a function of x_t.

$$Z_{it} = W_i x_t \tag{4}$$

Using this identity, the individual models can be written as:

$$A_{i0} W_i x_t = a_{i0} + a_{i1} t + \sum_{l=1}^{p} A_{il} \, W_i x_{t-l} + \varepsilon_{it} \tag{5}$$

It is possible to combine the new individual models into one single model, and this can be done by "stacking up" each model in a large-scale VAR.

$$G_0 x_t = a_0 + a_1 t + \sum_{l=1}^{p} G_l \, x_{t-l} + \varepsilon_t \tag{6}$$

Where:

$$G_0 = \begin{bmatrix} A_{00}W_0 \\ A_{10}W_1 \\ \vdots \\ A_{N0}W_N \end{bmatrix} G_l = \begin{bmatrix} A_{0l}W_0 \\ A_{1l}W_1 \\ \vdots \\ A_{Nl}W_N \end{bmatrix} a_0 = \begin{bmatrix} a_{00} \\ a_{10} \\ \vdots \\ a_{N0} \end{bmatrix} a_1 = \begin{bmatrix} a_{01} \\ a_{11} \\ \vdots \\ a_{N1} \end{bmatrix} \varepsilon_t = \begin{bmatrix} \varepsilon_{0t} \\ \varepsilon_{1t} \\ \vdots \\ \varepsilon_{Nt} \end{bmatrix}$$

Since the G_0 matrix is a non-singular matrix, which depends only on the estimated parameters and the link matrix W_i, it is possible to rewrite the equation (6) as:

$$x_t = b_0 + b_1 t + \sum_{i=1}^{p} F_i x_{t-i} + \epsilon_t \tag{7}$$

Where:

$$F_i = G_0^{-1} G_i$$
$$b_0 = G_0^{-1} a_0$$
$$b_1 = G_0^{-1} a_1$$
$$\epsilon_t = G_0^{-1} \varepsilon_t$$

Hence, the global model, which consists of a set of individual models from each region, can be solved recursively. With that it is possible to consistently determine the coefficients of the model.

3.1.3 Dominant Unit Model

In the presence of common variables to all regions in the global model, either as observed common factors, or in the form of dominant unit variables, then the specific models for each region need to take the common variables into consideration. Therefore, a vector ω_t of common variables and its lagged values augment each specific model. So, each element model can be stated as:

$$x_{it} = a_{i0} + a_{i1}t + \sum_{j=1}^{p_i} \Phi_{ij} x_{i,t-j} + \Lambda_{i0} x_{it}^* + \sum_{l=1}^{q_i} \Lambda_{il} x_{i,t-l}^* + D_{i0}\omega_t + \sum_{l=1}^{s_i} \Psi_{il} \omega_{t-l} + u_{it} \quad (8)$$

The marginal model for the dominant variables can be estimated with the feedback effects from x_t, or not. The feedback from the variables in the GVAR model are captured via cross-section averages, this is done by augmenting the dominant unit model with lags of $x_{\omega t}^*$.

$$\omega_t = \sum_{l=1}^{p_\omega} \Phi_{\omega l} \omega_{t-l} + \sum_{l=1}^{q_\omega} \Lambda_{\omega l} x_{i,t-l}^* + \eta_{\omega t} \quad (9)$$

Different lag orders for the dominant variables (p_ω) and cross-section averages (q_ω) could be considered. It is worthy of pointing out that contemporaneous values of foreign variables do not feature in the equation.

4 MODEL

When constructing the GVAR model for the Brazilian labor market some issues needs to be addressed. The first and perhaps the most obvious decision is which set of variables to choose to adequately capture the labor market and its dynamics in the global economy. Second, how would the labor market interact with the global economy, which variable could be used to evaluate the global economy. Finally, how should the Brazilian territory be evaluated in terms of regions (municipal level, state level, microregions, etc.). Each of these points will be discussed in this section.

The labor market can be defined as the market in which wages are determined; in other words, the place where people included in the labor force find paid work, and employers find willing workers. This market is characterized by employed workers, unemployed workers, and “out-of-labor force”. However, according to Blanchard and Fisher (1989), people classified as “out-of-labor force” are seldom like the unemployed because they are in fact discouraged workers, and although they are not looking for a job, they will take it if they can find one. By measuring the in and out flow of employment, it is possible to measure the employment changes, and therefore the variation in the employment rate (the ratio of employment to the population available for work). Therefore, the model of the labor market will consist on the in and out flows of employment, more specifically people admitted to new jobs and people fired from their jobs.

The labor market interacts with the global economy in many ways. One of these channels is the industrial production. The industrial production index is a measure of output of the industrial sector of the economy, and even though it is only a small share of the gross domestic product, it is still very sensitive to interest rates and consumer demand and changes. Consequently, changes in the levels of this indicator usually reflect similar changes in the overall economic activity. Therefore, the Industrial Production Index will be used as a global variable to evaluate the global economy.

Finally, an attempt to model the Brazilian labor market in the municipal level the municipal level was done. Brazil has a total of 5,564 municipalities, and as of 2005 (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2008) grouped them into 137

mesoregions, and 27 states. Due to computational boundary issues, it was decided to model the GVAR regions at the Brazilian mesoregion level, since a model at the municipal level would require further computational precision. Therefore, in this paper, the regions used in the GVAR model will be the mesoregions defined by Brazilian Institute of Geography and Statistics in 2015.

4.1 GVAR model

The objective of this study is to use the GVAR methodology, as described in the previous section to assess the Brazilian labor market model. Each Brazilian mesoregion will be a GVAR region/element.

Since the labor market model will consist of workers admitted to and disconnected from the labor market, the specific model for each mesoregion will contain the information of those admitted to and disconnected from the labor market in the period t for that region. Therefore, for each mesoregion i a vector x_{it} can be defined as:

$$x_{it} = \begin{bmatrix} Adm_{it} \\ Dis_{it} \end{bmatrix} \tag{10}$$

Where Adm_{it} is the number of workers admitted (employment flow) to the labor market in period t in region i; Dis_{it} is the number of workers disconnected (unemployment flow) from the labor market in period t in region i.

Each region experiences an influence from other regions. Using the GVAR methodology the foreign variables are defined as a vector x_{it}^* as follows:

$$Adm_{it}^* = \sum_{j=1}^{N} W_{ij} Adm_{jt} \tag{11}$$

$$Dis_{it}^* = \sum_{j=1}^{N} W_{ij} Dis_{jt} \tag{12}$$

$$x_{it}^{*} = \begin{bmatrix} Adm_{it}^{*} \\ Dis_{it}^{*} \end{bmatrix} \tag{13}$$

Where: W_{ij} is a link matrix that captures how much the region j influences region i; Adm_{it}^{*} is the influence in region i of the number of workers admitted to the labor market in other regions in period t; Dis_{it}^{*} is the influence in region i of the number of workers disconnected from the labor market in other regions in period t;

The specific models are defined with unrestricted intercepts and no trend coefficients (option CASE III in the treatment of deterministic components in the GVAR toolbox). It is worthy of mention that even though a deterministic trend is not included in the model, the levels of the domestic variables may be trended due to the drift coefficients.

$$x_{it} = a_{i0} + \sum_{j=1}^{k_{1,i}} \Phi_{ij} x_{i,t-j} + \Lambda_{i0} x_{it}^{*} + \sum_{l=1}^{k_{2,i}} \Lambda_{il} x_{i,t-l}^{*} + u_{it} \tag{14}$$

Where $k_{1,i}$ and $k_{2,i}$ are the lag order for the domestic variables and foreign variables respectively. The model is defined with a maximum 2-lag order for domestic and foreign variables, where the lag selection for each region will be done by the GVAR toolbox using Akaike Information Criterion.

4.1.1 Macroeconomic variable

In the GVAR model macroeconomic variables are treated as common variables and modeled in a Dominant Unit. Therefore, the Dominant Unit of the GVAR model will contain the log level of the Brazilian industrial production defined by the vector ω_t, with a feedback variable from the regions through the aggregate values of the employment and unemployment. So, the Dominant Unit will be a univariate model defined in first differences with a trend included in the levels, and can be expressed as:

$$\omega_t = [ln(IndProd_t)] \tag{15}$$

$$\Delta\omega_t = \Phi_{\omega 0} + \sum_{l=1}^{\kappa_1} \Phi_{\omega l}\Delta\omega_{t-l} + \sum_{l=1}^{\kappa_2} \Lambda_{\omega l}\Delta x^*_{i,t-l} + \eta_{\omega t} \quad (16)$$

Where Δx^* is the feedback variable containing the aggregate values of the employment and unemployment from all regions; κ_1 and κ_2 the lag order for the global variable (Industrial Production) and feedback variables respectively. The maximum lag order is defined as 3 for both, the global variable and the feedback variables, where the lag selection for each variable will be set by the GVAR toolbox using Akaike Information Criterion.

4.1.2 Weight Matrix

One of the most difficult steps in the GVAR methodology is the construction of the weight matrix. In Pesaran's initial work, the weight matrix is defined by country-specific trade weights. In fact, the weight matrix W_i is meant to capture the importance of all other regions for the region i (DI MAURO, PESARAN, 2013). So, to determine the weight matrix it is necessary to determine the importance of each region in respect to every other region.

Focusing on the labor market, to determine the importance of a region to another is to determine the importance of one labor market to another labor market. Each region has its own labor market with firms and workers, and since firms can't change markets it is the workers that freely change markets. In other words, a worker can look for a job in other regions, but a firm must attract the workers from other regions to their own market. Consequently, for a worker to commute to another region there must be a connection between these regions.

The connections between regions in the modern word can be any means of connection that allow a worker to commute (by car, by train, by plane, etc.) to another region. Therefore, regions with a lot of connections between them are more important than regions with fewer connections.

Consequently, the importance of region j to region i will be a function of the connections between them, and the weight matrix will be a based on the number of connections between the regions.

5 DATA

With the specification of the model the next stage is the acquisition of the data to be used in the model. The following section is a brief description of the data used in this paper, as well as its sources, frequency and any applied transformation.

Table 1: Data sources and characteristics

Data	**Source**	**Frequency**	**Period**
Brazilian Industrial production	IBGE (1)	Monthly	2004-01 to 2016-12
Employment and Unemployment	CAGED (2)	Monthly	2004-01 to 2016-12
Mesoregions and municipalities	IBGE (1)	N/A	as reported on 2015
Connection between regions	IBGE (1)	N/A	as of 2007

Source: elaborated by the author
(1) Brazilian Institute of Geography and Statistics (IBGE from the Portuguese *Instituto Brasileiro de Geografia e Estatística*)
(2) Ministry of Labor and Employment through the General Records of Employed and Unemployed Persons (CAGED from the Portuguese: *Cadastro Geral de Empregados e Desempregados*);

The data for the Brazilian Industrial production was obtained from Brazilian Institute of Geography and Statistics (IBGE from the Portuguese *Instituto Brasileiro de Geografia e Estatística*) acquired through the Institute of Applied Economic Research (IPEA, from the Portuguese *Instituto de Pesquisa Econômica Aplicada*). The industrial production series where obtained from two sources. The first source is the “industrial production of the general industry (Index 2012=100), not seasonally adjusted”, with monthly frequency, from January 2002 through December 2016. The second source is the “industrial production of the general industry (Index 2002=100), not seasonally adjusted”, with monthly frequency, from January 1975 through February 2014. (INSTITUTO DE PESQUISA ECONÔMICA APLICADA, 2017)

In order to have a single industrial production series, the data from the first source (Index 2012=100) was complemented with the period from January 1975 through December 2001. The data in that period was calculated so that it has the same monthly variation as data reported by the second source (Index 2002=100).

The employment and unemployment flows, which are the workers admitted to and disconnected from the labor market, was obtained from the Ministry of Labor and Employment through the General Records of Employed and Unemployed Persons (CAGED from the Portuguese:

Cadastro Geral de Empregados e Desempregados). The data was obtained at the municipal level and grouped by mesoregions. The frequency of the data is from January 2004 through December 2016. (MINISTÉRIO DO TRABALHO E EMPREGO, 2017)

The mesoregions definitions, as well as the information of total population, microregions, mesoregions, state, and their designation codes, were obtained from the Brazilian Institute of Geography and Statistics (IBGE from the Portuguese *Instituto Brasileiro de Geografia e Estatística*) as reported on the year 2015. (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2017).

Finally, the number of connections between regions were obtained from IBGE in the paper entitled *Regiões de influência das cidades* (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2008). This work aims at determining the influence of the cities in Brazil. The study not only analyzed regular transport links, such as those that go to the urban centers, but also the main destinations of the residents to obtain products and services, such as general goods, education, airport travel, and health services. The acquisition of agricultural inputs and the destination of the agricultural products were also analyzed in the study. The main result of the paper is a “Brazilian urban network” with a mapping of the connections for all 5,564 Brazilian municipalities. This “Brazilian urban network” contains the hierarchy of the urban network and the regions of influence of each urban center.

A connection chart between all the Brazilian cities is constructed by merging the links provided in the urban network framework, which are the main links between municipalities, with the links regarding airport connections, shopping destinations, education, health services, and recreation activities. One should be kept in mind that the merger process results only in unique links, in other words, two cities can only have one sole link between them.

Since every city belongs to a mesoregion the links between mesoregions are also determined with the following characteristics: if the two cities are within the same region then the link between them is an internal link; if the two cities are in different mesoregions then the link between them is a connection between the two mesoregions.

As mentioned earlier the weight matrix is a function of the number of connections between regions, however at this point it is worthy of mention that some connections are more important

than others, however, since the measurement of importance for each connection between each region is unfeasible, an equal weight to all connections is assumed, resulting in a linear function, which is the average.

The weight matrix to a region i can then be determined by the number of connections to other regions divided by its total number of connections. Therefore, a weight vector for each region is determined as:

$$W_i = \frac{[C_{i1} \quad \dots \quad C_{iN}]}{\sum_{j=1}^{N} C_{ij}} \tag{17}$$

Where C_{ij} is the number of connections that originated at region i and has region j as destination, keeping in mind that connections within the same region ($i = j$), also called internal links, have a zero weight ($C_{ii} = 0$).

5.1 Descriptive statistics

Table 2 shows the descriptive statistics for the industrial production as well as the admitted and disconnected series for the mesoregions that contain the cities of São Paulo, Rio de Janeiro and Brasilia (three of the most important cities in Brazil). The descriptive statistics for all the regions can be found in the appendices.

Table 2: Descriptive statistics of the variables

Region	Series Name	Mean	Median	Max	Min	Std. dev.	Skewness	Kurtosis	Jarque-Bera
Global	Ind. Prod.	4.5503	4.5502	4.7238	4.3041	0.0963	-0.3792	2.5900	4.7326
Sp - Metropol Sao Paulo	Admitted	226073.0	223610.5	329823.0	115254.0	55443.5	-0.0856	1.7569	9.8751
Sp - Metropol Sao Paulo	Disconnected	212768.2	217592.0	298117.0	107413.0	56594.5	-0.3070	1.8034	11.4459
Rj - Metropol do RJ	Admitted	95295.5	94490.0	140206.0	56900.0	22461.6	0.1119	1.7417	10.2581
Rj - Metropol do RJ	Disconnected	90694.9	92642.5	141759.0	51785.0	23537.8	-0.0474	1.7966	9.1128
Go - Distrito Federal	Admitted	22942.6	22685.5	36420.0	12557.0	5643.1	0.0728	1.7380	10.1272
Go - Distrito Federal	Disconnected	22068.6	22648.5	33552.0	10988.0	5931.7	-0.1269	1.7852	9.6577

Source: elaborated by the author
Note: The data for the industrial production is presented at log level.

All the models were estimated using MatLab software R2016b and the GVAR Toolbox 2.0. The following MatLab add-ons were installed during the estimation of the models: Mapping Toolbox version 4.4; Econometrics Toolbox version 3.5; Optimization Toolbox version 7.5; Statistics and Machine Learning Toolbox version 11.0.

The GVAR Toolbox 2.0, developed by Smith and Galesi (2014), is and open source collection of MatLab procedures with a Microsoft Excel based interface, designed for GVAR modeling purposes. It’s worth mentioning that the GVAR toolbox does not require any MatLab add-on.

6 RESULTS

Modeling a system such as the Brazilian labor market at the mesoregions level is naturally subject to considerable uncertainties. There are many choices to be made for each individual mesoregion model, for example: the variables to be included in the specific models; the lag order of the domestic variables; the lag order of the foreign variables; the number of cointegrating relations; and whether to impose long-run and short-run restrictions on the parameters are just a few of the choices.

As explained earlier the Global VAR model comprises several specific models, solved in a two-step process. The model is defined using the data for admissions and disconnections for every mesoregion as well as the weight matrix defined previously. All regions were set to be affected by foreign variable and the dominant unit. The Dominant Unit, in its turn, is composed of a single variable, the industrial production, and suffers a feedback effect from the mesoregions. This feedback is computed with an equal weight among all the mesoregions.

The final model was estimated using the GVAR automatic lag selection with the Akaike information criterion and a maximum lag order of 2 for domestic as well as foreign variables. A total of 137 specific models were specified (not considering the dominant unit model). The lag for domestic variables were set to 2 in 98 models, and set to 1 in the other 39 models. The lag for foreign variables were set to 2 in 91 models, and set to 1 in the other 46 models.

The cointegration test performed by the GVAR toolbox 2.0 was used to select the cointegration ranks in the final model. All individual models had the deterministic components treated as an unrestricted intercept and no trend in the error correction models. Out of the 137 estimated models, 9 were specified with 1 cointegration relation, and 128 models were specified with 2 cointegration relationship. At this point is worth to mention that the GVAR model allows for the possibility of cointegration within the domestic variable and between domestic and foreign variables.

The GVAR model determines a model for each region considering foreign effects, as well as effects from the variables in the dominant unit model. With no overidentifying restrictions imposed, the final model proved to be stable with 815 eigenvalues lying inside the unit circle

10 of which lying on the unit circle. A detailed specification of each individual model, including the dominant unit can be found in the appendices.

6.1 Forecast

Using the GVAR methodology, it is possible to estimate the response dynamics of the unemployment and employment in each region considering not only the industrial production but also the interdependencies of each region. With the use of conditional forecasts it is possible to evaluate the behavior of the labor market in response to a change in the global economy, in our case represented by the industrial production.

So, a series of conditional forecasts (each with a different growth scenario for the industrial production) is estimated to assess the impact of the industrial production on the labor market. The series of conditional forecasts of the labor market will consist of a base scenario and several other growth scenarios for the Brazilian industrial production.

The baseline scenario for the industrial production growth will be a 0% growth coefficient over the last year in the series, in this case the year of 2016. The other growth scenarios on the set will be: 2% growth coefficient; 4% growth coefficient; 6% growth coefficient; and 8% growth coefficient over the last year.

The industrial production growth is made by applying the annual growth coefficient in each month compared to the last year. In other words, a 2% growth coefficient means a 2% grow in January 2016 compared to January 2017 and so on. All the scenarios were analyzed over an eight-year forecast.

6.1.1 Forecast, net employment and accumulated employment

Net employment will be defined as the difference between admissions (employment flow) minus disconnections (unemployment flow). Also “total net employment” is defined as the sum of the net employment of every mesoregion, and consequently starting the forecast series in January 2017, the accumulated employment is the sum of all the previous “total net employment” until that year.

The accumulated employment is a macro representation of the individual labor markets and can be used to evaluate how the Brazilian labor market will behave in a macroeconomic level.

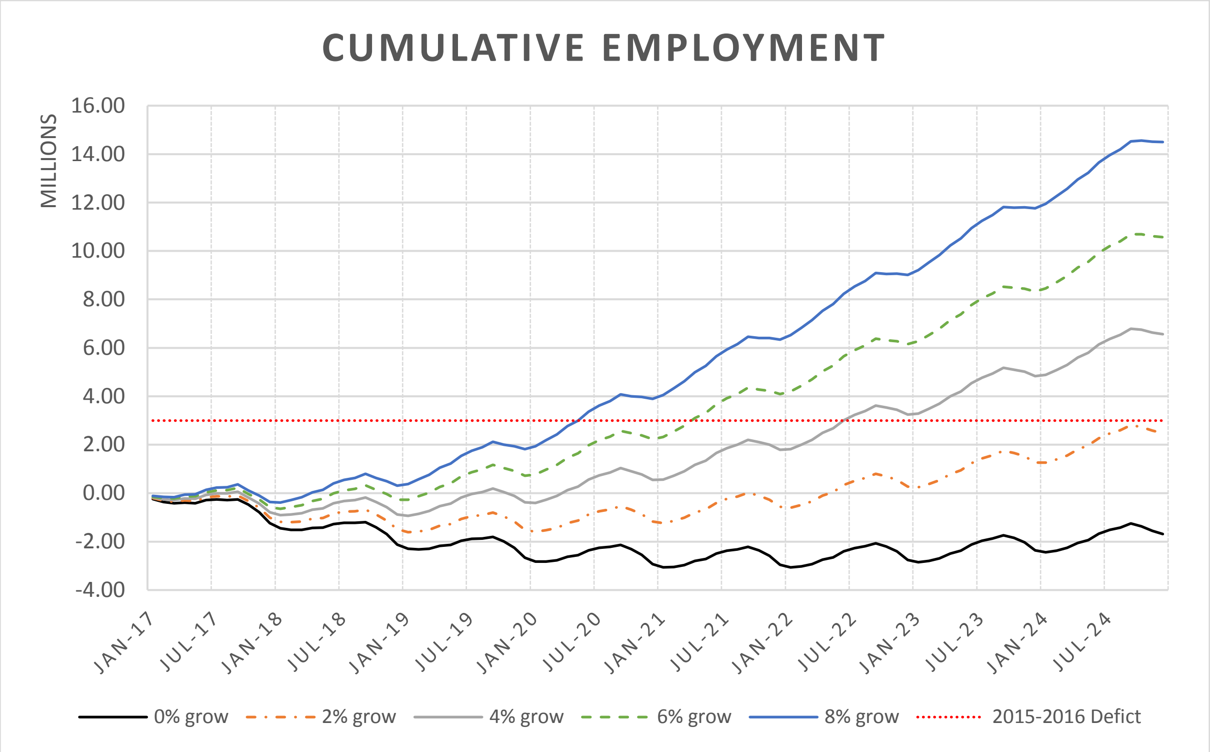

Figure 1: Brazilian accumulated employment forecast for different growth scenarios
Source: elaborated by the author
Note: 2015-2016 Deficit: The net employment deficit accumulated from 2015 through 2016

From 2015 through 2016 the total net employment accumulated a deficit of approximately 3 million, signaling that the economy is in a recession. Taking the last December 2016 as reference, the baseline forecasts reveal that a 0% annual growth in the industrial production would keep the total net employment to a negative level even in an eight-year forecast, meaning that the economy would retain in its recession status. A 2% annual growth in the industrial production would improve the total net employment, with the accumulated employment being positive in September 2021, and ending the forecast period with a 2.5 million accumulated employment. A 4% annual growth in the industrial production would cause a significant

improvement to the accumulated employment with the first positive value of the series occurring in September 2017, and an accumulated employment of 6.5 million by the end of 2024. For a 6% and 8% annual growth, the accumulated employment becomes positive in June 2017, and ends the forecast series with a value of 10.5 million and 14.5 million, respectively. It is worth mentioning that a 4% annual growth in the industrial production the Brazilian accumulated net employment deficit from 2015 would cease only in July 2022.

6.1.2 Industrial production elasticity by region

The net employment defined in the last section can be interpreted as the variation on the total employment level. So, the variation of the employment rate would be the net employment divided by the labor force. However, data for a labor force for each mesoregion is not available, alternatively the data for the total population of each region is available, so the total population of each region will be used as a substitute for the labor force. Therefore, the variation on employment rate that will be used in this paper is the net employment divided by the total population of the region[1].

Since the GVAR methodology allows for a forecast for each region, it is possible to establish the variation of the employment rate for every region, where the accumulated variation is the sum of all previously variations. Therefore, it is possible to evaluate how a change in the industrial production affect the labor market in each region, in other words it is possible to establish the employment elasticity in respect to the industrial production.

[1] Traditionally the employment rate is defined as the amount of people employed divided by the labor force. (BLANCHARD, 2012)

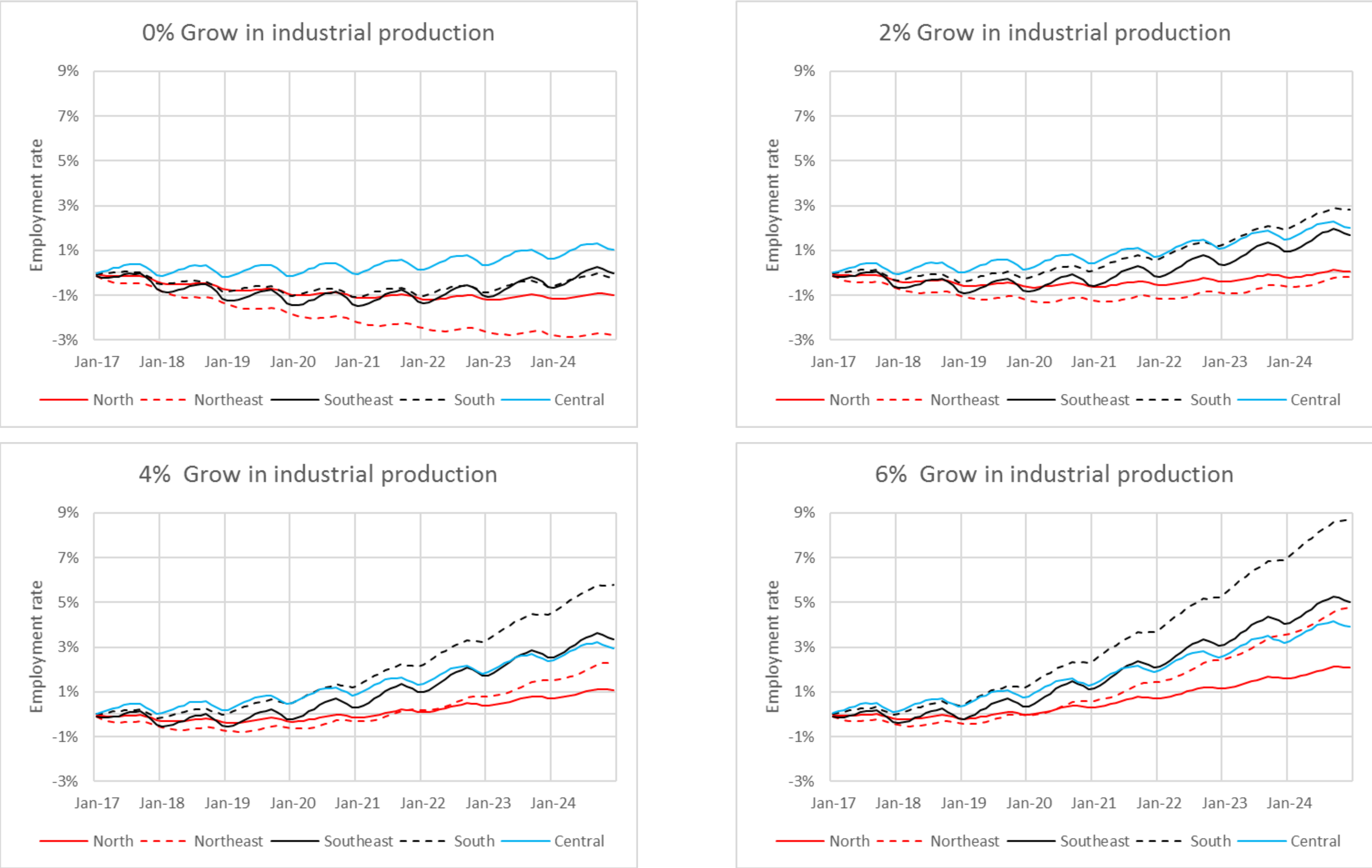

Figure 2: Accumulated employment rate variation for various industrial production growth scenarios.
Source: elaborated by the author

To make a macro analysis of the regions, the mesoregions are grouped into five classical major Brazilian regions (North, Northeast, Southeast, South, Central). Taking the IBGE predicted population for 2016 as the total population, and 0% growth as a base scenario, it is possible to obtain an industrial production elasticity of the employment for each major region over an eight-year forecast. Considering a 2% annual growth on the industrial production, the South region is the most sensitive with 0.18 elasticity, the second most sensitive region is the Northeast with a 0.15 elasticity. The Southeast region has a 0.10 elasticity, while the least sensitive major regions are the North and Central, each one with 0.06 elasticity.

This indicates that the Northeast and South regions are those with more elasticity, being strongly affected by changes in industrial production. The Southeast region, which is the most developed, has an intermediate elasticity. This is probably due to the high development level of the region, making its marginal gain not as high as in the Northeast and South regions.

Although the previous analysis was made with macro regions, the GVAR methodology allows to make the same analysis in a more in-depth level. Since the GVAR equations are solved for every region, we can evaluate not only the state elasticity but also the elasticity for every mesoregion.

Figure 3 shows the estimated employment rate for the Southeast region, the most developed in the country. Using the 0% growth as a base scenario the elasticity for the states of Minas Gerais, Espírito Santo, Rio de Janeiro and São Paulo are estimated. Again, considering a 2% annual growth on the industrial production, Rio de Janeiro is the most sensitive state with 0.19 elasticity. Followed by Espírito Santo with a 0.09 elasticity. Minas Gerais and, São Paulo are estimated to have an elasticity of 0.07 and 0.08, respectively.

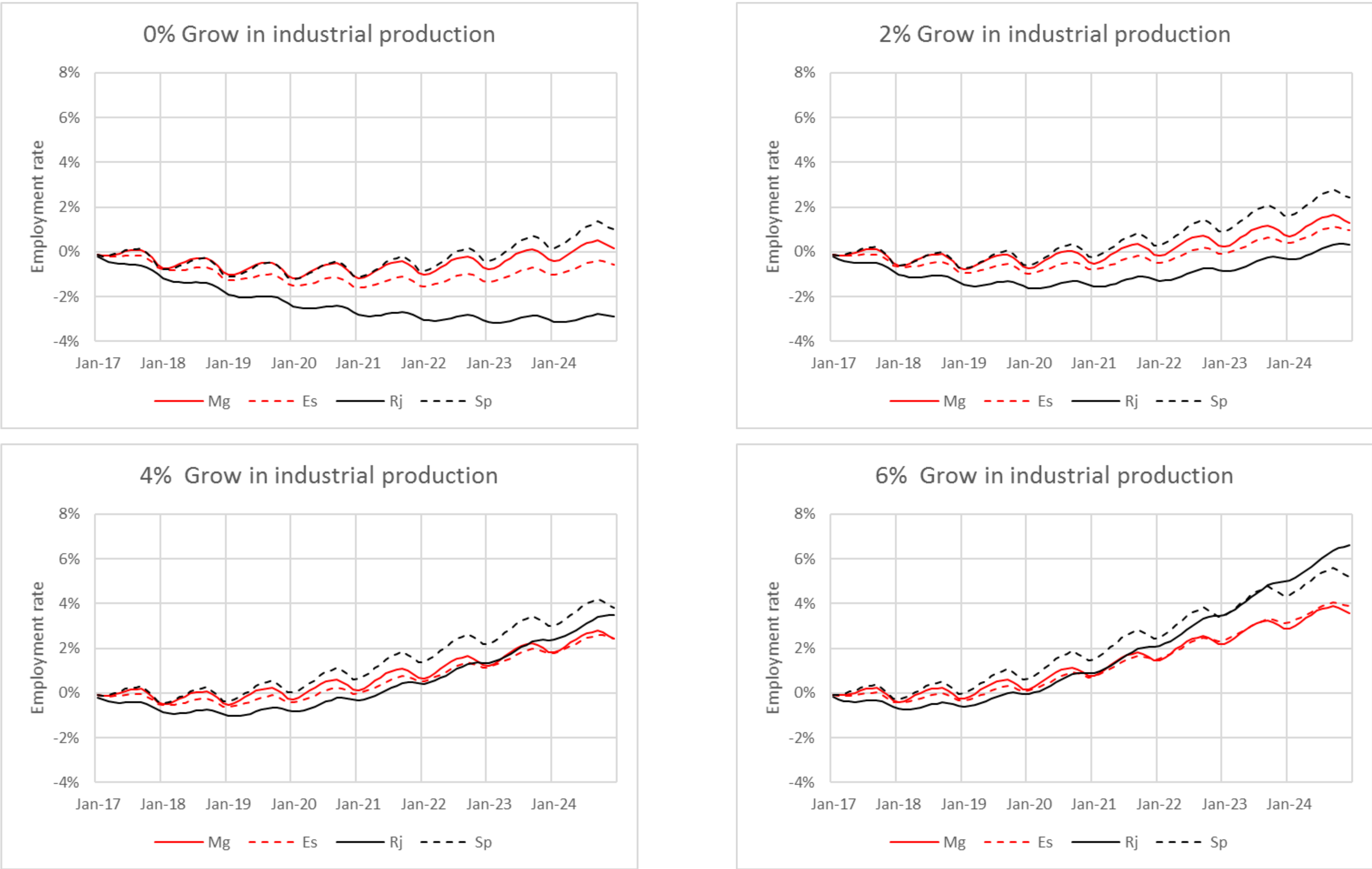

Figure 3: Accumulated employment rate variation for various industrial production growth scenarios on state level.
Source: elaborated by the author
Mg: Minas Gerais; Es: Espírito Santo; Rj: Rio de Janeiro; Sp: São Paulo

As commented earlier with the GVAR model it is possible to evaluate every region in a more in-depth analysis. Since listing all 137 regions estimated elasticity would be messy and impractical, the region of São Paulo metropolitan area (one of the most important in the country) is compared along with 4 other randomly selected regions, which are: Goiás Central region, Borborema region, Jequitinhonha region, and Porto Alegre metropolitan area. Goiás Central region is the most populous, rich and densely populated mesoregion of the Goiás state, with 3.1 million habitants and a GDP per capita estimated at 11.8 thousand Brazilian Reais. The mesoregion of Borborema is a dry land, with approximately 310 thousand habitants, its GDP per capita is estimated to be 5 thousand Brazilian Reais. The Jequitinhonha Valley is a region known due to its low social indicators. It has an GBP per capita of 2.6 thousand Brazilian Reais and 731 thousand habitants. Porto Alegre metropolitan area an important region in the South, it's economy is strongly influenced by the industrial sector, with a 12.1 thousand Brazilian Reais GDP per capita and 5 million hab. (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2017).

Figure 4 show the estimated elasticity for the regions. As previously, the 0% growth is used as a base scenario the elasticity. With a 2% annual growth scenario on the industrial production, Porto Alegre is the most sensitive mesoregion with 0.19 elasticity. Followed by São Paulo with a 0.16 elasticity. The Goiás central area has a moderate elasticity with a value of 0.07. Lastly the Borborema and Jequitinhonha mesoregions proven to be very inelastic, with only 0.02 elasticity.

Figure 4: Accumulated employment rate variation for various industrial production growth scenarios on mesoregion level.
Source: elaborated by the author
C.Go: Goiás central area; Borb: Borborema; Jequit: Jequitinhonha; P.Alegre: Porto Alegre metropolitan area; SP: São Paulo metropolitan area

The most populated mesoregions in Brazil are São Paulo metropolitan area, Rio de Janeiro metropolitan area, Belo Horizonte metropolitan area, Porto Alegre metropolitan area, and Salvador metropolitan area. The Rio de Janeiro metropolitan area has approximately 12.9 million habitants and a GDP per capita estimated to be 34 thousand Brazilian Reais. The Belo Horizonte metropolitan area in its turn has approximately 6.7 million habitants and a GDP per capita estimated to be 19.7 thousand Brazilian Reais. Lastly, Salvador metropolitan area has around 4.7 million habitants and a GDP per capita of 12.2 thousand Brazilian Reais. (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2017).

Figure 5 show the estimated elasticity for the most populated mesoregions in Brazil. As before, the 0% growth is used as a base scenario the elasticity. With a 2% annual growth scenario on the industrial production, the metropolitan area of Rio de Janeiro and Porto Alegre are the most sensitive mesoregions with 0.19 elasticity. Belo Horizonte and São Paulo have an elasticity of 0.17 and 0.16 respectively. Lastly the metropolitan area of Salvador has an 0.11 elasticity.

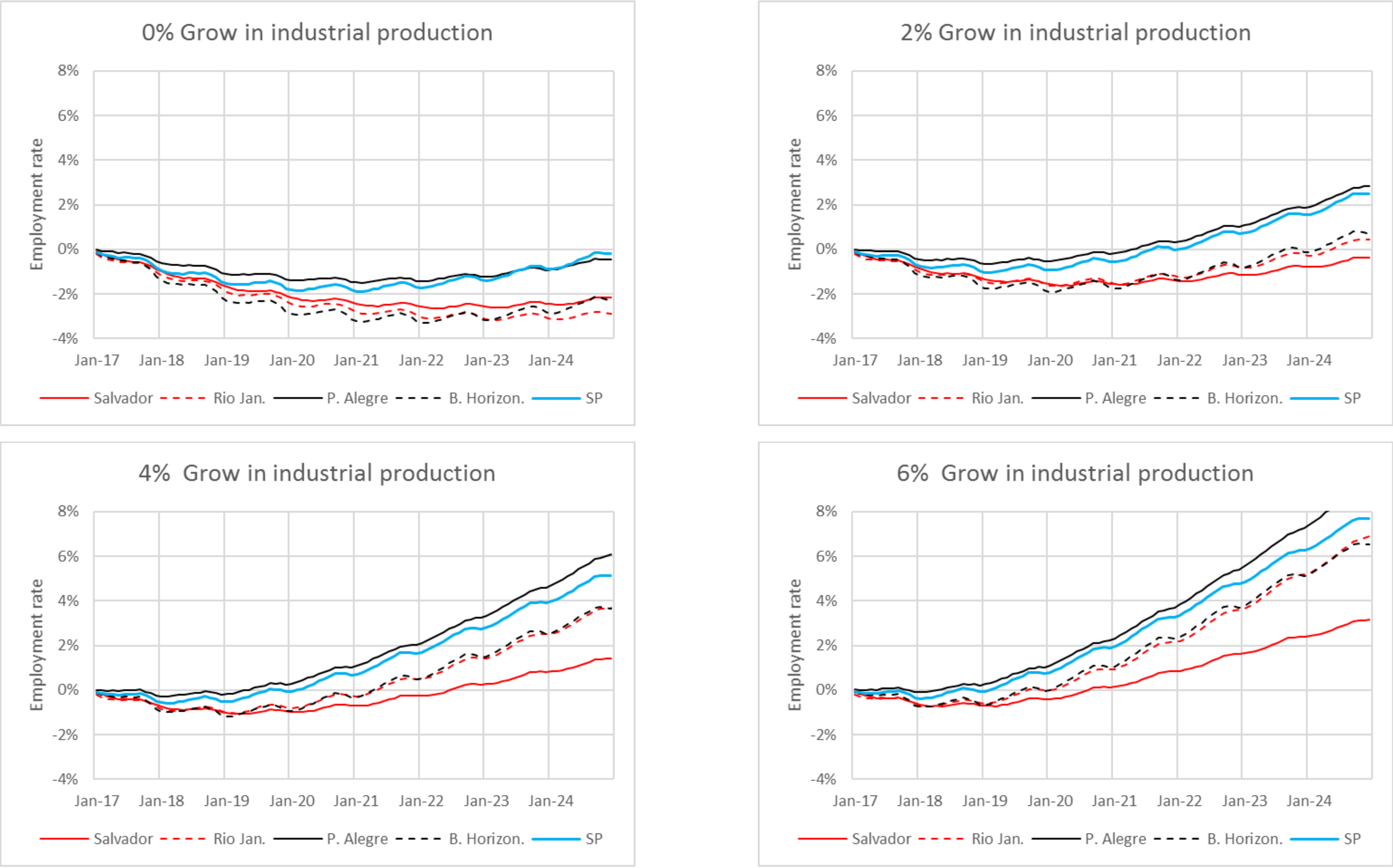

Figure 5 Accumulated employment rate variation for various industrial production growth scenarios on mesoregion level – Most populated mesoregions.
Source: elaborated by the author
Salvador: Salvador metropolitan area; Rio Jan: Rio de Janeiro metropolitan area; P.Alegre: Porto Alegre metropolitan area; B.Horizon.: Belo Horizonte metropolitan area SP: São Paulo metropolitan area

6.1.3 Net employment and Industrial production growth rate

From a global perspective, it is significant to know whether the relationship between net employment and industrial production rate in the steady state of the GVAR model agrees with another data set and with the macroeconomic theory.

Therefore, assuming that the industrial production growth rate and the net employment follow a linear relationship then a model can be specified as:

$$NE = b_0 + b_1 \cdot IPGR \tag{18}$$

Where NE is the Net employment within a year; IPGR is the Industrial production growth rate per year; b_0 and b_1 are the intercept and the coefficient in the model, respectively. The intercept can be interpreted as the natural growth in the net employment and the coefficient is the variation in the net employment associated to a change in the industrial production growth rate.

A data set containing the total net employment data from Brazil from 1995 until 2016, was provided by the economic consulting firm LCA (2017). The relationship can be estimated consistently using ordinary least squares (OLS). The GVAR steady state relationship between the variables (average annual industrial production growth and net employment) were estimated using the last year in the forecast series, in this case 2024. The GVAR steady state shows that the Brazilian net employment has a natural growth rate of approximately 694 thousand jobs per year, and the industrial production growth rate has a positive impact generating an extra 257 thousand jobs per year for each percentage point.

Table 3 shows the results of the OLS regression on different time frames of the data set. The GVAR model has a higher slope and higher intercept than the OLS model estimates, a likely reason for this difference is that the methodology used to estimate the industrial production have been reviewed and changed in 2000 and could be responsible for a change in the intercept and the coefficient. However, because of serial correlation, the OLS estimates are inefficient and invalid for inference procedures. Nevertheless, the signal of the GVAR estimates are

consistent with the OLS 95-16 estimate, where both estimates have a positive intercept and a positive coefficient, which also agrees with macroeconomic theory.

Table 3: OLS regression coefficients and GVAR stead state coefficients

	OLS 95-03	OLS 04-16	OLS 95-16	GVAR (Steady State)
Period	1995-2003	2004-2016	1995-2016	-
$\boldsymbol{b_0}^{(1)}$	-49 502.8 (-0.3)	710 485.9 (3.6)	378 563.5 (2.4)	693 936.1
$\boldsymbol{b_1}^{(2)}$	100 568.8 (1.6)	155 768.6 (4.4)	138 989.4 (4.4)	257 535.1

Source: elaborated by the author.
Original data from: CAGED
Data provided by LCA – Strategic Solutions in Economics
Note: The OLS model is refereed in equation (18)
t-statistics are in parentheses
(1) b_0 is the intercept in the OLS model and can be interpreted as the natural growth
(2) b_1 is the coefficient in the OLS model and can be interpreted as the effect of the industrial production growth rate in the net employment.

6.1.4 Region dynamics

One of the advantages of the GVAR methodology is being able to detect the dynamic interactions between the regions in the model. In other words, the GVAR model can provide a forecast with the dynamics of each region. Consequently, the final analysis of our study will be to evaluate the interactions of the regions among different scenarios.

Comparing all interactions for all the forecast scenarios would be unfeasible. Therefore, to compare the dynamics of the forecasts, a comparison between the scenarios in four distinct forecast horizons will be made. The scenarios compared will be the 0% growth (baseline), a 2% growth, and 4% growth in Industrial production, and the forecast horizons will be one year, three years, five years, and seven years ahead.

It is expected that the most populated areas have a higher number of admissions and disconnections, or a higher net employment, than less populated areas. Therefore, to account for the total population in the region, the comparison between the regions will be made using the previously defined employment rate[2].

[2] Net employment divided by the total population of the region.

By using the GVAR methodology and comparing the accumulated employment rate it is possible not only to determine how the employment rate in each region reacts to a variation in the industrial production, but also to determine the dynamics of the interactions of the regions. The South, Southeast and Northeast regions prove to be very dynamic, displaying a constant interaction within its regions, while the North and Central regions appear to get little influence from the neighboring regions.

As shown in Figure 6, the 0% growth scenario shows almost no improvement in the individual regions. On December 2017, this scenario has 112 mesoregions, which show a negative net employment. On December 2023, only 28 regions were able to develop a positive balance of employment, and 84 mesoregions still show a negative net employment (the 84 regions are divided as: North: 15; Northeast: 33; Southeast: 16; South: 14; Central: 6). The 2% growth scenario shows some improvement over the 0% growth, with only 41 mesoregions with negative net employment on December 2023 (North: 14; Northeast: 18; Southeast: 6; South: 1; Central: 2). Finally, the 4% scenario shows a significant improvement, only 13 among all 137 mesoregion regions have a negative net employment by December 2023 (North: 6; Northeast: 3; Southeast: 2; South: 1; Central: 1).

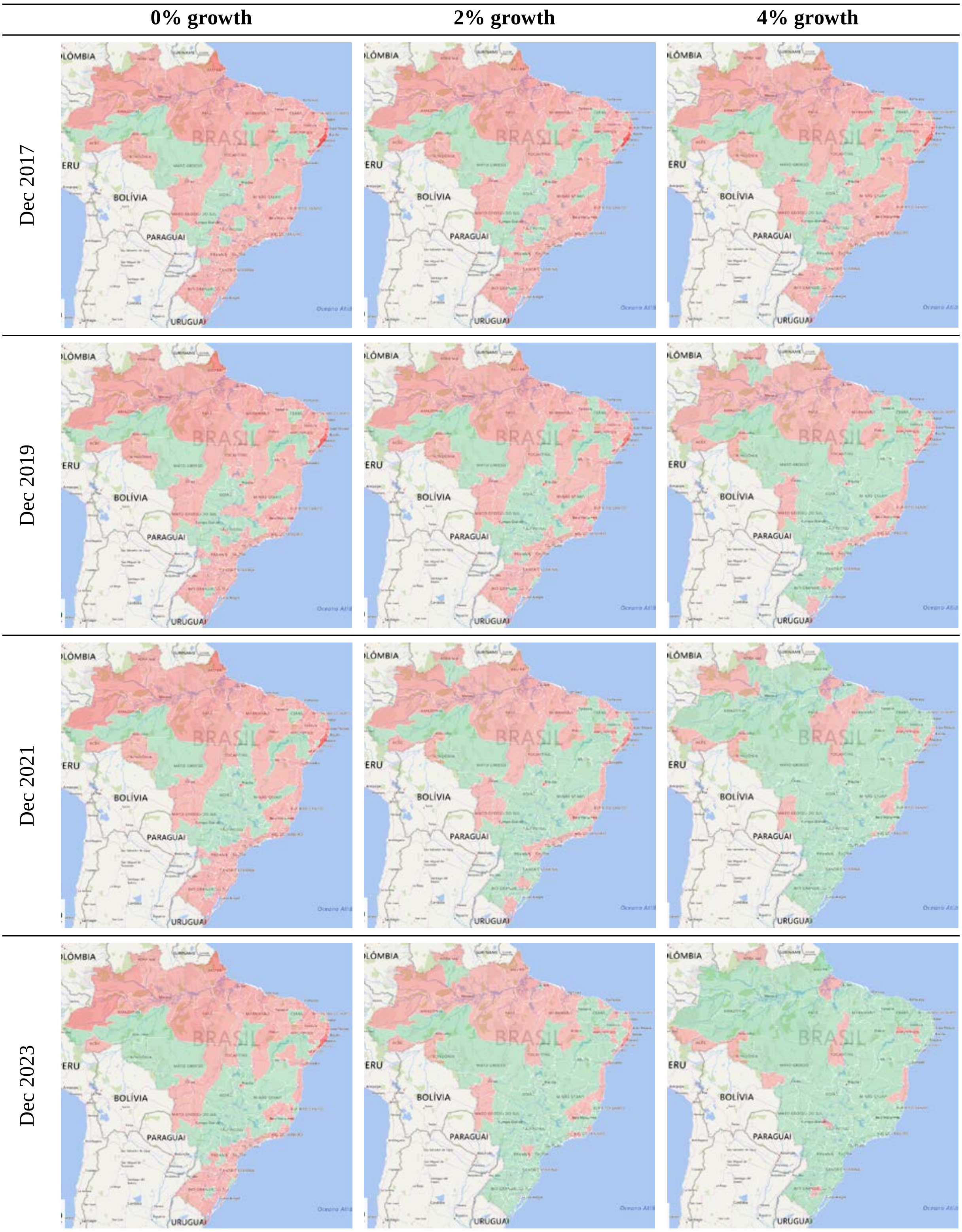

Figure 6: Dynamic comparison of the accumulated employment rate between different growth scenarios
Source: elaborated by the author. Original data from: CAGED

7 CONCLUSION

The initial purpose of this paper is a twofold: firstly, creating a model of the Brazilian labor market at a regional level using the GVAR methodology, as proposed by Pesaran, Weiner and Schuermann (2004). Secondly, using the developed model to estimate the regional elasticity of employment in respect to the economic activity of the country, identifying the dynamics of the regions as well as infer on the effects of the global variables on the labor market.

The increasing integration of the Brazilian territory has generated great interdependence among its regions. This interdependence plays a key role in the modeling and analysis of the markets. Therefore, the macroeconomic analyzes should consider not only the existence of a correlation between local and global variables, but also the correlation with variables from other regions through this interdependence channel.

In this scenario, the GVAR methodology, developed by Pesaran et al. (2004), plays a leading role in the modeling of the labor market, since it accounts for the interdependence and connections between economies and regions. Therefore, if the assumptions of weak exogeneity is maintained, it is possible to use the GVAR to construct a simple and practical model for the labor market.

Aiming at the first objective of this study, the utilization of GVAR methodology resulted in a model with 137 mesoregions, plus a dominant unit for global variables. The final model is stable, with the domestic and foreign variables having a lag order of 2 at most. The model allows cointegration between the regions' domestic variables and external variables (foreign and global). The cointegration analysis showed that 128 regions have 2 cointegration relations, and 9 regions have 1 cointegration relation. No region showed zero cointegration relationship.

Thus, using the previously estimated model, several forecast scenarios for the labor market are analyzed, leading to the assessment that if industrial production remains at the current level. In other words a 0% annual growth coefficient, the labor market will keep a negative employment balance, meaning that the economy will remain in recession at least for the next 8 years. On the other hand, a 2% annual growth of the industrial production shows significant improvement in the accumulated net employment leading to a positive accumulated balance of 2.5 million

employment positions for an 8-year forecast. Higher growth scenarios (4%, 6% and 8% annual coefficients) also show higher accumulated employment. Therefore, an increase on the industrial production affects the labor market in a positive correlation, as expected according to the macroeconomic theory.

So, focusing on the five major regions in Brazil (North, Northeast, Southeast, South, and Central) and using the forecasts scenarios, it was possible to determine the elasticity of employment in relation to industrial production for each major region. The most sensitive region is the South followed by the Northeast; they have an elasticity of 0.18 and 0.16, respectively. The Southeast, the country's most developed one, has an elasticity of 0.1, while the North and Central regions are the most inelastic both having an elasticity of approximately 0.06.

As discussed previously, the use of the GVAR methodology allows for region specific analysis, therefore it is possible to evaluate not only the major regions, but also all the specific regions in the model. So, it was possible to estimate the elasticity of the states in the Southeast region. Rio de Janeiro is the most sensitive state with 0.19 elasticity. Followed by Espírito Santo, Minas Gerais and São Paulo with an elasticity of 0.09, 0.07 and 0.08, respectively.

In a deeper analysis, the GVAR methodology allowed for the estimation of the regional elasticity, and since listing all 137 regions estimated elasticity would be unreasonable, the region of São Paulo metropolitan area is compared along with 4 other regions: Porto Alegre metropolitan area, Goiás Central area, Borborema and Jequitinhonha. Porto Alegre displayed an elasticity of 0.19, Sao Paulo, in its turn, displayed an elasticity of 0.16. Goiás, Borborema and Jequitinhonha were estimated at 0.07, 0.02 and 0.02 respectively. The elasticity for the Brazilian most populated mesoregions are also estimated, were the Rio de Janeiro metropolitan area has a 0.19 elasticity, Belo Horizonte metropolitan area has a 0.17 elasticity and Salvador metropolitan area has an 0.11 elasticity.

Besides the elasticity, a long-run relationship between net employment and the industrial production growth rate is also estimated considering a linear relationship between the two variables. The long-run equilibrium analysis indicated a natural growth of 694 thousand jobs per year in Brazil, and the industrial production growth rate generates 257 thousand jobs per year for each percentage point.

Finally, the model also showed the dynamic relationship between the mesoregions. The South, Southeast and Northeast are very dynamic, presenting a constant interaction within their regions, while the North and Central regions appear to undergo little influence from neighboring regions.

In view of the above, it is possible to conclude that the GVAR methodology proved to be a powerful tool in the analysis, allowing for a regional specific modeling, while handling the curse of dimensionality that usually arises in an infinite-dimensional VAR. The results of the GVAR allowed for the construction of a parsimonious model of the Brazilian labor market in a mesoregion level with the account of external influences for every region. The final model considers the interaction between the domestic and external variables of each region as well as allows for regional influence over the global variable through a feedback channel. The analysis of the labor market shows the relationship between net employment and industrial production, and can determined the most elastic and inelastic region.

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APPENDIX A - DESCRIPTIVE STATISTICS

Table 4: Descriptive statistics of domestic variables - Admissions

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Ro - Madeira-Guapore	4300.6	4209.0	9507.0	1415.0	2163.4	0.4206	1.9300	11.7864	0.0028
Ro - Leste Rondoniense	5238.3	5284.0	7761.0	2558.0	1243.5	-0.0454	2.0509	5.5872	0.0612
Ac - Vale do Jurua	174.6	158.5	461.0	31.0	90.0	0.8432	3.3742	19.9823	0.0000
Ac - Vale do Acre	1725.2	1715.5	3254.0	711.0	518.5	0.1245	2.3989	2.5230	0.2832
Am - Norte Amazonense	16.1	10.0	340.0	0.0	36.6	7.4954	62.5613	25179.5129	0.0000
Am - Sudoeste Amazonense	27.1	25.0	102.0	2.0	15.5	1.3727	6.6797	142.1425	0.0000
Am - Centro Amazonense	13968.5	13979.5	21392.0	7026.0	3599.7	0.0910	1.9603	6.9065	0.0316
Am - Sul Amazonense	77.4	70.5	192.0	8.0	41.2	0.4823	2.3028	9.0613	0.0108
Rr - Norte de Roraima	1257.1	1314.0	2266.0	405.0	495.3	0.0063	1.7533	9.7397	0.0077
Rr - Sul de Roraima	55.2	53.5	145.0	1.0	32.2	0.4262	2.3100	7.6475	0.0218
Pa - Baixo Amazonas	1221.6	1222.0	1908.0	480.0	313.1	-0.0209	2.1760	4.1283	0.1269
Pa - Marajo	152.3	141.0	461.0	26.0	72.0	1.3094	5.7810	98.4593	0.0000
Pa - Metropol de Belem	11096.1	10763.5	16147.0	7017.0	2204.0	0.1361	1.9510	7.3031	0.0260
Pa - Nordeste Paraense	1696.7	1717.5	3147.0	573.0	555.6	0.0968	2.0589	5.6841	0.0583
Pa - Sudoeste Paraense	1668.5	892.0	6481.0	340.0	1522.5	1.3916	3.9896	58.3782	0.0000
Pa - Sudeste Paraense	7729.2	7756.0	12099.0	3476.0	1775.3	-0.0344	2.5520	1.1505	0.5626
Ap - Norte do Amapa	54.1	33.5	270.0	1.0	50.5	1.6733	5.6365	121.9322	0.0000
Ap - Sul do Amapa	1809.7	1733.0	3311.0	771.0	622.1	0.4427	2.2575	8.5023	0.0142
To - Ocidental do TO	2695.8	2734.0	3944.0	1282.0	556.9	-0.1740	2.4064	2.8585	0.2395
To - Oriental do TO	2353.4	2312.5	5063.0	952.0	777.1	0.3762	2.8170	3.8900	0.1430
Ma - Norte Maranhense	6728.6	6526.0	12879.0	2196.0	2686.7	0.0343	1.8762	7.8887	0.0194
Ma - Oeste Maranhense	2743.8	2670.0	4846.0	1143.0	758.4	0.4113	2.5604	5.5581	0.0621
Ma - Centro Maranhense	607.2	596.0	1250.0	165.0	234.7	0.0963	2.1583	4.5503	0.1028
Ma - Leste Maranhense	932.8	837.0	2582.0	315.0	421.1	1.6801	6.3810	152.7959	0.0000
Ma - Sul Maranhense	1274.9	1243.5	3378.0	203.0	615.4	0.8052	3.7448	21.2758	0.0000
Pi - Norte Piauiense	578.6	578.0	954.0	219.0	184.8	0.0391	1.9954	6.2681	0.0435
Pi - Centro-Norte Piaui	5340.1	5425.0	9061.0	2493.0	1600.4	0.1179	1.8803	8.1672	0.0168
Pi - Sudoeste Piauiense	767.7	760.0	1571.0	155.0	314.0	0.0725	2.1075	5.0052	0.0819
Pi - Sudeste Piauiense	459.3	427.0	2005.0	162.0	242.7	2.5778	15.5822	1238.4316	0.0000
Ce - Noroeste Cearense	1707.0	1670.0	4022.0	606.0	681.8	0.5565	3.2996	8.9709	0.0113
Ce - Norte Cearense	1507.9	1509.0	2973.0	549.0	519.6	0.2242	2.1687	5.5255	0.0631
Ce - Metropol Fortaleza	25019.1	25005.5	39644.0	11797.0	7494.9	-0.0280	1.7275	10.1797	0.0062
Ce - Sertoes Cearenses	480.2	508.0	874.0	119.0	181.1	-0.1831	1.9473	7.7509	0.0207
Ce - Jaguaribe	1521.1	1373.0	4078.0	541.0	694.5	1.1515	4.7543	56.5813	0.0000
Ce - Centro-Sul Cearense	403.4	381.5	1090.0	118.0	180.7	0.8101	3.7410	21.4458	0.0000
Ce - Sul Cearense	1969.4	2017.0	3469.0	740.0	673.2	0.0516	1.8851	7.7998	0.0202
Rn - Oeste Potiguar	2944.1	2924.5	4630.0	1230.0	798.0	0.2156	2.3223	3.9577	0.1382
Rn - Central Potiguar	810.0	812.5	1313.0	349.0	211.9	0.1452	2.3535	3.0260	0.2202
Rn - Agreste Potiguar	339.4	335.0	867.0	128.0	129.6	1.1807	5.4599	78.5776	0.0000
Rn - Leste Potiguar	9511.7	9449.5	13930.0	6112.0	1755.8	0.3226	2.3925	4.9193	0.0855
Pb - Sertao Paraibano	717.0	742.5	1413.0	259.0	277.5	0.2797	2.3018	4.9769	0.0830
Pb - Borborema	130.9	123.0	375.0	40.0	53.0	1.1420	5.2110	68.3131	0.0000
Pb - Agreste Paraibano	2546.8	2611.5	4453.0	959.0	854.6	0.1472	1.9590	7.2797	0.0263
Pb - Mata Paraibana	6605.5	6392.5	15283.0	2985.0	2438.6	0.9643	4.0662	32.7863	0.0000
Pe - Sertao Pernambucano	1180.2	1052.0	3090.0	316.0	529.2	1.0592	4.3347	42.3135	0.0000
Pe - Sao Francisco PE	3341.9	3206.0	7645.0	995.0	1429.6	0.7313	3.2286	14.6519	0.0007
Pe - Agreste Pernambucano	4012.1	3994.0	6722.0	1614.0	1178.8	0.0657	2.0987	5.0810	0.0788
Pe - Mata Pernambucana	4608.9	2955.5	23620.0	1265.0	4371.5	2.3734	8.3666	344.1422	0.0000
Pe - Metropol de Recife	24476.8	22669.5	41105.0	11206.0	8042.6	0.2275	1.7468	11.2146	0.0037
Al - Sertao Alagoano	177.2	156.0	896.0	36.0	115.9	2.1455	11.6245	622.5059	0.0000
Al - Agreste Alagoano	864.4	820.0	2278.0	216.0	372.2	1.3425	5.7332	99.0072	0.0000
Al - Leste Alagoano	9241.6	6884.0	42211.0	3301.0	7604.9	2.7629	10.3107	562.5375	0.0000
Se - Sertao Sergipano	209.5	208.5	488.0	24.0	94.9	0.3510	2.7972	3.4467	0.1785
Se - Agreste Sergipano	842.5	783.5	3009.0	281.0	424.8	1.8599	8.9815	333.3773	0.0000
Se - Leste Sergipano	6860.8	6563.0	12555.0	3803.0	1805.8	0.4301	2.4935	6.3649	0.0415
Ba - Extremo Oeste Baiano	3698.9	3770.5	6729.0	1416.0	1031.3	-0.0208	2.7649	0.2698	0.8738
Ba - Vale Sao-Fran da BA	2533.4	2414.0	4962.0	987.0	946.3	0.3532	2.0906	8.3676	0.0152
Ba - Centro Norte Baiano	4972.1	4774.5	8540.0	2207.0	1559.3	0.1760	1.8088	9.6846	0.0079
Ba - Nordeste Baiano	1804.2	1747.5	2847.0	818.0	483.8	0.0802	2.1692	4.3593	0.1131
Ba - Metropol de Salvador	28479.1	27710.0	41264.0	14472.0	7207.7	0.0932	1.7683	9.7289	0.0077
Ba - Centro Sul Baiano	4336.6	4431.5	7473.0	1859.0	1235.6	0.0346	2.1819	4.0867	0.1296
Ba - Sul Baiano	6575.3	6512.5	10830.0	3485.0	1519.7	0.4500	2.8481	5.4541	0.0654

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Mg - Noroeste de Minas	3309.2	3307.5	5446.0	1348.0	786.4	0.1852	3.0567	0.9697	0.6158
Mg - Norte de Minas	5344.4	5295.0	7722.0	3038.0	1093.5	0.0390	2.0592	5.4726	0.0648
Mg - Jequitinhonha	1362.8	1244.0	3520.0	561.0	532.8	1.5303	5.8266	116.8112	0.0000
Mg - Vale do Mucuri	1287.5	1259.0	2139.0	626.0	352.2	0.5212	2.8413	7.2964	0.0260
Mg - Triang Mineiro	26000.1	26399.5	38341.0	13485.0	5860.3	-0.1300	2.1268	5.0969	0.0782
Mg - Central Mineira	2774.2	2858.5	4185.0	1411.0	574.9	-0.0437	2.4917	1.5235	0.4669
Mg - Metropol de BH	71292.9	69145.5	104419.0	39709.0	17828.2	0.0873	1.6910	10.9703	0.0041
Mg - Vale do Rio Doce	8957.9	9176.0	12797.0	4860.0	1578.7	-0.2015	2.5896	1.9990	0.3681
Mg - Oeste de Minas	9373.9	9396.5	15917.0	4124.0	2362.3	0.0260	2.5658	1.0628	0.5878
Mg - Sul-Sudoeste MG	20946.9	20175.0	42628.0	10138.0	6494.7	0.9240	3.7249	26.5172	0.0000
Mg - Campo das Vertentes	3036.2	3048.0	4861.0	1477.0	683.2	0.1113	2.5054	1.7165	0.4239
Mg - Zona da Mata	12862.4	12747.0	20939.0	6932.0	3050.7	0.1779	2.3292	3.5065	0.1732
Es - Noroeste ES	2593.1	2531.5	5155.0	1127.0	776.1	0.7899	3.9489	23.0388	0.0000
Es - Litoral Norte ES	6292.6	5641.0	15472.0	2989.0	2415.2	1.6875	5.6627	124.1357	0.0000
Es - Central ES	19696.5	19381.5	28771.0	10475.0	4644.1	-0.0714	1.7659	9.6717	0.0079
Es - Sul ES	2438.2	2418.0	3882.0	1304.0	553.7	0.1336	2.3254	3.1728	0.2047
Rj - Noroeste Fluminense	1085.1	1062.0	2073.0	442.0	311.2	0.3235	2.6750	3.3213	0.1900
Rj - Norte Fluminense	6772.2	6586.0	11568.0	3562.0	1886.7	0.3599	2.2453	6.8559	0.0325
Rj - Centro Fluminense	3542.8	3569.5	5969.0	1809.0	828.1	0.1307	2.2212	4.1098	0.1281
Rj - Baixadas	3688.7	3746.5	6008.0	1643.0	1043.7	0.0320	2.1476	4.4470	0.1082
Rj - Sul Fluminense	7098.8	6953.0	10357.0	3911.0	1776.3	0.1208	1.6253	12.2965	0.0021
Rj - Metropol do RJ	95295.5	94490.0	140206.0	56900.0	22461.6	0.1119	1.7417	10.2581	0.0059
Sp - Sao Jose do Rio Preto	15374.7	15359.0	26134.0	6048.0	4413.2	0.2291	2.5353	2.6040	0.2720
Sp - Ribeirao Preto	28919.1	28344.0	45720.0	11850.0	7486.4	-0.0174	2.3390	2.5935	0.2734
Sp - Aracatuba	7406.4	7033.0	20867.0	2575.0	3015.1	1.3771	6.0973	115.8409	0.0000
Sp - Bauru	15900.6	15898.0	26267.0	7634.0	3912.2	0.2461	2.6761	2.1496	0.3414
Sp - Araraquara	10451.7	10402.5	19862.0	4795.0	2842.2	0.3464	3.1437	3.4024	0.1825
Sp - Piracicaba	15738.3	15805.5	25141.0	7819.0	3890.7	0.1181	2.2173	4.0647	0.1310
Sp - Campinas	42534.5	42454.0	60964.0	20559.0	10011.2	-0.0278	1.8493	8.2735	0.0160
Sp - Presidente Prudente	5975.7	5976.5	10233.0	2697.0	1570.0	0.2787	2.7233	2.4379	0.2955
Sp - Marilia	3335.6	3347.0	5596.0	1738.0	788.0	0.1997	2.5003	2.4773	0.2898
Sp - Assis	4636.5	4568.5	9501.0	1665.0	1446.8	0.7454	4.0744	22.9874	0.0000
Sp - Itapetininga	6564.5	6584.5	9989.0	3879.0	1285.9	-0.0524	2.1405	4.5702	0.1018
Sp - Macro Metropol SP	27544.3	26227.0	42823.0	13275.0	7228.3	0.0881	1.7054	10.7306	0.0047
Sp - Vale do Paraiba SP	17212.0	17423.5	24071.0	10506.0	3765.7	-0.1219	1.7465	10.2419	0.0060
Sp - Litoral Sul SP	1761.0	1785.0	2743.0	934.0	374.7	-0.0290	2.2183	3.7078	0.1566
Sp - Metropol Sao Paulo	226073.0	223610.5	329823.0	115254.0	55443.5	-0.0856	1.7569	9.8751	0.0072
Pr - Noroeste PR	5838.5	5844.5	11706.0	2072.0	2078.2	0.5801	3.2582	9.5067	0.0086
Pr - Centro Ocidental PR	1805.1	1813.0	3286.0	579.0	547.2	0.1818	2.3797	3.1354	0.2085
Pr - Norte Central PR	22525.6	22531.0	33529.0	10395.0	5595.8	-0.0587	1.9403	7.0485	0.0295
Pr - Norte Pioneiro PR	3163.4	3085.5	7687.0	1294.0	1097.6	1.4021	6.3448	128.4449	0.0000
Pr - Centro Oriental PR	5866.6	5797.0	8955.0	3488.0	1149.7	0.3098	2.4997	3.9677	0.1375
Pr - Oeste PR	11565.2	11479.0	19446.0	5575.0	2955.9	0.1822	2.0854	6.0017	0.0497
Pr - Sudoeste PR	3868.4	3773.5	7028.0	1441.0	1173.1	0.1919	2.1716	5.1399	0.0765
Pr - Centro-Sul PR	2778.0	2746.0	4572.0	1222.0	648.7	0.1691	3.0418	0.8010	0.6700
Pr - Sudeste PR	1949.0	1882.0	2956.0	964.0	456.4	0.1439	2.3005	3.4639	0.1769
Pr - Metropol de Curitiba	43944.6	42569.0	68129.0	23162.0	11551.5	0.1431	1.6920	11.2929	0.0035
Sc - Oeste Catarinense	13495.5	13785.0	22628.0	7078.0	3215.3	0.1424	2.4561	2.2422	0.3259
Sc - Norte Catarinense	14936.5	14584.0	26700.0	6237.0	4291.0	0.2141	2.2971	4.1606	0.1249
Sc - Serrana	4014.1	3814.0	7242.0	1749.0	1168.2	0.4573	2.6115	6.3607	0.0416
Sc - Vale do Itajai	23603.1	23489.0	42763.0	11384.0	6417.4	0.2816	2.4464	3.8724	0.1443
Sc - Grande Florianopolis	15204.7	15017.5	24270.0	7578.0	4073.5	0.0558	1.9652	6.7046	0.0350
Sc - Sul Catarinense	9395.5	9079.5	14942.0	5387.0	2256.5	0.3016	2.0746	7.6587	0.0217
Rs - Noroeste RS	12671.8	12251.5	20679.0	6689.0	3433.6	0.1931	2.0587	6.4260	0.0402
Rs - Nordeste RS	15764.1	15793.0	28528.0	6297.0	4705.2	0.2932	2.5412	3.4578	0.1775
Rs - Centro Ocidental RS	2833.5	2752.0	5688.0	1552.0	791.6	0.6195	3.2796	10.8463	0.0044
Rs - Centro Oriental RS	8054.9	7577.5	16016.0	3550.0	2728.1	0.8658	3.4038	21.1743	0.0000
Rs - Metropol Porto Alegre	51772.6	49528.0	78148.0	32329.0	12171.2	0.3235	1.8216	11.4428	0.0033
Rs - Sudoeste RS	2899.2	2847.5	5120.0	1682.0	733.2	0.6504	3.5052	13.1833	0.0014
Rs - Sudeste RS	5234.1	4906.0	10412.0	2285.0	1820.1	0.5482	2.6634	8.5600	0.0138
Ms - Pantanais Sul MT	732.1	734.0	1247.0	331.0	179.3	0.1580	2.6201	1.4398	0.4868
Ms - Centro Norte de MS	9066.9	9404.5	12733.0	4878.0	2148.3	-0.1465	1.7499	10.3616	0.0056
Ms - Leste de MS	4547.2	4390.0	7891.0	1740.0	1358.6	0.2598	2.4339	3.6462	0.1615
Ms - Sudoeste de MS	4997.7	5089.5	8382.0	1809.0	1287.2	-0.0133	2.7151	0.4103	0.8145
Mt - Norte MT	10165.4	10279.5	18610.0	2859.0	3338.1	0.0974	2.2950	3.2157	0.2003
Mt - Nordeste MT	1712.1	1703.5	2998.0	689.0	506.8	0.2554	2.5087	3.0975	0.2125
Mt - Sudoeste MT	2616.9	2477.5	5757.0	1196.0	862.1	0.9331	4.0048	30.3378	0.0000
Mt - Centro-Sul MT	9098.1	9014.5	13786.0	4553.0	2450.7	0.0662	1.7798	9.4324	0.0089
Mt - Sudeste MT	5070.4	5131.5	8335.0	2000.0	1387.6	-0.0218	2.4607	1.6864	0.4303

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Go - Noroeste Goiano	742.0	706.0	1323.0	289.0	222.0	0.2770	2.2187	5.7152	0.0574
Go - Norte Goiano	1022.6	1043.5	1827.0	426.0	316.7	0.1808	2.4346	2.7190	0.2568
Go - Centro Goiano	30013.8	29315.0	50106.0	14198.0	8267.3	0.1207	1.8387	8.7966	0.0123
Go - Leste Goiano	3574.9	3641.0	6264.0	1293.0	1208.8	0.0610	1.7561	9.7912	0.0075
Go - Sul Goiano	11592.5	11844.0	18842.0	4762.0	3228.9	-0.0203	2.0092	6.0619	0.0483
Go - Distrito Federal	22942.6	22685.5	36420.0	12557.0	5643.1	0.0728	1.7380	10.1272	0.0063

Source: elaborated by the author. Original data from: CAGED and IpeaData

Table 5: Descriptive statistics of domestic variables - Disconnections

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Ro - Madeira-Guapore	4204.2	4137.5	9139.0	1273.0	2081.5	0.1724	1.7167	11.1246	0.0038
Ro - Leste Rondoniense	5081.9	5181.5	7420.0	2675.0	1220.1	-0.1170	1.7332	10.4287	0.0054
Ac - Vale do Jurua	170.8	171.0	479.0	29.0	89.9	0.5348	2.7734	7.8174	0.0201
Ac - Vale do Acre	1721.0	1833.0	3232.0	696.0	524.6	-0.1913	2.2977	3.9099	0.1416
Am - Norte Amazonense	17.2	9.0	339.0	1.0	44.9	6.1049	40.5974	10434.7283	0.0000
Am - Sudoeste Amazonense	27.7	22.5	324.0	6.0	29.3	7.2572	69.2852	30733.3254	0.0000
Am - Centro Amazonense	13483.8	14063.0	20232.0	6286.0	3268.0	-0.3046	2.1403	6.9585	0.0308
Am - Sul Amazonense	69.9	68.5	165.0	11.0	38.0	0.4188	2.1941	8.5777	0.0137
Rr - Norte de Roraima	1203.8	1188.0	2792.0	344.0	541.2	0.3409	2.2813	6.1670	0.0458
Rr - Sul de Roraima	51.3	43.5	157.0	4.0	35.0	0.7781	2.9607	16.0488	0.0003
Pa - Baixo Amazonas	1186.7	1209.5	2183.0	509.0	307.6	0.1049	2.9834	0.2949	0.8629
Pa - Marajo	160.7	133.5	564.0	60.0	79.6	2.2555	9.3029	403.0333	0.0000
Pa - Metropol de Belem	10555.0	10673.0	14516.0	5351.0	2407.4	-0.2887	1.9955	8.4355	0.0147
Pa - Nordeste Paraense	1601.3	1583.0	2759.0	617.0	519.4	0.1261	2.0999	5.3744	0.0681
Pa - Sudoeste Paraense	1590.7	740.0	8470.0	408.0	1474.6	1.7315	6.3404	155.6034	0.0000
Pa - Sudeste Paraense	7581.3	7558.5	13212.0	3932.0	1677.4	0.1382	2.8391	0.6064	0.7384
Ap - Norte do Amapa	51.5	31.0	414.0	2.0	59.4	3.1488	15.7849	1359.4928	0.0000
Ap - Sul do Amapa	1756.3	1718.5	3639.0	683.0	639.9	0.3204	2.4118	4.7381	0.0936
To - Ocidental do TO	2645.4	2665.5	4153.0	1237.0	585.0	-0.0517	2.5688	1.1001	0.5769
To - Oriental do TO	2268.3	2291.5	3978.0	885.0	753.4	0.1514	2.0899	5.6768	0.0585
Ma - Norte Maranhense	6471.7	6764.0	12820.0	1922.0	2849.1	-0.0967	1.7248	10.4502	0.0054
Ma - Oeste Maranhense	2690.1	2583.5	6593.0	1318.0	857.8	0.8925	4.7951	43.5349	0.0000
Ma - Centro Maranhense	579.0	561.5	1245.0	141.0	246.2	0.1249	2.0382	6.1007	0.0473
Ma - Leste Maranhense	917.9	881.5	2716.0	235.0	443.9	1.5725	6.2790	138.9378	0.0000
Ma - Sul Maranhense	1236.0	1137.0	5793.0	250.0	662.7	2.4459	15.9924	1291.0232	0.0000
Pi - Norte Piauiense	547.5	568.0	1184.0	176.0	193.3	0.3082	2.5846	3.4654	0.1768
Pi - Centro-Norte Piaui	4967.3	5061.0	8162.0	2363.0	1676.3	0.1756	1.7162	11.1622	0.0038
Pi - Sudoeste Piauiense	743.2	765.5	1673.0	153.0	317.4	0.1270	2.3336	3.0580	0.2168
Pi - Sudeste Piauiense	405.5	427.0	1065.0	118.0	187.8	0.4832	2.9265	6.1966	0.0451
Ce - Noroeste Cearense	1529.1	1567.5	2800.0	621.0	532.0	0.1775	2.1657	5.0602	0.0796
Ce - Norte Cearense	1381.9	1341.5	2694.0	596.0	495.6	0.3373	2.1851	7.0376	0.0296
Ce - Metropol Fortaleza	23084.3	23441.5	37002.0	10847.0	7515.9	-0.0283	1.5923	12.5269	0.0019
Ce - Sertoes Cearenses	415.0	458.0	773.0	122.0	162.0	-0.2036	1.9998	7.2694	0.0264
Ce - Jaguaribe	1434.2	1385.5	3055.0	516.0	563.5	0.5882	3.0495	9.2219	0.0099
Ce - Centro-Sul Cearense	355.3	361.0	787.0	123.0	148.8	0.4978	2.7650	6.8266	0.0329
Ce - Sul Cearense	1810.5	1915.5	3271.0	814.0	621.5	0.0543	1.8364	8.5232	0.0141
Rn - Oeste Potiguar	2793.2	2851.0	4154.0	1149.0	671.9	-0.3028	2.4931	3.8946	0.1427
Rn - Central Potiguar	746.8	774.5	1133.0	300.0	187.5	-0.3560	2.2554	6.6864	0.0353
Rn - Agreste Potiguar	299.1	302.5	629.0	107.0	104.5	0.5007	3.1525	6.8869	0.0320
Rn - Leste Potiguar	9073.2	8977.5	13578.0	4811.0	1694.5	0.0886	2.3078	3.0591	0.2166
Pb - Sertao Paraibano	628.7	626.0	1210.0	225.0	260.3	0.2144	1.9153	8.5203	0.0141
Pb - Borborema	116.2	106.5	365.0	40.0	48.2	1.4276	6.8999	157.4639	0.0000
Pb - Agreste Paraibano	2314.5	2211.5	4239.0	859.0	896.6	0.1614	1.7662	10.2222	0.0060
Pb - Mata Paraibana	6212.7	5990.0	13125.0	2477.0	2376.4	0.5436	2.4793	9.3836	0.0092
Pe - Sertao Pernambucano	1103.5	1069.5	2418.0	370.0	507.4	0.4340	2.1900	8.9653	0.0113
Pe - Sao Francisco PE	3202.1	2924.0	8868.0	848.0	1599.3	1.2324	4.1938	50.3872	0.0000
Pe - Agreste Pernambucano	3661.7	3771.0	6836.0	1469.0	1276.8	0.1029	2.0441	5.8955	0.0525
Pe - Mata Pernambucana	4524.2	2983.0	18812.0	1149.0	3487.6	1.7631	5.6869	131.9309	0.0000
Pe - Metropol de Recife	23229.2	21996.5	40376.0	10165.0	8250.6	0.2099	1.7890	10.3384	0.0057
Al - Sertao Alagoano	176.4	135.0	838.0	32.0	120.5	1.7017	8.1011	252.9229	0.0000
Al - Agreste Alagoano	766.9	777.0	1295.0	279.0	265.0	-0.0511	1.9870	6.4043	0.0407
Al - Leste Alagoano	9201.2	7479.0	28199.0	3313.0	5237.7	1.5504	4.5502	80.5476	0.0000
Se - Sertao Sergipano	183.3	176.0	1066.0	28.0	114.2	3.1594	24.1430	3256.7888	0.0000
Se - Agreste Sergipano	716.6	682.0	2699.0	191.0	412.5	1.8770	8.1101	270.1681	0.0000
Se - Leste Sergipano	6421.7	6419.5	11069.0	3209.0	1724.9	0.2506	2.3940	3.8141	0.1485
Ba - Extremo Oeste Baiano	3638.7	3699.0	5344.0	1094.0	766.0	-0.3303	2.9706	2.8923	0.2355
Ba - Vale Sao-Fran da BA	2438.8	2038.0	7022.0	907.0	1221.8	1.6008	5.0948	98.2743	0.0000

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Ba - Centro Norte Baiano	4579.3	4644.0	9850.0	1961.0	1588.8	0.2258	2.3619	3.7502	0.1533
Ba - Nordeste Baiano	1646.8	1697.0	2791.0	586.0	466.7	-0.2702	2.3446	4.4755	0.1067
Ba - Metropol de Salvador	27437.6	27438.0	42457.0	13163.0	7510.8	-0.1265	1.7750	9.8152	0.0074
Ba - Centro Sul Baiano	4056.0	4168.0	7663.0	1763.0	1226.8	0.0824	2.5046	1.5731	0.4554
Ba - Sul Baiano	6459.8	6504.5	9726.0	3344.0	1405.2	-0.0466	2.3771	2.3367	0.3109
Mg - Noroeste de Minas	3235.8	3227.5	5014.0	1601.0	608.3	0.1151	3.0270	0.3795	0.8272
Mg - Norte de Minas	5019.6	5151.5	7494.0	2518.0	1076.1	-0.2170	2.0610	6.6588	0.0358
Mg - Jequitinhonha	1278.9	1229.5	2389.0	644.0	352.1	0.5981	3.0672	9.5574	0.0084
Mg - Vale do Mucuri	1243.1	1247.5	2540.0	569.0	319.2	0.4787	4.3305	18.5691	0.0001
Mg - Triang Mineiro	24938.1	25984.0	34381.0	12692.0	5060.2	-0.4795	2.4469	7.8622	0.0196
Mg - Central Mineira	2638.5	2667.0	4493.0	1408.0	535.1	0.5475	4.3291	20.4162	0.0000
Mg - Metropol de BH	68218.6	68198.5	96029.0	35689.0	16734.8	-0.1466	1.8008	9.5574	0.0084
Mg - Vale do Rio Doce	8680.0	8874.0	11392.0	5541.0	1289.8	-0.2178	2.3516	3.7398	0.1541
Mg - Oeste de Minas	8887.2	8923.0	13654.0	4237.0	2030.3	-0.0029	2.3972	2.1250	0.3456
Mg - Sul-Sudoeste MG	20065.5	19715.0	33816.0	9904.0	5006.2	0.3707	2.6897	4.1354	0.1265
Mg - Campo das Vertentes	2856.8	2893.5	4211.0	1559.0	618.1	-0.2415	2.3058	4.4147	0.1100
Mg - Zona da Mata	12173.3	12336.0	17325.0	6575.0	2653.6	-0.1674	2.0112	6.7677	0.0339
Es - Noroeste ES	2481.4	2407.5	4487.0	1199.0	629.9	0.7377	3.6699	17.7705	0.0001
Es - Litoral Norte ES	6126.6	5588.0	11983.0	3138.0	1789.9	1.3820	4.7097	71.0081	0.0000
Es - Central ES	18809.0	19246.0	28032.0	9012.0	4754.5	-0.2610	2.0219	7.6955	0.0213
Es - Sul ES	2286.4	2261.5	3442.0	1119.0	529.1	-0.1612	2.2709	3.8718	0.1443
Rj - Noroeste Fluminense	1006.0	1032.5	2522.0	445.0	312.5	0.8172	5.1260	48.9433	0.0000
Rj - Norte Fluminense	6477.7	6535.5	11115.0	3035.0	1760.3	0.1888	2.5002	2.3649	0.3065
Rj - Centro Fluminense	3343.6	3422.0	5249.0	1739.0	715.5	0.0665	2.3776	2.3921	0.3024
Rj - Baixadas	3497.9	3558.5	6554.0	1625.0	1149.5	0.0774	2.0944	5.1755	0.0752
Rj - Sul Fluminense	6848.5	7055.0	10974.0	3435.0	1797.2	-0.0400	1.9095	7.4250	0.0244
Rj - Metropol do RJ	90694.9	92642.5	141759.0	51785.0	23537.8	-0.0474	1.7966	9.1128	0.0105
Sp - Sao Jose do Rio Preto	14512.2	13929.5	38957.0	7036.0	5111.5	1.9312	8.7111	319.3168	0.0000
Sp - Ribeirao Preto	27772.5	25644.5	68486.0	15635.0	9195.3	2.0515	8.2873	300.7170	0.0000
Sp - Aracatuba	7140.9	6777.0	24289.0	3280.0	3012.2	2.7026	12.9395	857.5792	0.0000
Sp - Bauru	15209.8	15305.5	26782.0	7905.0	3402.3	0.5322	3.7264	11.4080	0.0033
Sp - Araraquara	10123.8	9942.5	18038.0	5325.0	2507.4	0.6281	3.2509	11.0135	0.0041
Sp - Piracicaba	15021.5	14984.0	26834.0	7567.0	3738.5	0.3811	3.1198	4.0162	0.1342
Sp - Campinas	40604.8	41390.0	54961.0	20719.0	9475.7	-0.3196	1.8600	10.8015	0.0045
Sp - Presidente Prudente	5665.6	5754.0	11662.0	2820.0	1403.9	0.5677	4.4623	23.5594	0.0000
Sp - Marilia	3185.3	3274.0	4394.0	1788.0	706.1	-0.1834	1.8435	9.2301	0.0099
Sp - Assis	4427.2	4268.0	11087.0	2168.0	1436.6	1.8078	8.3207	278.1709	0.0000
Sp - Itapetininga	6225.5	6199.0	9476.0	3204.0	1369.9	0.0445	2.3763	2.3375	0.3108
Sp - Macro Metropol SP	26080.1	26502.5	37982.0	13083.0	7191.9	-0.1784	1.7237	11.0651	0.0040
Sp - Vale do Paraiba SP	16508.5	17148.5	23022.0	8541.0	4098.6	-0.3431	1.8647	11.1464	0.0038
Sp - Litoral Sul SP	1644.7	1692.0	2506.0	805.0	401.5	-0.0685	2.2616	3.3925	0.1834
Sp - Metropol Sao Paulo	212768.2	217592.0	298117.0	107413.0	56594.5	-0.3070	1.8034	11.4459	0.0033
Pr - Noroeste PR	5498.4	5430.5	11513.0	2638.0	1661.5	0.9385	4.7669	45.0788	0.0000
Pr - Centro Ocidental PR	1682.3	1682.5	2548.0	904.0	434.1	0.1041	1.8756	8.1537	0.0170
Pr - Norte Central PR	21326.4	21510.0	29414.0	11307.0	4811.4	-0.1614	1.8576	8.8198	0.0122
Pr - Norte Pioneiro PR	2974.2	2918.0	7569.0	1630.0	765.0	2.3876	13.9195	951.9316	0.0000
Pr - Centro Oriental PR	5562.3	5452.0	8145.0	3556.0	1059.8	0.3053	2.4198	4.4289	0.1092
Pr - Oeste PR	10706.6	10625.5	15846.0	5284.0	2745.0	-0.0628	1.7986	9.1258	0.0104
Pr - Sudoeste PR	3498.1	3640.0	5411.0	1728.0	1055.3	0.0931	1.7362	10.2450	0.0060
Pr - Centro-Sul PR	2625.4	2563.5	3788.0	1696.0	483.1	0.3456	2.3451	5.7007	0.0578
Pr - Sudeste PR	1835.1	1766.5	2658.0	1032.0	377.6	0.2401	2.1029	6.4461	0.0398
Pr - Metropol de Curitiba	41894.5	41540.0	61782.0	22029.0	11051.8	-0.0766	1.7364	10.1678	0.0062
Sc - Oeste Catarinense	12647.3	12823.5	18461.0	7396.0	2758.1	-0.0229	2.2486	3.4050	0.1822
Sc - Norte Catarinense	14154.7	14254.5	20207.0	7012.0	3578.2	-0.1399	1.8089	9.3808	0.0092
Sc - Serrana	3898.4	3670.0	6213.0	2563.0	897.8	0.6519	2.5406	12.4458	0.0020
Sc - Vale do Itajai	22449.1	22767.5	33680.0	11362.0	5639.0	-0.1831	2.0210	6.7900	0.0335
Sc - Grande Florianopolis	14302.6	14472.5	21739.0	7054.0	4116.2	-0.0823	1.8084	9.0490	0.0108
Sc - Sul Catarinense	8852.3	8980.0	12986.0	5121.0	2147.8	-0.0030	1.8746	7.8813	0.0194
Rs - Noroeste RS	11789.7	12087.5	18545.0	6294.0	3024.5	-0.0522	1.9180	7.3373	0.0255
Rs - Nordeste RS	15146.2	15310.5	25792.0	8247.0	3816.4	0.3838	2.7357	4.2450	0.1197
Rs - Centro Ocidental RS	2664.9	2731.0	4054.0	1483.0	704.6	0.0862	1.8623	8.2568	0.0161
Rs - Centro Oriental RS	7691.8	7620.0	13602.0	4364.0	1939.9	0.5787	3.1267	9.0591	0.0108
Rs - Metropol Porto Alegre	49539.5	47755.5	70444.0	30935.0	11520.4	0.1409	1.6913	11.2899	0.0035
Rs - Sudoeste RS	2724.6	2720.5	4594.0	1472.0	692.4	0.1492	2.3635	2.9765	0.2258
Rs - Sudeste RS	4986.2	4736.0	9930.0	1995.0	1750.7	0.5586	2.7955	8.4553	0.0146
Ms - Pantanais Sul MT	713.8	720.5	1436.0	339.0	187.5	0.3718	3.1813	3.9855	0.1363
Ms - Centro Norte de MS	8736.6	9162.5	12114.0	4696.0	2026.5	-0.3131	1.9797	9.0296	0.0109
Ms - Leste de MS	4406.2	4347.5	7776.0	2005.0	1252.0	0.2910	2.1946	6.1690	0.0458
Ms - Sudoeste de MS	4783.9	4857.5	9811.0	2475.0	1162.1	0.2483	4.2262	12.2982	0.0021

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Mt - Norte MT	9780.4	9859.0	16326.0	4388.0	2996.0	0.0180	1.9021	7.4955	0.0236
Mt - Nordeste MT	1678.3	1621.0	2735.0	895.0	436.8	0.2243	2.1181	6.0790	0.0479
Mt - Sudoeste MT	2590.3	2525.0	4935.0	1117.0	779.6	0.9459	4.0681	31.8807	0.0000
Mt - Centro-Sul MT	8922.3	9253.0	13492.0	4030.0	2499.6	-0.0521	1.7607	9.6905	0.0079
Mt - Sudeste MT	5000.5	5040.5	7851.0	2585.0	1164.0	-0.1188	2.3131	3.1801	0.2039
Go - Noroeste Goiano	696.1	651.5	1327.0	306.0	216.3	0.4473	2.3474	7.8201	0.0200
Go - Norte Goiano	985.6	1028.0	1861.0	351.0	327.4	0.0577	2.3396	2.6688	0.2633
Go - Centro Goiano	28617.0	29318.0	44193.0	14477.0	7931.7	-0.1216	1.6794	11.3573	0.0034
Go - Leste Goiano	3424.2	3540.0	5886.0	1214.0	1183.7	0.0350	1.7902	9.1858	0.0101
Go - Sul Goiano	11071.0	11576.5	19133.0	4880.0	3105.7	-0.0179	2.5192	1.3143	0.5183
Go - Distrito Federal	22068.6	22648.5	33552.0	10988.0	5931.7	-0.1269	1.7852	9.6577	0.0080

Source: elaborated by the author. Original data from: CAGED and IpeaData

Table 6: Descriptive statistics of foreign-specific variables - Admissions

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Ro - Madeira-Guapore	29041.1	29100.6	41693.0	14754.6	6743.2	-0.0486	1.7879	9.2512	0.0098
Ro - Leste Rondoniense	37633.9	37506.6	54197.6	18553.9	9348.8	-0.0499	1.7270	10.2330	0.0060
Ac - Vale do Jurua	18934.9	18850.7	29033.3	9555.4	4771.5	0.0610	1.7486	9.9125	0.0070
Ac - Vale do Acre	46290.6	45257.7	66896.7	23357.4	11592.8	-0.0362	1.7027	10.6050	0.0050
Am - Norte Amazonense	13968.5	13979.5	21392.0	7026.0	3599.7	0.0910	1.9603	6.9065	0.0316
Am - Sudoeste Amazonense	22948.5	22335.1	33225.2	11663.6	5540.8	-0.0049	1.7387	9.9753	0.0068
Am - Centro Amazonense	93977.9	92929.0	137704.3	50354.1	22241.9	-0.0250	1.7245	10.2248	0.0060
Am - Sul Amazonense	9175.9	8765.8	14273.0	4414.1	2494.6	0.1459	1.8774	8.4053	0.0150
Rr - Norte de Roraima	41873.1	40863.3	59492.5	22179.7	9960.8	-0.0198	1.7013	10.6042	0.0050
Rr - Sul de Roraima	6553.5	6464.8	9768.8	3163.8	1667.4	0.0679	1.9038	7.5856	0.0225
Pa - Baixo Amazonas	29047.9	28121.3	41426.7	15838.1	6862.1	-0.0085	1.6835	10.8974	0.0043
Pa - Marajo	7688.3	7413.3	11091.7	4739.9	1602.0	0.1287	1.8611	8.5179	0.0141
Pa - Metropol de Belem	56005.8	54836.3	81689.8	29392.1	13709.2	-0.0461	1.7050	10.5882	0.0050
Pa - Nordeste Paraense	13933.3	13492.4	19488.1	8579.6	2834.6	0.0130	1.7790	9.3334	0.0094
Pa - Sudoeste Paraense	25613.9	25176.5	36853.7	13536.8	6059.4	-0.0742	1.7045	10.6870	0.0048
Pa - Sudeste Paraense	31758.4	31398.8	45868.2	16824.1	7519.4	-0.0587	1.7158	10.4437	0.0054
Ap - Norte do Amapa	4572.6	4386.0	6713.3	2637.5	1079.9	0.1297	1.8251	9.0605	0.0108
Ap - Sul do Amapa	32721.9	32196.6	47074.4	16752.3	7578.0	-0.0760	1.7589	9.8013	0.0074
To - Ocidental do TO	12186.0	11853.2	17737.5	6041.1	3055.2	-0.0449	1.7366	10.0635	0.0065
To - Oriental do TO	14595.7	14624.0	21406.8	7722.1	3484.3	-0.0508	1.7220	10.3168	0.0058
Ma - Norte Maranhense	14382.6	13939.2	20778.9	7892.2	3423.3	-0.0337	1.6807	10.9740	0.0041
Ma - Oeste Maranhense	8864.0	8679.3	13292.1	4473.4	2414.1	-0.0648	1.6923	10.8583	0.0044
Ma - Centro Maranhense	8254.4	8272.6	12542.5	3802.8	2395.9	-0.0799	1.6876	10.9957	0.0041
Ma - Leste Maranhense	5151.3	5202.5	8519.3	2185.2	1710.5	-0.0375	1.7284	10.1810	0.0062
Ma - Sul Maranhense	13008.7	12843.4	18530.5	6386.0	3290.3	-0.1005	1.7136	10.6571	0.0049
Pi - Norte Piauiense	9287.4	9345.3	14126.5	4579.9	2696.9	-0.0194	1.6928	10.7476	0.0046
Pi - Centro-Norte Piaui	14583.4	14448.2	21374.1	7641.0	3634.3	-0.0623	1.6879	10.9230	0.0042
Pi - Sudoeste Piauiense	6815.8	6840.7	10182.9	3402.9	1824.8	-0.0225	1.7377	10.0051	0.0067
Pi - Sudeste Piauiense	5587.8	5592.9	8684.6	2676.8	1552.4	-0.0102	1.7697	9.4789	0.0087
Ce - Noroeste Cearense	22743.2	22609.2	34248.3	11383.4	6404.3	-0.0474	1.6865	10.9049	0.0043
Ce - Norte Cearense	17147.3	17062.0	26560.9	8313.7	4980.5	-0.0358	1.7117	10.4538	0.0054
Ce - Metropol Fortaleza	32763.0	32560.1	48060.5	16847.9	7898.8	-0.0012	1.7276	10.1562	0.0062
Ce - Sertoes Cearenses	14698.9	14564.9	21757.9	7444.9	4066.0	-0.0294	1.6897	10.8126	0.0045
Ce - Jaguaribe	14107.3	14035.4	21025.5	7020.4	3894.6	-0.0216	1.7097	10.4662	0.0053
Ce - Centro-Sul Cearense	16347.7	16078.2	24181.6	8106.5	4383.1	-0.0773	1.6711	11.2673	0.0036
Ce - Sul Cearense	17525.1	17378.9	25784.5	8814.2	4742.1	-0.0506	1.6664	11.2571	0.0036
Rn - Oeste Potiguar	14640.5	14253.9	21391.3	8200.4	3579.6	0.0685	1.7334	10.1861	0.0061
Rn - Central Potiguar	5343.9	5250.2	8392.1	3120.3	1188.0	0.3290	2.3285	5.5418	0.0626
Rn - Agreste Potiguar	7035.7	6889.3	10291.3	4401.8	1326.9	0.2995	2.2540	5.7182	0.0573
Rn - Leste Potiguar	22116.2	21783.0	32583.2	11337.6	5504.2	-0.0553	1.6963	10.7598	0.0046
Pb - Sertao Paraibano	5668.6	5548.7	10279.9	2719.2	1657.6	0.2879	2.3558	4.6460	0.0980
Pb - Borborema	5572.0	5384.9	9526.1	2547.0	1716.5	0.2018	2.0076	7.1505	0.0280
Pb - Agreste Paraibano	11527.9	11257.8	19320.2	5665.5	3283.6	0.2254	2.0433	6.9716	0.0306
Pb - Mata Paraibana	14892.6	14417.8	23906.3	7213.3	4070.4	0.1120	1.9612	7.0083	0.0301
Pe - Sertao Pernambucano	13938.1	13539.5	21173.6	6736.3	3870.6	0.0543	1.6989	10.7131	0.0047
Pe - Sao Francisco PE	16979.0	16340.3	25396.8	8363.5	4754.7	0.0791	1.6545	11.5616	0.0031
Pe - Agreste Pernambucano	19981.0	19218.4	35002.2	9322.6	5973.5	0.2574	2.1472	6.1802	0.0455
Pe - Mata Pernambucana	21345.8	20526.0	32321.6	10277.5	6004.7	0.0787	1.6905	10.9406	0.0042
Pe - Metropol de Recife	29870.4	29328.8	42855.7	15531.4	6985.5	-0.0154	1.8246	8.6288	0.0134
Al - Sertao Alagoano	7569.5	7207.9	17112.9	3586.2	2653.9	1.1994	4.9286	63.9353	0.0000
Al - Agreste Alagoano	14550.2	13896.0	33861.3	7268.7	5253.2	1.3333	5.3011	83.6257	0.0000
Al - Leste Alagoano	17797.5	17423.6	27524.2	8765.5	4695.7	0.0720	1.8615	8.2100	0.0165

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Se - Sertao Sergipano	5091.7	4938.9	10359.1	2689.4	1554.1	0.8087	3.5403	19.5706	0.0001
Se - Agreste Sergipano	18200.8	17904.7	26423.3	9628.8	4418.1	-0.0074	1.7508	9.7804	0.0075
Se - Leste Sergipano	22108.3	21659.2	36924.4	11755.4	5583.2	0.1529	2.1555	4.9537	0.0840
Ba - Extremo Oeste Baiano	27353.1	27186.7	39810.2	14437.1	6750.4	0.0096	1.6893	10.7990	0.0045
Ba - Vale Sao-Fran da BA	14741.2	14435.4	20735.7	7659.2	3616.0	-0.0362	1.7000	10.6509	0.0049
Ba - Centro Norte Baiano	26525.3	25940.5	37910.0	14048.3	6532.7	0.0283	1.7148	10.3894	0.0055
Ba - Nordeste Baiano	14928.9	14550.9	21622.0	7885.2	3752.5	0.0689	1.7110	10.5580	0.0051
Ba - Metropol de Salvador	26809.0	26574.8	39637.5	13937.9	6564.6	-0.0267	1.7264	10.1949	0.0061
Ba - Centro Sul Baiano	23062.2	22612.8	32872.5	12713.4	5533.2	-0.0015	1.7053	10.5270	0.0052
Ba - Sul Baiano	36411.4	35739.4	51124.6	20263.8	8755.3	-0.0002	1.6823	10.9158	0.0043
Mg - Noroeste de Minas	38739.0	38371.7	53929.0	20700.4	8681.8	-0.0512	1.8115	8.8924	0.0117
Mg - Norte de Minas	50767.9	49504.6	71107.9	27473.2	12104.2	0.0297	1.6947	10.7285	0.0047
Mg - Jequitinhonha	32427.1	31771.4	45468.2	18049.6	7732.6	0.0404	1.6852	10.9099	0.0043
Mg - Vale do Mucuri	39153.8	38279.0	55031.8	22221.3	9167.2	0.0459	1.6984	10.6993	0.0047
Mg - Triang Mineiro	64326.7	63319.0	91842.1	32924.1	15057.2	-0.0110	1.7880	9.1908	0.0101
Mg - Central Mineira	41964.0	40875.4	59548.6	22959.0	10161.3	0.0519	1.7062	10.5834	0.0050
Mg - Metropol de BH	28407.2	28220.0	40636.4	15022.1	6426.5	-0.0529	1.8024	9.0374	0.0109
Mg - Vale do Rio Doce	49330.2	48549.3	69755.3	27361.0	12011.4	0.0507	1.6875	10.8964	0.0043
Mg - Oeste de Minas	59070.7	57679.2	84001.2	31716.1	14015.9	0.0123	1.7171	10.3347	0.0057
Mg - Sul-Sudoeste MG	90844.1	89794.7	130871.7	46350.9	21616.4	-0.0453	1.7536	9.7874	0.0075
Mg - Campo das Vertentes	46816.6	45875.9	68644.8	25566.6	11091.6	0.0358	1.7573	9.7075	0.0078
Mg - Zona da Mata	59219.8	57547.1	83522.3	33615.3	14079.4	0.0661	1.6814	11.0472	0.0040
Es - Noroeste ES	23255.6	23259.6	33327.9	13413.0	5215.5	-0.0283	1.7426	9.9331	0.0070
Es - Litoral Norte ES	24937.6	24925.4	36266.9	13908.1	5844.8	-0.0249	1.7283	10.1616	0.0062
Es - Central ES	23935.1	23899.8	34472.3	13232.5	5463.6	0.0547	1.7682	9.5789	0.0083
Es - Sul ES	30089.0	29823.9	43324.1	17099.6	7037.4	0.0253	1.7026	10.5903	0.0050
Rj - Noroeste Fluminense	39106.7	38808.7	56418.6	22376.7	9115.7	0.0607	1.7399	10.0536	0.0066
Rj - Norte Fluminense	66542.5	65988.1	97593.3	36510.8	15915.8	-0.0071	1.7170	10.3336	0.0057
Rj - Centro Fluminense	65898.0	65919.9	95655.5	37428.7	15469.0	0.0456	1.7255	10.2472	0.0060
Rj - Baixadas	89802.9	88909.9	131468.3	49544.1	21362.1	0.0018	1.7177	10.3209	0.0057
Rj - Sul Fluminense	89618.9	88959.7	131191.5	49723.6	21239.7	-0.0007	1.7164	10.3424	0.0057
Rj - Metropol do RJ	59018.6	58728.8	86022.3	30487.3	14240.4	-0.0593	1.7359	10.1141	0.0064
Sp - Sao Jose do Rio Preto	77029.9	76554.6	111077.3	38082.4	17907.2	-0.0620	1.8624	8.1618	0.0169
Sp - Ribeirao Preto	55377.3	55317.6	78971.5	27860.7	12757.3	-0.0633	1.8392	8.5094	0.0142
Sp - Aracatuba	30220.9	30333.8	43567.4	14443.8	6903.5	-0.0537	2.0544	5.5666	0.0618
Sp - Bauru	79430.7	78995.3	115480.8	40169.1	19011.6	-0.0649	1.7688	9.6020	0.0082
Sp - Araraquara	51485.9	52060.3	74017.8	24905.3	11618.9	-0.0611	2.0038	6.2183	0.0446
Sp - Piracicaba	74465.8	73809.8	107454.0	37704.8	17652.8	-0.0564	1.7660	9.6186	0.0082
Sp - Campinas	76409.0	75734.4	110040.2	38569.4	17942.8	-0.0588	1.8014	9.0694	0.0107
Sp - Presidente Prudente	28712.7	28743.9	41375.6	14175.3	6644.0	-0.0490	1.8868	7.7686	0.0206
Sp - Marilia	45193.6	45233.0	64674.1	22406.8	10438.2	-0.0631	1.8758	7.9694	0.0186
Sp - Assis	40577.0	40111.9	58273.9	20503.0	9472.9	-0.0667	1.8126	8.9237	0.0115
Sp - Itapetininga	73739.7	72715.8	107149.3	37256.4	17736.8	-0.0523	1.7590	9.7184	0.0078
Sp - Macro Metropol SP	94202.0	93808.4	136897.8	48035.0	22510.2	-0.0611	1.7557	9.7980	0.0075
Sp - Vale do Paraiba SP	123462.0	122575.3	179636.3	63429.3	29816.8	-0.0664	1.7462	9.9703	0.0068
Sp - Litoral Sul SP	155647.3	153578.9	228337.5	79489.9	38276.8	-0.0685	1.7443	10.0079	0.0067
Sp - Metropol Sao Paulo	35111.9	34638.6	51662.5	19032.9	8060.4	0.0439	1.7262	10.2305	0.0060
Pr - Noroeste PR	27009.2	26685.1	40913.2	13212.0	6679.2	0.0359	1.8049	8.9580	0.0113
Pr - Centro Ocidental PR	25145.9	24866.9	37654.0	12001.0	6186.6	-0.0136	1.8471	8.2894	0.0158
Pr - Norte Central PR	34368.0	33978.2	50933.0	17453.0	8355.2	-0.0100	1.7616	9.6076	0.0082
Pr - Norte Pioneiro PR	34190.6	33729.5	51170.6	17175.0	8374.6	0.0164	1.7474	9.8411	0.0073
Pr - Centro Oriental PR	50604.7	49534.5	75402.7	25987.4	12451.7	0.0053	1.7146	10.3719	0.0056
Pr - Oeste PR	43180.8	41990.9	64819.8	22325.5	10754.0	0.0325	1.7070	10.5270	0.0052
Pr - Sudoeste PR	20708.4	20506.0	32513.3	10645.5	5028.6	0.0723	1.8116	8.9601	0.0113
Pr - Centro-Sul PR	30681.3	29976.2	46738.2	15652.8	7576.6	0.0456	1.7380	10.0418	0.0066
Pr - Sudeste PR	29383.3	28435.8	45229.5	15243.8	7346.0	0.0796	1.7270	10.3356	0.0057
Pr - Metropol de Curitiba	44679.6	44235.8	67345.0	23138.7	10810.8	-0.0020	1.7502	9.7884	0.0075
Sc - Oeste Catarinense	24366.3	24125.5	37816.2	13686.8	6039.3	0.0559	1.7510	9.8585	0.0072
Sc - Norte Catarinense	41770.8	41030.7	64638.3	22171.8	10349.3	0.0319	1.7499	9.8199	0.0074
Sc - Serrana	29223.8	28888.6	45936.8	16404.7	7129.5	0.0893	1.7850	9.4460	0.0089
Sc - Vale do Itajai	32181.8	31639.5	49491.9	18015.3	7995.5	0.0395	1.7341	10.0921	0.0064
Sc - Grande Florianopolis	33850.0	33761.6	55581.1	17094.8	8536.0	0.0797	1.9536	6.9460	0.0310
Sc - Sul Catarinense	36741.1	35855.9	55709.0	21776.9	8885.1	0.1027	1.7252	10.4765	0.0053
Rs - Noroeste RS	34114.9	32737.3	51811.4	20325.4	7943.5	0.2617	1.8005	10.8081	0.0045
Rs - Nordeste RS	40701.3	39387.4	61309.1	23638.5	9647.9	0.2049	1.7685	10.6082	0.0050
Rs - Centro Ocidental RS	29061.8	27970.6	44347.5	17471.3	6878.2	0.2769	1.8480	10.3027	0.0058
Rs - Centro Oriental RS	45234.7	43581.1	68096.7	26846.8	10656.3	0.2379	1.7541	11.2258	0.0037
Rs - Metropol Porto Alegre	33443.8	32633.8	51442.1	17803.4	8045.8	0.0565	1.8059	8.9938	0.0111
Rs - Sudoeste RS	33109.6	32302.1	49611.0	19118.1	7913.2	0.1387	1.7203	10.7878	0.0045

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Rs - Sudeste RS	39941.7	38683.9	59986.8	23686.2	9348.5	0.2350	1.7643	11.0249	0.0040
Ms - Pantanais Sul MT	32637.2	32677.6	47392.4	16974.0	7598.9	-0.0628	1.7921	9.2276	0.0099
Ms - Centro Norte de MS	53133.2	53291.2	78051.5	27066.6	12589.1	-0.0362	1.7729	9.4598	0.0088
Ms - Leste de MS	36443.5	36504.3	52472.7	18015.7	8396.0	-0.0639	1.8909	7.7542	0.0207
Ms - Sudoeste de MS	42199.2	42364.9	61548.6	21216.9	9956.1	-0.0668	1.7810	9.4154	0.0090
Mt - Norte MT	32705.8	32791.8	47790.7	16743.6	7862.9	-0.0473	1.7469	9.9012	0.0071
Mt - Nordeste MT	26636.8	26285.1	40066.0	13371.1	6766.7	0.0025	1.7325	10.0771	0.0065
Mt - Sudoeste MT	23021.1	23011.0	33708.3	12044.9	5604.7	-0.0451	1.7243	10.2656	0.0059
Mt - Centro-Sul MT	25634.1	25514.9	37197.4	12975.2	5992.9	-0.0434	1.7849	9.2858	0.0096
Mt - Sudeste MT	25343.4	25652.7	37087.1	12772.6	6197.0	-0.0373	1.7563	9.7268	0.0077
Go - Noroeste Goiano	30676.8	30000.5	48906.6	14993.4	8103.2	0.0729	1.7815	9.4300	0.0090
Go - Norte Goiano	32904.1	32387.1	50493.4	16285.6	8457.5	0.0310	1.7492	9.8304	0.0073
Go - Centro Goiano	38942.3	38935.6	57205.7	20193.2	9277.7	-0.0400	1.7453	9.9101	0.0070
Go - Leste Goiano	29001.2	28690.6	43514.6	14835.2	7328.9	0.0374	1.7202	10.3170	0.0058
Go - Sul Goiano	40195.5	39809.4	60637.0	19755.6	9895.4	0.0088	1.8027	8.9598	0.0113
Go - Distrito Federal	80268.0	79787.8	115478.2	42097.8	19112.4	0.0023	1.7407	9.9429	0.0069

Source: elaborated by the author. Original data from: CAGED and IpeaData

Table 7: Descriptive statistics of foreign-specific variables – Disconnections

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Ro - Madeira-Guapore	27566.0	27877.1	37862.6	14689.4	6776.1	-0.3057	1.8030	11.4312	0.0033
Ro - Leste Rondoniense	35637.8	36197.5	49101.5	18294.4	9371.2	-0.2962	1.7460	12.1820	0.0023
Ac - Vale do Jurua	18117.4	18517.7	25931.2	9498.2	4717.9	-0.1925	1.6952	11.6794	0.0029
Ac - Vale do Acre	43819.2	44469.8	61512.6	22497.7	11614.3	-0.2752	1.7444	11.8891	0.0026
Am - Norte Amazonense	13483.8	14063.0	20232.0	6286.0	3268.0	-0.3046	2.1403	6.9585	0.0308
Am - Sudoeste Amazonense	21875.3	22332.7	31506.6	10785.5	5412.0	-0.3489	1.9487	10.0700	0.0065
Am - Centro Amazonense	88962.3	91639.6	124389.1	47678.2	22776.3	-0.2551	1.7727	11.1531	0.0038
Am - Sul Amazonense	8880.8	9133.1	12803.8	4048.4	2335.8	-0.2989	1.8825	10.1364	0.0063
Rr - Norte de Roraima	39735.5	40413.1	56347.3	20731.5	10093.7	-0.2736	1.8099	10.8311	0.0044
Rr - Sul de Roraima	6320.5	6618.0	9414.6	2819.8	1599.9	-0.3018	2.0553	7.8923	0.0193
Pa - Baixo Amazonas	27537.8	28548.6	38937.6	14447.2	7035.8	-0.2468	1.7932	10.7195	0.0047
Pa - Marajo	7329.5	7447.8	10179.4	3697.6	1720.8	-0.2656	1.9744	8.3701	0.0152
Pa - Metropol de Belem	52982.9	54263.9	75327.4	27817.8	14111.3	-0.2501	1.7664	11.1871	0.0037
Pa - Nordeste Paraense	13255.6	13507.5	18184.6	6969.4	3054.6	-0.2995	1.9269	9.5187	0.0086
Pa - Sudoeste Paraense	24234.3	25040.9	33585.8	12762.9	6221.6	-0.2782	1.7594	11.6910	0.0029
Pa - Sudeste Paraense	30049.9	30791.2	41828.8	15727.6	7689.5	-0.2893	1.7791	11.5444	0.0031
Ap - Norte do Amapa	4357.4	4361.0	6573.3	2105.1	1164.6	-0.1090	1.8842	8.0575	0.0178
Ap - Sul do Amapa	30951.1	31587.3	42767.2	16254.6	7686.0	-0.3401	1.8436	11.4033	0.0033
To - Ocidental do TO	11593.5	12019.7	16297.8	5846.3	3069.9	-0.2538	1.7244	11.9167	0.0026
To - Oriental do TO	13909.1	14331.9	19634.7	7165.5	3539.7	-0.2844	1.7595	11.7816	0.0028
Ma - Norte Maranhense	13598.0	14030.2	19504.8	7258.0	3579.8	-0.2033	1.7138	11.4815	0.0032
Ma - Oeste Maranhense	8425.1	8764.1	12666.5	3992.6	2545.3	-0.2121	1.6732	12.2656	0.0022
Ma - Centro Maranhense	7850.0	8134.3	12055.1	3588.6	2522.1	-0.1979	1.6328	12.8165	0.0016
Ma - Leste Maranhense	4884.1	5011.0	8059.9	1958.7	1804.1	-0.1018	1.5824	12.9625	0.0015
Ma - Sul Maranhense	12322.2	12720.4	17409.7	6185.5	3393.3	-0.2753	1.7309	12.1111	0.0023
Pi - Norte Piauiense	8612.8	8733.9	13638.1	4236.6	2735.7	-0.0212	1.5560	13.1901	0.0014
Pi - Centro-Norte Piaui	13760.1	14187.5	19628.8	7122.7	3740.6	-0.2403	1.7268	11.7000	0.0029
Pi - Sudoeste Piauiense	6441.1	6724.1	9483.4	3281.2	1858.3	-0.1238	1.6200	12.4125	0.0020
Pi - Sudeste Piauiense	5248.9	5473.7	7907.0	2647.1	1575.7	-0.0715	1.6291	11.9777	0.0025
Ce - Noroeste Cearense	21119.8	21746.6	32500.2	10330.8	6474.4	-0.0897	1.6132	12.3404	0.0021
Ce - Norte Cearense	15858.1	16393.4	24873.0	7659.1	4973.4	-0.0616	1.6054	12.3685	0.0021
Ce - Metropol Fortaleza	31047.3	31831.7	43948.4	16839.8	7981.9	-0.2302	1.7443	11.2874	0.0035
Ce - Sertoes Cearenses	13687.1	13955.0	20795.4	6873.7	4061.1	-0.0978	1.6334	12.0200	0.0025
Ce - Jaguaribe	13121.6	13452.5	20399.9	6656.4	3902.5	-0.0704	1.6421	11.7445	0.0028
Ce - Centro-Sul Cearense	15267.5	15610.4	22131.9	7622.0	4416.0	-0.1823	1.6509	12.3393	0.0021
Ce - Sul Cearense	16369.7	16707.8	24380.3	8222.5	4842.9	-0.1298	1.6535	11.8601	0.0027
Rn - Oeste Potiguar	13691.4	13895.5	20485.8	7237.0	3635.2	-0.0402	1.6909	10.8127	0.0045
Rn - Central Potiguar	5056.8	4992.0	7618.0	2619.9	1150.3	-0.0243	1.9419	6.9516	0.0309
Rn - Agreste Potiguar	6686.0	6616.0	9918.8	3496.8	1316.8	0.0449	2.1850	4.0760	0.1303
Rn - Leste Potiguar	20908.1	21243.9	30257.0	10723.7	5629.6	-0.2447	1.7418	11.5126	0.0032
Pb - Sertao Paraibano	5317.8	5445.1	8950.9	2488.8	1658.3	0.0602	1.8546	8.2701	0.0160
Pb - Borborema	5217.0	5197.3	8695.9	2342.7	1771.5	0.0910	1.7810	9.5166	0.0086
Pb - Agreste Paraibano	10905.1	10859.1	17445.0	5313.0	3338.5	0.0735	1.8251	8.7577	0.0125
Pb - Mata Paraibana	14094.8	14322.8	21905.6	6796.6	4046.9	-0.0702	1.8059	9.0401	0.0109
Pe - Sertao Pernambucano	13176.8	13303.2	20419.4	6454.0	3967.7	-0.0455	1.7071	10.5520	0.0051
Pe - Sao Francisco PE	16063.5	15966.4	24914.7	7854.9	4899.2	-0.0125	1.6917	10.7603	0.0046
Pe - Agreste Pernambucano	18980.2	18903.5	31099.4	8759.5	5840.9	0.0573	1.8676	8.0698	0.0177

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Pe - Mata Pernambucana	20166.0	20074.5	32028.8	9790.8	6207.6	-0.0031	1.7138	10.3859	0.0056
Pe - Metropol de Recife	28294.9	29290.8	40337.3	15085.6	7045.8	-0.2181	1.8468	9.5493	0.0084
Al - Sertao Alagoano	7239.8	7251.4	13791.9	3353.0	2191.0	0.3928	2.8165	4.2307	0.1206
Al - Agreste Alagoano	13998.6	13936.1	27263.1	6553.0	4351.5	0.4604	2.8889	5.6543	0.0592
Al - Leste Alagoano	16841.2	16950.5	25774.3	8407.0	4725.7	-0.0878	1.7934	9.3060	0.0095
Se - Sertao Sergipano	4811.6	4760.6	9184.0	2406.6	1382.5	0.4975	3.0061	6.5736	0.0374
Se - Agreste Sergipano	17167.2	17323.1	24896.6	8975.2	4453.7	-0.2025	1.8020	10.0565	0.0066
Se - Leste Sergipano	21056.4	21277.6	33155.4	11044.9	5455.6	-0.1025	2.0071	6.3559	0.0417
Ba - Extremo Oeste Baiano	26113.4	26473.7	37120.8	13741.3	6807.9	-0.2184	1.7315	11.3565	0.0034
Ba - Vale Sao-Fran da BA	14037.7	14120.7	20332.7	7220.7	3666.2	-0.2364	1.7619	11.0814	0.0039
Ba - Centro Norte Baiano	25403.4	25412.3	38004.3	12811.3	6766.7	-0.1899	1.7599	10.5882	0.0050
Ba - Nordeste Baiano	14255.7	14279.6	21363.4	7064.4	3853.9	-0.1533	1.7376	10.6150	0.0050
Ba - Metropol de Salvador	25323.9	25993.6	35924.3	13253.0	6734.6	-0.2353	1.7487	11.2795	0.0036
Ba - Centro Sul Baiano	22040.9	22101.2	31853.0	11279.7	5739.1	-0.2204	1.7558	10.9864	0.0041
Ba - Sul Baiano	34703.3	34846.4	49375.0	18382.3	9011.5	-0.2214	1.7653	10.8450	0.0044
Mg - Noroeste de Minas	36968.0	37203.3	50278.7	19444.3	8359.9	-0.2882	1.9089	9.5937	0.0083
Mg - Norte de Minas	48353.9	48678.6	66690.4	25602.9	11693.5	-0.2283	1.8153	10.1457	0.0063
Mg - Jequitinhonha	30941.9	30929.2	42528.8	16275.6	7429.4	-0.2062	1.8144	9.9055	0.0071
Mg - Vale do Mucuri	37423.5	37520.3	51159.4	20067.0	8685.5	-0.1974	1.8197	9.7297	0.0077
Mg - Triang Mineiro	61034.4	60861.1	83250.2	32216.0	14754.6	-0.3096	1.8542	10.7203	0.0047
Mg - Central Mineira	40015.9	40109.1	55183.5	20946.4	9665.8	-0.2082	1.8200	9.8417	0.0073
Mg - Metropol de BH	26892.3	27344.9	36173.3	14404.0	6334.7	-0.3134	1.8376	11.0318	0.0040
Mg - Vale do Rio Doce	47030.8	47124.6	65242.7	24699.8	11529.1	-0.1965	1.8136	9.8135	0.0074
Mg - Oeste de Minas	56199.2	56970.9	76943.1	29379.3	13516.3	-0.2531	1.8344	10.1730	0.0062
Mg - Sul-Sudoeste MG	85913.3	87709.6	118182.9	44797.8	21551.1	-0.3160	1.8219	11.3098	0.0035
Mg - Campo das Vertentes	44631.0	45324.9	61888.1	23307.6	10461.0	-0.2202	1.8522	9.4953	0.0087
Mg - Zona da Mata	56460.4	56446.6	78912.4	30474.9	13823.9	-0.1750	1.8110	9.6426	0.0081
Es - Noroeste ES	22157.5	22716.0	31023.4	11566.6	5277.3	-0.2644	1.9025	9.3350	0.0094
Es - Litoral Norte ES	23675.4	24119.3	33375.3	12495.9	5921.9	-0.2531	1.8687	9.6651	0.0080
Es - Central ES	22753.0	23011.9	32092.0	12446.5	5475.8	-0.2083	1.8328	9.6482	0.0080
Es - Sul ES	28629.6	28939.0	41064.3	15342.8	7113.3	-0.2085	1.8383	9.5686	0.0084
Rj - Noroeste Fluminense	37131.7	38313.7	55018.6	20521.3	9351.3	-0.1520	1.7922	9.7335	0.0077
Rj - Norte Fluminense	62972.9	64810.9	90529.7	34172.7	16460.6	-0.2045	1.7598	10.7432	0.0046
Rj - Centro Fluminense	62530.9	64499.0	92203.8	34758.5	15956.7	-0.1523	1.7650	10.1647	0.0062
Rj - Baixadas	85045.7	87533.4	121883.7	46117.8	22018.4	-0.2089	1.7632	10.7357	0.0047
Rj - Sul Fluminense	84923.4	87419.7	121662.3	46282.1	21932.9	-0.2094	1.7624	10.7540	0.0046
Rj - Metropol do RJ	55728.7	57005.1	78139.6	28780.5	14447.3	-0.2979	1.8053	11.2703	0.0036
Sp - Sao Jose do Rio Preto	72812.9	74515.9	98687.7	38217.6	17779.9	-0.3503	1.8767	11.1037	0.0039
Sp - Ribeirao Preto	52403.2	53011.9	70556.9	27833.0	12482.5	-0.3386	1.8495	11.2887	0.0035
Sp - Aracatuba	28603.9	29025.8	42875.3	15101.5	6802.1	-0.2743	2.0220	7.8831	0.0194
Sp - Bauru	74948.1	76730.2	103596.8	38824.4	19123.2	-0.3181	1.8157	11.4413	0.0033
Sp - Araraquara	48835.9	50105.6	70261.7	26209.3	11416.5	-0.2872	2.0001	8.3530	0.0154
Sp - Piracicaba	70381.3	71661.0	96474.6	37018.3	17617.9	-0.3214	1.8193	11.4401	0.0033
Sp - Campinas	72164.2	73558.5	98455.2	37647.6	17830.4	-0.3272	1.8336	11.3250	0.0035
Sp - Presidente Prudente	27208.9	27795.0	36505.2	14375.7	6404.6	-0.3332	1.8750	10.8187	0.0045
Sp - Marilia	42752.9	43742.6	57560.3	22487.0	10225.9	-0.3592	1.8973	10.9763	0.0041
Sp - Assis	38323.8	39113.7	52217.9	20005.9	9347.1	-0.3268	1.8461	11.1311	0.0038
Sp - Itapetininga	69599.2	71193.0	96145.4	35934.3	17787.7	-0.3105	1.8105	11.3942	0.0034
Sp - Macro Metropol SP	88941.8	91510.5	123162.0	46301.6	22693.1	-0.3147	1.8091	11.4852	0.0032
Sp - Vale do Paraiba SP	116453.5	119065.6	162084.4	60390.7	30264.5	-0.3025	1.7977	11.4612	0.0032
Sp - Litoral Sul SP	146652.0	149251.1	204871.2	74340.2	38848.1	-0.2960	1.7952	11.3976	0.0034
Sp - Metropol Sao Paulo	33493.0	33815.8	46823.5	18464.0	8141.3	-0.2356	1.7808	10.7720	0.0046
Pr - Noroeste PR	25577.5	25540.6	35573.6	13485.2	6126.1	-0.1569	1.7885	9.8307	0.0073
Pr - Centro Ocidental PR	23762.7	24212.4	32629.9	12447.2	5606.0	-0.2017	1.8161	9.8312	0.0073
Pr - Norte Central PR	32504.1	32480.2	44550.7	17200.6	8201.2	-0.2773	1.7941	11.1296	0.0038
Pr - Norte Pioneiro PR	32395.2	32287.4	45070.0	16920.2	7994.5	-0.2071	1.7789	10.4667	0.0053
Pr - Centro Oriental PR	47863.4	47906.9	66636.8	25371.5	12240.3	-0.2259	1.7630	10.9345	0.0042
Pr - Oeste PR	40915.7	40565.7	57508.6	21478.1	10524.5	-0.2099	1.7556	10.8687	0.0044
Pr - Sudoeste PR	19504.6	19625.7	27446.8	10529.3	4824.7	-0.1826	1.7763	10.2548	0.0059
Pr - Centro-Sul PR	29004.0	28691.9	40621.6	15372.5	7309.9	-0.1849	1.7571	10.5832	0.0050
Pr - Sudeste PR	27892.0	27517.6	39481.8	14741.1	7052.7	-0.1640	1.7529	10.4584	0.0054
Pr - Metropol de Curitiba	42210.0	42926.3	59221.6	22667.5	10758.1	-0.2437	1.7776	10.9246	0.0042
Sc - Oeste Catarinense	22994.5	23078.1	32588.7	12170.4	5996.7	-0.1942	1.7572	10.6747	0.0048
Sc - Norte Catarinense	39522.5	39296.1	55678.4	20646.0	10190.7	-0.2259	1.7809	10.6513	0.0049
Sc - Serrana	27629.7	27309.8	39299.2	14690.3	6995.8	-0.1823	1.7920	10.0047	0.0067
Sc - Vale do Itajai	30404.5	30422.4	43153.2	15783.7	7982.0	-0.2169	1.7671	10.7650	0.0046
Sc - Grande Florianopolis	32091.3	32097.2	46137.9	16578.5	8087.7	-0.2436	1.8577	9.7013	0.0078
Sc - Sul Catarinense	34777.3	34778.1	49391.0	19073.9	8915.6	-0.1343	1.7261	10.6602	0.0048
Rs - Noroeste RS	32517.3	31987.7	45982.2	19481.5	7579.7	0.0433	1.7121	10.4637	0.0053

Region	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Rs - Nordeste RS	38659.0	37947.9	54396.6	22529.8	9237.3	-0.0115	1.6978	10.6560	0.0049
Rs - Centro Ocidental RS	27687.7	27146.5	38987.0	16759.2	6456.5	0.0584	1.7039	10.6410	0.0049
Rs - Centro Oriental RS	43105.4	42016.1	60894.4	25582.0	10267.2	0.0286	1.6949	10.7232	0.0047
Rs - Metropol Porto Alegre	31652.6	31732.5	44125.2	17017.4	7838.3	-0.2115	1.7857	10.4091	0.0055
Rs - Sudoeste RS	31385.8	31181.2	44218.3	18232.8	7770.6	-0.0773	1.7102	10.6034	0.0050
Rs - Sudeste RS	38075.6	37129.6	53483.6	22745.6	9017.9	0.0182	1.6877	10.8331	0.0044
Ms - Pantanais Sul MT	30935.2	31668.9	42264.9	16550.5	7590.8	-0.3279	1.8308	11.3792	0.0034
Ms - Centro Norte de MS	50278.6	50940.3	69530.5	26709.1	12601.3	-0.2928	1.8022	11.2383	0.0036
Ms - Leste de MS	34492.5	35213.2	46257.7	18358.5	8205.9	-0.3523	1.8965	10.8557	0.0044
Ms - Sudoeste de MS	39912.8	40632.4	54684.2	20965.8	9887.9	-0.3260	1.8346	11.2897	0.0035
Mt - Norte MT	31078.9	31428.4	43166.9	16398.5	7850.7	-0.2786	1.7789	11.3872	0.0034
Mt - Nordeste MT	25354.1	25720.6	35983.8	13031.2	6691.8	-0.2218	1.6997	11.9254	0.0026
Mt - Sudoeste MT	21995.5	22491.2	31171.2	11437.6	5648.2	-0.2401	1.7541	11.2526	0.0036
Mt - Centro-Sul MT	24379.6	25024.4	33263.1	12908.5	5954.3	-0.2780	1.7791	11.3750	0.0034
Mt - Sudeste MT	24132.7	24378.2	33753.7	12555.5	6136.3	-0.2789	1.7707	11.5203	0.0032
Go - Noroeste Goiano	29197.2	29965.8	43075.5	14979.0	7874.1	-0.1670	1.6716	11.8391	0.0027
Go - Norte Goiano	31296.2	31626.2	44898.3	15991.8	8340.2	-0.2107	1.7101	11.6241	0.0030
Go - Centro Goiano	36881.1	37535.8	51656.1	19297.2	9367.4	-0.2994	1.8079	11.2545	0.0036
Go - Leste Goiano	27692.5	28368.7	40360.3	14033.6	7339.3	-0.1894	1.7318	11.0376	0.0040
Go - Sul Goiano	38202.4	38260.2	53529.9	19697.6	9601.6	-0.2438	1.7518	11.3373	0.0035
Go - Distrito Federal	76114.7	76866.6	105486.3	40536.2	19045.5	-0.2582	1.7799	11.0805	0.0039

Source: elaborated by the author. Original data from: CAGED and IpeaData

Table 8: Descriptive statistics of the Dominant Unit variable

Statistics	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Brazilian Industrial Production	4.5503	4.5502	4.7238	4.3041	0.0963	-0.3792	2.5900	4.7326	0.0938

Source: elaborated by the author. Original data from: CAGED and IpeaData

APPENDIX B - VECMX ESTIMATES OF THE INDIVIDUAL MODELS

Table 9: Vector error correction model estimates of the individual models

Region	Serie	Intercept	Adm$_{-1}$	Desl$_{-1}$	Adm*$_{-1}$	Desl*$_{-1}$	lindProd$_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm*$_{-1}$	Δdis*$_{-1}$	ΔlindProd$_{-1}$	Δadm$_{-1}$	Δdis$_{-1}$
Ro -Madeira-Guapore	Δadm	5,736.8	-0.251	0.172	0.106	-0.072	-1,416.404	0.143	-0.048	741.151	-	-	-	-0.129	-0.046
Ro -Madeira-Guapore	Δdis	-32.2	0.176	-0.367	0.039	0.027	-226.418	0.016	0.051	-50.466	-	-	-	-0.142	-0.315
Ro -Leste Rondoniense	Δadm	1,956.3	-0.424	0.035	0.029	0.020	-382.994	0.088	-0.010	2,804.237	-	-	-	-	-
Ro -Leste Rondoniense	Δdis	-5,462.0	0.208	-0.894	-0.067	0.139	1,427.338	-0.033	0.135	2,912.240	-	-	-	-	-
Ac -Vale do Jurua	Δadm	830.8	-0.430	-0.206	0.014	-0.002	-208.713	0.007	-0.001	-126.265	-0.007	0.004	-49.833	-	-
Ac -Vale do Jurua	Δdis	-631.5	0.013	-0.638	-0.009	0.017	132.908	-0.008	0.006	262.024	-0.002	-0.008	118.218	-	-
Ac -Vale do Acre	Δadm	324.9	-0.625	-0.020	0.014	0.011	-69.020	0.025	-0.005	713.154	-0.005	-0.013	880.912	-	-
Ac -Vale do Acre	Δdis	-2,547.7	0.194	-0.657	-0.018	0.033	604.311	-0.017	0.049	414.964	0.002	0.005	-1,098.572	-	-
Am -Norte Amazonense	Δadm	33.1	-0.980	0.586	-0.000	0.001	-7.504	0.000	-0.003	46.783	-	-	-	-	-
Am -Norte Amazonense	Δdis	264.1	-0.025	-1.057	-0.001	0.001	-52.841	-0.001	0.004	-87.244	-	-	-	-	-
Am -Sudoeste Amazonense	Δadm	-76.3	-0.980	0.003	0.000	0.001	16.051	0.000	-0.000	36.773	-	-	-	-	-
Am -Sudoeste Amazonense	Δdis	-147.1	0.051	-1.000	-0.001	0.001	38.239	-0.001	0.001	35.535	-	-	-	-	-
Am -Centro Amazonense	Δadm	-41,701.0	-0.592	-0.024	0.084	-0.032	9,936.782	0.180	-0.038	10,012.518	-	-	-	-	-
Am -Centro Amazonense	Δdis	-6,141.0	0.075	-0.499	0.003	0.049	1,575.003	-0.032	0.197	-5,858.005	-	-	-	-	-
Am -Sul Amazonense	Δadm	31.7	-0.516	0.269	0.000	0.003	-7.786	0.006	0.000	80.895	-	-	-	-	-
Am -Sul Amazonense	Δdis	-50.1	0.289	-0.596	-0.003	0.006	10.995	-0.001	0.007	6.958	-	-	-	-	-
Rr -Norte de Roraima	Δadm	-1,142.9	-0.362	0.328	0.002	-0.002	267.181	0.026	-0.012	514.203	-	-	-	-0.161	-0.169
Rr -Norte de Roraima	Δdis	1,478.5	0.462	-0.419	-0.002	0.002	-341.052	0.013	0.016	-58.365	-	-	-	-0.356	-0.277
Rr -Sul de Roraima	Δadm	192.2	-0.780	0.383	0.005	0.003	-48.362	0.002	0.001	44.960	-	-	-	-	-
Rr -Sul de Roraima	Δdis	78.5	0.545	-0.754	-0.004	0.007	-19.000	-0.003	0.007	78.033	-	-	-	-	-
Pa -Baixo Amazonas	Δadm	-4,250.2	-0.533	-0.022	-0.006	0.017	1,020.164	0.037	-0.007	1,274.658	0.019	0.002	-122.536	-0.162	0.066
Pa -Baixo Amazonas	Δdis	-280.5	0.296	-0.589	-0.019	0.027	93.075	-0.007	0.055	155.611	0.016	0.024	-893.705	-0.228	-0.099
Pa -Marajo	Δadm	455.3	-0.852	0.056	0.021	-0.024	-70.372	0.029	-0.021	1.160	-	-	-	-	-
Pa -Marajo	Δdis	-769.6	0.074	-0.795	-0.037	0.017	228.943	-0.024	0.015	211.764	-	-	-	-	-
Pa -Metropol de Belem	Δadm	-22,157.1	-0.650	-0.301	0.034	0.087	5,715.307	0.143	-0.011	308.410	-	-	-	-	-
Pa -Metropol de Belem	Δdis	-16,607.7	0.058	-1.046	-0.089	0.226	4,395.251	-0.046	0.238	-1,402.980	-	-	-	-	-
Pa -Nordeste Paraense	Δadm	-3,323.1	-0.514	0.063	0.040	0.020	716.386	0.143	0.028	1,028.829	0.028	0.063	-150.355	-0.080	-0.162
Pa -Nordeste Paraense	Δdis	409.9	0.351	-0.621	-0.066	0.102	-96.128	-0.018	0.081	1,367.057	0.013	0.009	-479.011	-0.138	-0.162
Pa -Sudoeste Paraense	Δadm	2,425.8	-0.112	0.120	0.035	-0.024	-600.317	0.133	-0.020	-704.555	-	-	-	0.104	-0.082
Pa -Sudoeste Paraense	Δdis	-5,846.7	0.270	-0.291	-0.084	0.059	1,450.624	-0.050	0.085	1,290.529	-	-	-	0.031	-0.327
Pa -Sudeste Paraense	Δadm	-4,344.5	-0.429	0.106	0.077	-0.024	1,130.842	0.239	-0.105	3,813.677	-0.103	0.018	2,953.501	0.236	-0.030
Pa -Sudeste Paraense	Δdis	-10,550.0	0.041	-0.410	-0.098	0.143	2,671.779	-0.075	0.304	1,095.710	-0.018	0.088	1,146.144	-0.042	-0.263
Ap -Norte do Amapa	Δadm	-556.8	-0.594	-0.029	0.005	-0.011	134.996	0.010	-0.012	172.043	-	-	-	0.159	0.065
Ap -Norte do Amapa	Δdis	-356.1	0.361	-0.638	-0.027	0.017	92.356	-0.031	0.031	-109.699	-	-	-	-0.216	-0.052

Region	Serie	Intercept	Adm$_{-1}$	Desl$_{-1}$	Adm*$_{-1}$	Desl*$_{-1}$	lindProd$_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm*$_{-1}$	Δdis*$_{-1}$	ΔlindProd$_{-1}$	Δadm$_{-1}$	Δdis$_{-1}$
Ap -Sul do Amapa	Δadm	-5,559.5	-0.414	-0.033	0.001	0.025	1,216.932	0.038	0.020	1,167.281	0.002	-0.019	1,577.341	-0.263	0.133
Ap -Sul do Amapa	Δdis	-1,353.7	0.205	-0.623	-0.022	0.051	265.896	-0.010	0.046	1,300.347	0.008	0.008	-426.337	-0.201	-0.133
To -Ocidental do TO	Δadm	706.6	-0.453	-0.001	0.079	-0.015	-59.009	0.237	-0.001	-842.729	0.001	-0.091	507.771	-	-
To -Ocidental do TO	Δdis	71.5	0.159	-0.544	-0.031	0.089	59.474	-0.015	0.332	-1,028.972	-0.036	0.047	1,000.444	-	-
To -Oriental do TO	Δadm	3,303.8	-0.320	0.350	0.094	-0.082	-784.667	0.196	-0.031	1,073.834	0.030	0.019	1,014.153	-0.265	-0.246
To -Oriental do TO	Δdis	-3,476.2	0.338	-0.369	-0.099	0.086	828.472	-0.048	0.161	910.277	0.067	0.035	524.615	-0.201	-0.344
Ma -Norte Maranhense	Δadm	-8,078.7	-0.404	-0.181	0.152	0.276	1,327.187	0.327	0.146	4,992.782	-0.211	0.009	2,899.045	0.048	0.097
Ma -Norte Maranhense	Δdis	4,033.7	0.052	-0.589	-0.025	0.454	-1,399.012	0.005	0.586	-2,275.863	0.014	-0.051	1,895.791	-0.174	-0.131
Ma -Oeste Maranhense	Δadm	-5,742.8	-0.489	0.114	0.012	0.054	1,365.689	0.251	-0.050	1,572.291	-	-	-	-0.077	-0.057
Ma -Oeste Maranhense	Δdis	7,477.8	0.441	-0.696	-0.021	0.130	-1,697.303	0.078	0.204	-1,756.493	-	-	-	-0.321	-0.121
Ma -Centro Maranhense	Δadm	-2,504.7	-0.761	0.107	0.016	0.028	560.852	0.067	0.029	323.507	-	-	-	-	-
Ma -Centro Maranhense	Δdis	-708.6	0.154	-0.732	-0.042	0.087	154.429	0.002	0.052	350.526	-	-	-	-	-
Ma -Leste Maranhense	Δadm	-341.0	-0.852	-0.083	0.161	-0.057	144.428	0.195	0.033	1,190.477	0.059	0.139	-183.676	-	-
Ma -Leste Maranhense	Δdis	-7,199.7	-0.196	-1.023	-0.031	0.122	1,734.529	-0.079	0.043	-244.972	-0.111	-0.150	-1,239.529	-	-
Ma -Sul Maranhense	Δadm	6,534.9	-0.672	0.306	0.138	-0.078	-1,515.793	0.085	0.057	1,152.336	0.042	0.019	1,722.148	-0.044	-0.068
Ma -Sul Maranhense	Δdis	-606.9	0.258	-0.602	0.053	-0.020	125.057	-0.147	0.197	-208.093	-0.061	0.141	-476.683	-0.229	-0.115
Pi -Norte Piauiense	Δadm	491.0	-0.586	-0.035	0.045	-0.008	-106.737	0.049	0.009	117.717	-0.004	0.026	-242.013	-	-
Pi -Norte Piauiense	Δdis	465.0	0.090	-0.624	0.012	0.023	-106.263	0.032	0.047	-279.036	-0.007	0.001	-305.674	-	-
Pi -Centro-Norte Piaui	Δadm	5,785.1	-0.334	0.028	0.098	0.051	-1,374.537	0.370	0.033	-1,826.993	-0.075	-0.036	6,030.410	-0.159	-0.081
Pi -Centro-Norte Piaui	Δdis	-7,545.9	0.404	-0.767	-0.393	0.486	1,811.307	-0.206	0.454	-378.240	0.254	0.055	-675.271	-0.351	-0.202
Pi -Sudoeste Piauiense	Δadm	-696.4	-0.465	0.089	0.055	-0.001	135.857	0.096	0.031	805.421	-	-	-	-0.084	-0.129
Pi -Sudoeste Piauiense	Δdis	255.9	0.421	-0.594	-0.034	0.055	-56.671	-0.004	0.088	-332.532	-	-	-	-0.287	-0.063
Pi -Sudeste Piauiense	Δadm	-1,209.4	-0.412	0.182	-0.016	0.030	275.806	0.079	0.035	977.432	-0.001	0.054	72.814	-	-
Pi -Sudeste Piauiense	Δdis	-202.6	0.036	-0.539	-0.021	0.070	34.096	0.005	0.039	96.322	-0.003	-0.043	153.069	-	-
Ce -Noroeste Cearense	Δadm	-1,392.1	-0.555	-0.224	-0.020	0.063	398.085	0.093	-0.015	363.031	0.026	-0.068	817.716	-	-
Ce -Noroeste Cearense	Δdis	3,406.3	0.006	-0.746	-0.021	0.065	-694.315	-0.024	0.084	-2,626.430	0.049	-0.005	-1,854.533	-	-
Ce -Norte Cearense	Δadm	-1,955.1	-0.527	0.003	0.023	0.017	456.119	0.079	0.004	1,356.746	-	-	-	0.027	0.116
Ce -Norte Cearense	Δdis	2,158.5	0.234	-0.880	-0.060	0.110	-440.750	-0.027	0.070	-89.739	-	-	-	-0.351	-0.111
Ce -Metropol Fortaleza	Δadm	-29,120.2	-0.381	0.291	0.255	-0.182	6,424.781	0.647	-0.116	9,922.949	-0.047	0.105	1,123.034	-0.173	0.067
Ce -Metropol Fortaleza	Δdis	-11,008.6	0.026	-0.365	-0.133	0.429	2,168.960	0.114	0.371	13,334.091	0.015	0.240	2,998.099	-0.209	-0.283
Ce -Sertoes Cearenses	Δadm	-1,973.1	-0.804	0.342	-0.004	0.017	450.950	0.029	0.014	514.917	0.003	0.010	-62.830	0.029	-0.301
Ce -Sertoes Cearenses	Δdis	904.0	0.257	-0.707	-0.002	0.019	-211.698	-0.006	0.034	-208.546	-0.005	0.014	-244.082	0.017	-0.177
Ce -Jaguaribe	Δadm	-6,694.3	-0.775	-0.561	-0.058	0.115	1,757.238	0.094	-0.001	2,665.624	0.066	-0.073	2,250.313	0.078	0.394
Ce -Jaguaribe	Δdis	708.3	0.083	-0.426	-0.033	0.047	-86.270	0.014	0.071	-1,814.578	0.065	0.075	-4,071.142	-0.099	0.078
Ce -Centro-Sul Cearense	Δadm	-1,141.5	-1.074	0.490	0.011	0.007	246.627	0.037	0.006	379.848	0.016	0.014	-278.710	0.120	-0.232
Ce -Centro-Sul Cearense	Δdis	-529.7	0.126	-1.217	-0.020	0.049	107.196	-0.002	0.034	105.850	0.011	-0.005	-133.179	-0.137	0.110
Ce -Sul Cearense	Δadm	-1,290.3	-0.464	-0.147	0.031	0.046	256.816	0.096	-0.003	1,156.208	-	-	-	-0.145	0.033
Ce -Sul Cearense	Δdis	907.7	0.169	-0.886	-0.043	0.125	-206.665	-0.005	0.107	-1,243.307	-	-	-	-0.189	0.039
Rn -Oeste Potiguar	Δadm	-13,990.8	-0.738	-0.191	0.025	0.061	3,404.433	0.176	-0.029	2,435.894	-0.065	-0.103	-362.732	0.332	0.250

Region	Serie	Intercept	Adm_{-1}	$Desl_{-1}$	Adm^*_{-1}	$Desl^*_{-1}$	$lindProd_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm^*_{-1}	Δdis^*_{-1}	$\Delta lindProd_{-1}$	Δadm_{-1}	Δdis_{-1}
Rn -Oeste Potiguar	Δdis	-2,202.6	-0.104	-0.453	-0.013	0.076	642.162	-0.005	0.102	-918.543	0.052	0.052	-3,116.562	-0.065	-0.025
Rn -Central Potiguar	Δadm	-905.4	-0.641	0.133	0.043	0.024	214.815	0.081	-0.015	447.709	-	-	-	-0.182	0.071
Rn -Central Potiguar	Δdis	-156.7	0.262	-0.449	-0.037	0.052	47.564	0.005	0.064	26.039	-	-	-	-0.169	-0.080
Rn -Agreste Potiguar	Δadm	-770.9	-0.684	0.013	-0.002	0.028	182.493	0.018	0.003	544.317	-	-	-	-	-
Rn -Agreste Potiguar	Δdis	-1,124.7	0.111	-0.789	-0.014	0.040	254.681	-0.013	0.031	327.971	-	-	-	-	-
Rn -Leste Potiguar	Δadm	-29,199.2	-0.541	0.115	-0.016	0.030	7,253.278	0.299	-0.011	4,174.169	0.038	-0.083	5,328.546	-0.120	0.026
Rn -Leste Potiguar	Δdis	9,341.2	0.302	-0.715	-0.143	0.259	-1,757.829	0.020	0.395	-1,314.673	0.026	0.154	-498.119	-0.208	-0.060
Pb -Sertao Paraibano	Δadm	1,225.6	-0.574	0.053	0.080	0.023	-312.609	0.081	0.028	149.321	-0.028	0.012	189.165	-0.202	0.018
Pb -Sertao Paraibano	Δdis	575.7	0.166	-0.481	-0.005	0.054	-141.856	0.017	0.056	-197.573	-0.014	-0.034	-123.508	-0.183	-0.181
Pb -Borborema	Δadm	-367.8	-0.648	0.119	0.003	0.006	86.031	0.010	0.009	92.699	-	-	-	-0.075	-0.099
Pb -Borborema	Δdis	-238.1	0.252	-0.691	-0.011	0.018	56.451	-0.005	0.009	15.284	-	-	-	-0.135	-0.293
Pb -Agreste Paraibano	Δadm	3,244.7	-0.489	0.398	0.119	-0.077	-755.881	0.169	-0.021	566.010	-0.018	0.045	313.702	-0.244	-0.140
Pb -Agreste Paraibano	Δdis	-3,616.4	0.549	-0.446	-0.134	0.087	848.656	-0.001	0.176	-410.835	0.055	-0.016	27.519	-0.266	-0.260
Pb -Mata Paraibana	Δadm	-47,345.4	-0.672	-0.653	-0.308	0.724	11,036.327	0.281	0.117	11,700.664	0.130	-0.234	4,739.565	-0.139	0.484
Pb -Mata Paraibana	Δdis	22,989.4	0.026	-1.144	-0.125	0.662	-5,174.065	-0.011	0.598	436.760	0.132	0.015	-1,318.245	-0.021	0.279
Pe -Sertao Pernambucano	Δadm	-31.6	-0.003	0.005	-0.000	-0.000	7.741	0.079	0.002	580.285	-	-	-	-0.355	-0.071
Pe -Sertao Pernambucano	Δdis	2,822.8	0.226	-0.464	0.026	0.014	-687.727	0.044	0.057	-423.613	-	-	-	-0.121	-0.108
Pe -Sao Francisco PE	Δadm	-14,503.7	-0.673	-0.209	0.029	0.071	3,471.489	0.264	-0.151	-2,821.549	-0.050	-0.181	614.664	0.351	0.161
Pe -Sao Francisco PE	Δdis	868.8	0.282	-0.560	0.140	-0.085	-223.314	-0.228	0.074	3,568.172	-0.068	0.086	-290.546	-0.394	0.116
Pe -Agreste Pernambucano	Δadm	-6,825.8	-0.686	0.174	0.053	0.033	1,599.351	0.090	0.014	2,288.417	-	-	-	-0.201	0.005
Pe -Agreste Pernambucano	Δdis	4,622.0	0.294	-0.634	-0.020	0.102	-1,100.436	-0.003	0.121	-63.608	-	-	-	-0.247	-0.113
Pe -Mata Pernambucana	Δadm	-46,119.2	-0.947	-0.299	0.242	-0.264	11,436.198	1.137	-0.835	-16,623.594	0.548	-1.121	-489.231	0.188	0.310
Pe -Mata Pernambucana	Δdis	122,017.3	-0.142	-0.897	0.485	-0.213	-27,107.435	0.105	0.453	-6,217.910	0.001	0.351	4,498.944	0.027	0.233
Pe -Metropol de Recife	Δadm	5,672.2	-0.435	0.072	0.723	-0.258	-2,424.076	0.904	0.045	-6,930.203	-0.067	0.212	3,458.487	-0.166	-0.090
Pe -Metropol de Recife	Δdis	-14,890.9	0.270	-0.534	-0.324	0.607	2,895.452	0.016	0.692	7,763.669	-0.036	0.248	-262.106	-0.073	-0.218
Al -Sertao Alagoano	Δadm	89.0	-0.572	0.416	0.006	0.003	-28.160	0.003	0.010	120.341	-0.004	-0.001	1.521	0.022	-0.393
Al -Sertao Alagoano	Δdis	-59.0	0.395	-0.287	-0.004	-0.002	19.433	-0.002	0.001	204.240	-0.001	0.019	-307.268	-0.284	-0.355
Al -Agreste Alagoano	Δadm	-5,079.3	-0.644	0.396	-0.022	0.008	1,216.395	-0.008	-0.001	1,708.490	-	-	-	-0.183	-0.286
Al -Agreste Alagoano	Δdis	211.0	0.463	-0.592	-0.008	0.008	-33.802	0.006	0.007	187.853	-	-	-	-0.178	-0.252
Al -Leste Alagoano	Δadm	71,752.1	-1.049	-0.436	2.005	-1.262	-15,907.960	2.281	-1.571	-42,460.883	0.714	-1.329	-9,192.154	0.064	0.429
Al -Leste Alagoano	Δdis	121,193.7	-0.138	-0.746	0.543	0.045	-27,148.214	-0.437	1.223	13,262.149	-0.316	0.759	19,593.323	0.027	0.283
Se -Sertao Sergipano	Δadm	244.0	-0.507	-0.011	0.026	0.000	-58.816	0.023	-0.002	70.862	-	-	-	-0.218	0.009
Se -Sertao Sergipano	Δdis	468.4	0.158	-0.668	0.013	0.027	-127.090	0.004	0.005	-2.377	-	-	-	-0.058	-0.116
Se -Agreste Sergipano	Δadm	482.1	-1.004	0.032	0.074	0.003	-232.307	0.072	-0.002	-712.734	-0.005	-0.031	-448.647	-	-
Se -Agreste Sergipano	Δdis	5,037.0	0.200	-1.065	-0.006	0.075	-1,236.196	-0.002	0.112	215.238	-0.019	0.008	768.469	-	-
Se -Leste Sergipano	Δadm	-6,193.2	-0.962	0.301	0.251	-0.042	1,359.297	0.181	0.052	2,312.298	-	-	-	-	-
Se -Leste Sergipano	Δdis	4,491.7	0.125	-0.977	-0.039	0.290	-948.504	-0.048	0.251	712.774	-	-	-	-	-
Ba -Extremo Oeste Baiano	Δadm	11,806.2	-0.966	0.321	0.187	-0.113	-2,544.752	0.142	0.001	1,709.188	-0.124	0.102	-797.906	0.383	0.077
Ba -Extremo Oeste Baiano	Δdis	-290.1	0.419	-0.843	0.009	0.017	245.642	0.009	0.086	-1,312.043	0.019	-0.025	-267.854	-0.257	0.162

Region	Serie	Intercept	Adm$_{-1}$	Desl$_{-1}$	Adm*$_{-1}$	Desl*$_{-1}$	lindProd$_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm*$_{-1}$	Δdis*$_{-1}$	ΔlindProd$_{-1}$	Δadm$_{-1}$	Δdis$_{-1}$
Ba -Vale Sao-Fran da BA	Δadm	-1,688.9	-0.674	-0.392	0.023	0.065	679.563	0.134	0.001	-1,145.548	-	-	-	0.016	0.251
Ba -Vale Sao-Fran da BA	Δdis	-28,881.6	-0.057	-0.729	-0.240	0.191	6,958.916	-0.209	0.033	5,245.898	-	-	-	-0.329	0.195
Ba -Centro Norte Baiano	Δadm	-1,542.4	-0.518	0.152	0.061	0.021	275.932	0.176	-0.026	1,566.859	0.061	0.012	-2,526.427	-	-
Ba -Centro Norte Baiano	Δdis	429.2	0.165	-0.777	-0.093	0.220	-176.761	-0.009	0.175	211.135	0.011	-0.028	-906.930	-	-
Ba -Nordeste Baiano	Δadm	4,114.3	-0.756	0.053	0.090	0.001	-921.093	0.135	-0.006	-106.126	-	-	-	-0.029	-0.006
Ba -Nordeste Baiano	Δdis	-756.5	0.205	-0.746	-0.012	0.066	186.858	0.030	0.061	-50.738	-	-	-	-0.116	-0.149
Ba -Metropol de Salvador	Δadm	-44,343.6	-0.395	-0.286	0.385	0.265	10,192.609	0.845	0.104	5,417.696	-	-	-	-0.254	0.197
Ba -Metropol de Salvador	Δdis	-23,114.8	0.225	-0.960	-0.230	1.010	5,186.453	-0.042	1.179	3,704.346	-	-	-	0.029	-0.038
Ba -Centro Sul Baiano	Δadm	-4,615.4	-0.590	-0.317	0.024	0.127	1,124.255	0.150	0.002	2,100.002	-	-	-	-	-
Ba -Centro Sul Baiano	Δdis	-6,649.4	0.232	-0.691	-0.108	0.174	1,562.314	-0.044	0.218	726.397	-	-	-	-	-
Ba -Sul Baiano	Δadm	34,434.3	-0.795	-0.018	0.191	-0.049	-7,546.090	0.050	0.010	4,269.741	-0.153	0.022	5,474.659	0.278	0.116
Ba -Sul Baiano	Δdis	3,998.1	0.467	-0.928	-0.068	0.126	-650.525	-0.020	0.171	-1,190.562	0.021	-0.032	3,361.184	-0.507	0.129
Mg -Noroeste de Minas	Δadm	8,384.2	-0.678	0.000	0.111	-0.064	-1,784.662	0.112	-0.029	-2,498.499	-0.064	0.014	1,167.347	0.090	-0.117
Mg -Noroeste de Minas	Δdis	-9,001.9	0.405	-0.624	-0.053	0.046	2,201.715	-0.030	0.042	1,416.864	0.021	-0.011	-377.384	-0.146	-0.102
Mg -Norte de Minas	Δadm	7,017.9	-0.359	-0.079	0.032	0.012	-1,515.664	0.051	0.001	1,544.746	0.005	0.011	1,139.333	-0.223	-0.006
Mg -Norte de Minas	Δdis	-3,094.5	0.361	-0.756	-0.061	0.087	841.595	-0.013	0.095	2,052.551	0.041	-0.002	-615.334	-0.180	-0.068
Mg -Jequitinhonha	Δadm	-1,236.5	-0.806	-0.521	0.016	0.009	485.208	0.033	0.021	103.764	-0.023	-0.009	2,571.860	0.119	0.190
Mg -Jequitinhonha	Δdis	-2,724.5	0.412	-0.403	-0.021	0.013	650.861	-0.003	0.026	457.026	0.016	0.023	-1,028.078	-0.222	-0.092
Mg -Vale do Mucuri	Δadm	5,479.8	-0.664	0.010	0.040	-0.017	-1,230.269	0.027	-0.010	-275.511	-0.024	-0.000	965.574	-0.058	0.024
Mg -Vale do Mucuri	Δdis	-576.7	0.197	-0.616	-0.006	0.015	169.530	-0.005	0.051	-899.716	0.004	0.014	-389.513	-0.195	-0.140
Mg -Triang Mineiro	Δadm	45,401.9	-0.637	-0.238	0.279	0.004	-9,018.792	0.320	-0.025	-799.237	-0.167	-0.115	11,969.910	0.214	0.212
Mg -Triang Mineiro	Δdis	-17,622.3	0.534	-0.644	-0.148	0.149	4,437.784	-0.069	0.361	-3,948.118	0.169	0.047	-5,776.922	-0.517	-0.103
Mg -Central Mineira	Δadm	765.9	-0.649	0.124	0.039	-0.024	3.063	0.052	-0.027	2,258.156	-0.017	-0.007	571.418	0.147	-0.024
Mg -Central Mineira	Δdis	-7,146.9	0.082	-0.544	-0.019	0.022	1,817.435	-0.030	0.096	-255.042	0.008	0.042	-1,378.555	-0.093	-0.227
Mg -Metropol de BH	Δadm	-51,840.5	-0.491	0.260	1.302	-0.816	11,876.640	2.568	0.011	6,353.771	-	-	-	-	-
Mg -Metropol de BH	Δdis	-2,497.8	0.179	-0.490	-0.201	1.033	244.699	-0.045	2.045	11,454.741	-	-	-	-	-
Mg -Vale do Rio Doce	Δadm	2,839.0	-0.520	-0.038	0.111	-0.066	-51.828	0.162	-0.007	-370.157	-	-	-	-	-
Mg -Vale do Rio Doce	Δdis	-6,751.7	0.269	-0.630	-0.053	0.075	1,948.637	-0.007	0.175	2,832.208	-	-	-	-	-
Mg -Oeste de Minas	Δadm	29,708.4	-0.550	0.014	0.149	-0.053	-6,697.188	0.203	-0.071	-892.057	-0.031	-0.077	3,349.462	0.064	0.026
Mg -Oeste de Minas	Δdis	-10,576.0	0.223	-0.973	-0.056	0.131	2,873.594	-0.073	0.243	-3,424.898	0.095	-0.040	-2,713.103	-0.312	0.218
Mg -Sul-Sudoeste MG	Δadm	11,408.1	-0.757	-0.411	0.271	-0.134	-77.602	0.241	-0.128	2,037.997	-0.247	-0.174	17,520.138	0.429	0.261
Mg -Sul-Sudoeste MG	Δdis	-57,306.4	0.269	-0.562	-0.104	0.096	14,093.082	-0.027	0.174	6,191.814	0.108	-0.070	-8,605.305	-0.338	0.376
Mg -Campo das Vertentes	Δadm	3,796.5	-0.672	-0.312	0.045	0.008	-728.849	0.056	-0.017	-131.352	-0.012	-0.044	1,947.937	0.102	0.128
Mg -Campo das Vertentes	Δdis	-7,210.9	0.260	-0.747	-0.039	0.053	1,757.782	-0.009	0.053	1,818.480	0.036	-0.007	-1,813.906	-0.217	0.080
Mg -Zona da Mata	Δadm	17,768.6	-0.698	-0.504	0.211	0.029	-3,683.122	0.182	-0.083	6,335.530	-0.068	-0.109	2,369.782	0.077	0.253
Mg -Zona da Mata	Δdis	-11,728.1	0.234	-0.721	-0.046	0.125	2,897.830	0.018	0.196	-412.955	0.084	0.006	-3,334.560	-0.230	-0.039
Es -Noroeste ES	Δadm	15,676.1	-0.567	-0.049	0.201	-0.109	-3,587.559	0.152	-0.088	165.853	-0.042	-0.066	624.383	-	-
Es -Noroeste ES	Δdis	4,609.5	0.718	-1.011	-0.035	0.062	-994.981	-0.027	0.156	-1,726.236	-0.013	0.029	-749.444	-	-
Es -Litoral Norte ES	Δadm	78,027.9	-0.581	-0.351	0.646	-0.337	-17,647.184	0.327	-0.269	-1,074.544	-0.379	-0.134	9,991.800	-	-

Region	Serie	Intercept	Adm$_{-1}$	Desl$_{-1}$	Adm*$_{-1}$	Desl*$_{-1}$	lindProd$_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm*$_{-1}$	Δdis*$_{-1}$	ΔlindProd$_{-1}$	Δadm$_{-1}$	Δdis$_{-1}$
Es -Litoral Norte ES	Δdis	228.3	0.569	-0.844	-0.057	0.095	119.943	-0.098	0.277	2,023.415	-0.070	0.078	-291.342	-	-
Es -Central ES	Δadm	-27,824.1	-0.540	-0.110	0.440	0.033	6,425.325	0.798	0.097	-1,333.450	0.075	-0.139	-4,397.319	-0.159	0.456
Es -Central ES	Δdis	1,529.9	0.188	-0.613	-0.012	0.394	-519.519	0.241	0.667	-3,989.028	0.137	-0.043	-4,512.971	-0.083	0.115
Es -Sul ES	Δadm	8,665.4	-0.535	0.112	0.075	-0.031	-1,971.825	0.069	0.000	202.876	-0.035	0.023	1,976.090	-0.081	-0.208
Es -Sul ES	Δdis	-10,961.8	0.170	-0.693	-0.080	0.090	2,628.993	-0.047	0.100	1,709.676	0.043	-0.004	-1,096.314	-0.031	-0.143
Rj -Noroeste Fluminense	Δadm	1,079.4	-0.638	0.410	0.018	-0.009	-255.196	0.029	-0.008	625.405	-0.003	-0.003	-26.208	-0.082	0.061
Rj -Noroeste Fluminense	Δdis	1,016.2	0.457	-1.115	-0.015	0.034	-232.745	-0.006	0.040	-636.354	0.014	-0.004	-992.171	-0.188	0.144
Rj -Norte Fluminense	Δadm	14,741.2	-0.554	0.136	0.114	-0.060	-3,447.235	0.078	0.002	2,928.976	-	-	-	-	-
Rj -Norte Fluminense	Δdis	-12,416.0	-0.110	-0.913	-0.023	0.105	3,076.717	-0.052	0.139	-1,036.702	-	-	-	-	-
Rj -Centro Fluminense	Δadm	-3,044.4	-0.995	0.756	0.052	-0.046	768.177	0.047	-0.011	2,142.355	-	-	-	-	-
Rj -Centro Fluminense	Δdis	5,694.1	-0.076	-0.774	0.036	-0.000	-1,144.862	0.023	0.034	-663.564	-	-	-	-	-
Rj -Baixadas	Δadm	-7,143.9	-0.589	0.195	-0.002	0.016	1,648.131	0.006	0.027	334.653	-0.006	0.006	-1,339.334	-0.030	0.073
Rj -Baixadas	Δdis	-4,892.0	0.093	-0.514	-0.028	0.043	1,158.795	-0.016	0.049	686.780	0.015	-0.003	-2,320.083	-0.251	-0.041
Rj -Sul Fluminense	Δadm	651.0	-0.606	0.014	0.075	-0.027	-182.397	0.082	0.007	-1,869.051	-	-	-	-	-
Rj -Sul Fluminense	Δdis	1,904.0	0.283	-0.726	-0.018	0.054	-419.092	-0.000	0.083	-20.518	-	-	-	-	-
Rj -Metropol do RJ	Δadm	-39,341.3	-0.549	0.135	0.575	0.074	9,074.547	0.875	0.332	17,786.765	0.215	0.242	6,972.252	-0.214	-0.071
Rj -Metropol do RJ	Δdis	-15,480.5	0.214	-0.428	-0.651	0.927	4,553.797	0.014	1.563	14,516.000	-0.310	0.505	3,550.702	0.029	-0.229
Sp -Sao Jose do Rio Preto	Δadm	75,130.4	-0.681	0.376	0.296	-0.196	-17,279.263	0.295	-0.082	-11,373.915	-	-	-	-0.008	-0.135
Sp -Sao Jose do Rio Preto	Δdis	-33,317.2	0.160	-0.787	-0.140	0.188	8,639.982	-0.111	0.501	-19,004.568	-	-	-	-0.031	0.111
Sp -Ribeirao Preto	Δadm	176,670.9	-0.610	0.143	0.814	-0.483	-40,163.570	0.788	-0.119	-29,894.968	-0.391	0.132	17,757.159	0.212	-0.030
Sp -Ribeirao Preto	Δdis	26,448.2	-0.353	-0.726	0.204	0.098	-2,775.438	-0.498	1.497	-41,565.326	-0.086	0.387	-3,348.471	0.233	0.020
Sp -Aracatuba	Δadm	83,382.8	-1.205	0.183	0.819	-0.447	-19,273.060	0.580	0.035	-14,416.294	-0.274	0.201	6,024.109	0.352	-0.063
Sp -Aracatuba	Δdis	-2,371.9	0.077	-0.629	-0.005	0.090	841.533	-0.115	0.636	-9,178.217	-0.010	0.256	-8,372.805	-0.040	-0.208
Sp -Bauru	Δadm	95,607.5	-0.746	0.271	0.351	-0.223	-21,766.282	0.284	-0.062	-12,259.508	-0.196	0.062	23,186.723	0.191	-0.128
Sp -Bauru	Δdis	-3,104.1	-0.102	-0.765	0.077	0.022	1,877.503	-0.084	0.326	-11,819.166	-0.064	0.108	-6,891.656	0.063	-0.117
Sp -Araraquara	Δadm	42,548.1	-0.804	-0.147	0.360	-0.176	-9,351.708	0.274	-0.093	-13,901.036	-0.159	0.002	666.305	0.177	0.176
Sp -Araraquara	Δdis	-12,905.8	0.178	-0.511	-0.085	0.109	3,339.100	0.030	0.255	-7,150.543	0.088	0.085	-11,860.205	-0.056	-0.195
Sp -Piracicaba	Δadm	59,233.0	-0.674	0.190	0.332	-0.203	-13,609.180	0.313	-0.072	-9,877.431	-0.073	-0.000	5,801.291	-	-
Sp -Piracicaba	Δdis	7,945.0	-0.194	-0.668	0.142	0.003	-1,256.394	-0.038	0.343	-16,285.229	-0.038	0.041	-2,453.195	-	-
Sp -Campinas	Δadm	48,826.8	-0.888	0.032	0.657	-0.165	-11,127.363	0.687	-0.121	-10,788.656	-0.072	0.003	128.972	0.040	0.073
Sp -Campinas	Δdis	-16,939.7	0.007	-0.625	0.034	0.275	4,311.102	-0.034	0.577	-9,676.147	-0.028	0.208	-7,146.566	-0.023	-0.294
Sp -Presidente Prudente	Δadm	11,866.7	-0.475	0.098	0.162	-0.087	-2,612.128	0.291	-0.043	-4,155.067	-	-	-	0.128	-0.065
Sp -Presidente Prudente	Δdis	-11,636.3	0.179	-0.747	-0.121	0.168	3,012.608	-0.049	0.351	-2,799.093	-	-	-	0.022	0.058
Sp -Marilia	Δadm	5,169.3	-0.705	0.073	0.058	-0.010	-1,146.761	0.058	-0.017	784.565	0.002	-0.002	-1,421.204	0.017	-0.038
Sp -Marilia	Δdis	-6,385.7	0.335	-0.677	-0.046	0.054	1,578.078	-0.009	0.055	2,039.815	0.020	-0.021	-217.957	-0.188	0.220
Sp -Assis	Δadm	40,147.2	-0.690	0.061	0.218	-0.124	-9,076.533	0.227	-0.059	-7,254.353	-0.056	-0.032	5,939.620	-	-
Sp -Assis	Δdis	-1,697.4	-0.025	-0.781	-0.019	0.061	805.806	-0.093	0.373	-6,544.065	0.000	0.133	-610.374	-	-
Sp -Itapetininga	Δadm	-7,112.6	-0.865	0.081	0.045	-0.001	1,977.253	0.077	-0.033	2,751.891	0.012	-0.025	-183.819	-0.027	-0.035
Sp -Itapetininga	Δdis	21,418.8	0.151	-0.843	0.017	0.039	-4,636.501	-0.029	0.135	-7,253.397	0.001	0.043	-2,874.170	-0.262	-0.047

Region	**Serie**	**Intercept**	**Adm_{-1}**	**$Desl_{-1}$**	**Adm^*_{-1}**	**$Desl^*_{-1}$**	**$lindProd_{-1}$**	**Δadm***	**Δdis**	**ΔlindProd**	**Δadm^*_{-1}**	**Δdis^*_{-1}**	**$\Delta lindProd_{-1}$**	**Δadm_{-1}**	**Δdis_{-1}**
Sp -Macro Metropol SP	Δadm	-21,950.1	-0.492	0.190	0.136	-0.051	4,897.607	0.338	-0.009	-1,587.010	0.078	0.005	-2,955.968	-0.183	-0.073
Sp -Macro Metropol SP	Δdis	-6,003.3	0.268	-0.500	-0.081	0.150	1,310.419	-0.017	0.303	-3,208.304	0.059	0.103	-4,742.649	-0.172	-0.348
Sp -Vale do Paraiba SP	Δadm	-29,900.7	-0.449	0.179	0.023	-0.006	7,138.901	0.113	0.002	715.650	0.039	0.001	-1,831.145	-0.183	-0.122
Sp -Vale do Paraiba SP	Δdis	3,514.2	0.196	-0.707	-0.014	0.083	-689.479	-0.009	0.146	-7,679.072	-0.002	0.023	-7,740.325	0.017	-0.135
Sp -Litoral Sul SP	Δadm	2,137.6	-0.900	0.153	0.008	-0.001	-428.535	0.010	0.002	-1,712.219	0.001	0.002	-1,019.710	-	-
Sp -Litoral Sul SP	Δdis	4,083.8	0.239	-0.834	-0.000	0.007	-885.805	-0.000	0.016	-894.470	-0.000	0.004	-522.386	-	-
Sp -Metropol Sao Paulo	Δadm	-219,085.9	-0.447	0.027	1.941	0.536	50,185.010	5.989	-0.042	64,962.011	0.588	-0.213	-24,316.869	-	-
Sp -Metropol Sao Paulo	Δdis	73,764.6	0.151	-0.491	-0.344	2.932	-19,618.561	1.246	4.494	27,776.798	0.124	-0.496	6,716.191	-	-
Pr -Noroeste PR	Δadm	46,188.9	-0.866	0.161	0.486	-0.257	-10,672.852	0.266	0.032	427.253	-0.082	0.189	4,270.640	-	-
Pr -Noroeste PR	Δdis	-3,881.4	0.072	-0.828	-0.093	0.209	1,131.415	-0.189	0.456	-5,478.966	-0.003	0.118	-3,780.871	-	-
Pr -Centro Ocidental PR	Δadm	4,232.0	-0.808	0.190	0.048	0.006	-977.931	0.059	-0.000	891.609	0.003	-0.027	860.544	0.000	0.015
Pr -Centro Ocidental PR	Δdis	1,699.4	0.184	-0.760	-0.030	0.070	-366.299	-0.008	0.094	-649.356	0.008	0.021	252.288	-0.095	-0.220
Pr -Norte Central PR	Δadm	32,999.8	-0.558	0.049	0.475	-0.120	-7,443.340	0.884	-0.108	-5,745.228	-0.045	-0.024	4,650.459	-0.023	0.003
Pr -Norte Central PR	Δdis	-4,779.7	0.240	-1.031	-0.070	0.502	1,631.919	-0.006	0.640	-4,773.146	0.234	0.117	-9,864.179	-0.237	0.073
Pr -Norte Pioneiro PR	Δadm	23,612.3	-0.777	-0.246	0.236	-0.170	-5,040.500	0.151	-0.135	-3,158.395	-0.087	-0.012	1,192.231	0.246	0.169
Pr -Norte Pioneiro PR	Δdis	-7,465.8	-0.089	-0.979	-0.001	0.014	2,239.432	-0.039	0.151	-1,940.409	-0.010	0.102	-2,727.465	0.016	0.027
Pr -Centro Oriental PR	Δadm	-1,096.7	-0.058	0.099	0.006	-0.009	222.672	0.114	0.001	-185.584	0.053	-0.000	-2,604.411	-0.429	0.043
Pr -Centro Oriental PR	Δdis	5,750.7	0.307	-0.523	-0.032	0.049	-1,177.890	0.005	0.094	-911.691	-0.004	0.015	-1,395.985	-0.073	-0.145
Pr -Oeste PR	Δadm	-7,947.8	-0.403	0.233	0.017	0.024	1,848.166	0.263	-0.019	1,269.998	0.067	0.014	-2,964.983	-0.011	-0.198
Pr -Oeste PR	Δdis	-7,731.0	0.477	-0.942	-0.230	0.315	2,056.631	-0.038	0.278	230.721	0.076	-0.023	-1,498.694	-0.045	0.113
Pr -Sudoeste PR	Δadm	3,311.5	-0.333	0.065	0.012	0.056	-787.529	0.209	0.025	274.362	0.068	-0.025	774.660	-0.136	-0.034
Pr -Sudoeste PR	Δdis	-3,352.2	0.398	-0.598	-0.143	0.168	789.886	-0.013	0.210	-83.109	0.087	0.053	-910.515	-0.238	-0.116
Pr -Centro-Sul PR	Δadm	-1,827.5	-0.408	0.129	-0.007	0.024	471.599	0.122	-0.017	-708.504	0.038	-0.005	-1,022.377	-0.225	-0.099
Pr -Centro-Sul PR	Δdis	6,647.9	0.232	-0.655	-0.002	0.032	-1,418.652	0.022	0.068	-1,431.558	-0.001	-0.009	268.510	-0.127	-0.084
Pr -Sudeste PR	Δadm	2,795.6	-0.486	0.155	0.020	0.004	-618.818	0.067	0.002	-252.978	0.015	0.006	117.009	-0.150	-0.136
Pr -Sudeste PR	Δdis	-2,129.7	0.355	-0.623	-0.045	0.050	549.595	0.004	0.056	186.408	0.022	0.010	-1,069.843	-0.184	-0.071
Pr -Metropol de Curitiba	Δadm	-16,453.6	-0.376	0.044	0.383	-0.058	3,622.096	1.067	-0.092	2,395.297	0.394	0.029	-6,248.597	-0.397	0.069
Pr -Metropol de Curitiba	Δdis	-34,822.9	0.751	-0.949	-0.688	0.845	8,062.159	0.056	0.828	5,088.032	0.474	-0.117	-5,554.439	-0.373	0.081
Sc -Oeste Catarinense	Δadm	8,490.4	-0.726	0.117	0.424	-0.159	-1,510.736	0.936	-0.377	-8,277.711	0.154	-0.079	-9,387.300	-	-
Sc -Oeste Catarinense	Δdis	-947.7	0.364	-0.496	-0.214	0.251	381.374	-0.187	0.657	1,389.680	0.009	0.137	-6,687.969	-	-
Sc -Norte Catarinense	Δadm	16,309.8	-0.411	0.033	0.230	-0.070	-3,834.474	0.585	-0.120	-5,425.875	0.230	-0.117	-4,604.151	-0.257	0.088
Sc -Norte Catarinense	Δdis	-1,688.9	0.276	-0.746	-0.072	0.232	433.604	0.075	0.276	-1,913.987	0.218	-0.090	-4,341.708	-0.405	0.046
Sc -Serrana	Δadm	21,675.7	-0.860	-0.029	0.244	-0.161	-4,570.344	0.328	-0.117	-6,873.101	-	-	-	0.157	-0.016
Sc -Serrana	Δdis	8,620.5	0.693	-0.835	-0.002	0.018	-1,890.595	-0.001	0.145	-382.564	-	-	-	-0.259	-0.182
Sc -Vale do Itajai	Δadm	28,657.2	-0.970	0.535	0.684	-0.328	-6,550.639	1.062	-0.118	-6,103.576	0.042	0.169	-4,940.463	0.206	-0.435
Sc -Vale do Itajai	Δdis	-6,516.3	0.078	-0.428	-0.107	0.320	1,760.229	-0.051	0.779	-4,939.177	0.025	0.332	-10,053.189	0.061	-0.481
Sc -Grande Florianopolis	Δadm	-25,333.6	-0.592	0.419	0.108	-0.054	5,804.479	0.199	0.124	3,508.837	-0.001	0.157	-6,090.038	-0.081	0.036
Sc -Grande Florianopolis	Δdis	-8,721.9	0.298	-0.504	-0.171	0.251	2,008.800	-0.048	0.385	3,350.356	0.178	0.065	-2,130.685	-0.403	0.048
Sc -Sul Catarinense	Δadm	11,042.4	-0.675	0.182	0.150	-0.017	-2,463.922	0.284	0.011	-845.763	0.024	0.004	-423.269	-	-

Region	Serie	Intercept	Adm$_{-1}$	Desl$_{-1}$	Adm*$_{-1}$	Desl*$_{-1}$	lindProd$_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm*$_{-1}$	Δdis*$_{-1}$	ΔlindProd$_{-1}$	Δadm$_{-1}$	Δdis$_{-1}$
Sc -Sul Catarinense	Δdis	-2,164.7	0.178	-0.823	-0.103	0.243	684.047	-0.029	0.277	1,337.038	0.063	-0.022	-3,256.243	-	-
Rs -Noroeste RS	Δadm	-11,000.7	-0.552	0.309	0.183	-0.093	2,444.261	0.388	0.019	4,479.234	-0.001	0.068	-4,285.322	0.154	-0.096
Rs -Noroeste RS	Δdis	5,319.4	0.471	-0.807	-0.194	0.314	-1,180.471	0.009	0.326	-2,630.365	0.098	0.009	-4,109.364	-0.167	-0.041
Rs -Nordeste RS	Δadm	74,004.4	-1.518	0.811	1.049	-0.734	-16,850.387	0.923	-0.314	-20,487.903	-0.073	0.122	-7,769.983	0.524	-0.217
Rs -Nordeste RS	Δdis	17,981.6	0.739	-1.115	-0.190	0.327	-3,881.656	-0.034	0.378	-434.462	0.001	0.036	-6,143.036	-0.117	0.050
Rs -Centro Ocidental RS	Δadm	2,730.4	-1.055	0.182	0.073	0.027	-680.909	0.056	0.049	1,777.488	-0.018	0.019	727.627	0.179	-0.039
Rs -Centro Ocidental RS	Δdis	2,326.0	0.439	-0.793	-0.041	0.077	-527.075	-0.032	0.115	344.451	0.003	0.034	-417.535	-0.282	-0.146
Rs -Centro Oriental RS	Δadm	55,861.1	-0.846	-0.221	0.315	-0.125	-12,353.994	0.267	-0.006	3,019.628	-	-	-	0.218	0.116
Rs -Centro Oriental RS	Δdis	-30,971.9	-0.144	-0.828	-0.056	0.119	7,891.374	-0.076	0.076	12,669.681	-	-	-	0.012	0.291
Rs -Metropol Porto Alegre	Δadm	-22,385.4	-0.435	0.378	0.458	-0.386	5,063.352	1.055	0.447	14,942.686	0.043	0.415	2,498.472	-0.184	0.021
Rs -Metropol Porto Alegre	Δdis	6,005.2	0.118	-0.103	-0.125	0.105	-1,377.723	0.137	1.448	1,781.614	0.051	0.513	9,015.538	-0.006	-0.373
Rs -Sudoeste RS	Δadm	12,248.4	-1.147	-0.296	0.095	0.026	-2,656.678	0.079	0.030	22.593	-0.002	-0.006	-318.659	0.336	0.057
Rs -Sudoeste RS	Δdis	6,003.7	0.451	-0.652	-0.006	0.029	-1,370.266	-0.037	0.092	1,320.558	-0.013	0.038	452.655	-0.377	-0.028
Rs -Sudeste RS	Δadm	-18,559.9	-0.407	0.104	0.025	0.004	4,180.150	0.125	0.038	1,175.093	0.019	0.001	909.551	0.077	-0.180
Rs -Sudeste RS	Δdis	1,944.1	0.731	-0.866	-0.093	0.103	-368.602	-0.043	0.136	-1,480.056	-0.035	0.040	-988.952	-0.177	-0.077
Ms -Pantanais Sul MT	Δadm	1,497.9	-0.412	-0.100	0.011	0.002	-336.696	0.024	-0.002	-88.494	-	-	-	-0.351	0.026
Ms -Pantanais Sul MT	Δdis	-98.3	0.305	-0.532	-0.007	0.011	29.550	0.004	0.021	27.038	-	-	-	-0.151	-0.218
Ms -Centro Norte de MS	Δadm	-5,137.9	-0.508	0.101	0.019	0.041	1,275.120	0.163	0.004	2,929.589	0.058	-0.003	3,137.794	-0.198	-0.103
Ms -Centro Norte de MS	Δdis	-5,476.9	0.298	-0.819	-0.087	0.155	1,488.383	-0.004	0.165	2,324.737	0.057	0.009	1,016.149	-0.205	-0.089
Ms -Leste de MS	Δadm	3,019.8	-0.358	0.112	0.045	-0.004	-747.122	0.147	-0.024	34.199	-	-	-	-0.151	-0.022
Ms -Leste de MS	Δdis	-2,698.4	0.292	-0.616	-0.009	0.051	587.982	0.014	0.110	-2,314.870	-	-	-	-0.216	-0.128
Ms -Sudoeste de MS	Δadm	29,850.7	-0.784	0.069	0.140	-0.037	-6,738.087	0.128	-0.044	-298.542	-	-	-	-0.085	0.117
Ms -Sudoeste de MS	Δdis	5,042.6	0.103	-0.955	-0.032	0.100	-797.149	-0.034	0.161	-2,875.859	-	-	-	-0.135	-0.005
Mt -Norte MT	Δadm	724.9	-0.551	0.582	0.098	-0.093	-241.597	0.454	-0.121	-1,709.036	-0.040	0.056	1,095.925	0.025	-0.463
Mt -Norte MT	Δdis	-732.2	0.602	-0.635	-0.107	0.101	263.618	-0.008	0.184	-1,197.587	0.159	0.005	-1,899.670	-0.483	0.037
Mt -Nordeste MT	Δadm	-3,634.9	-0.841	0.692	-0.007	0.011	840.489	0.062	-0.021	1,971.129	-	-	-	0.170	-0.292
Mt -Nordeste MT	Δdis	4,660.5	0.413	-0.769	-0.003	0.027	-1,030.044	-0.006	0.055	-1,079.218	-	-	-	-0.306	0.109
Mt -Sudoeste MT	Δadm	27,794.5	-0.842	0.036	0.278	-0.160	-6,269.970	0.175	-0.118	-2,976.937	-0.122	0.002	3,397.535	0.260	0.061
Mt -Sudoeste MT	Δdis	-12,322.4	-0.038	-0.992	-0.075	0.098	3,203.078	-0.085	0.125	-687.721	0.017	-0.030	-1,665.455	0.045	0.184
Mt -Centro-Sul MT	Δadm	-3,041.1	-0.364	-0.007	0.072	0.077	593.728	0.321	0.018	3,064.704	0.058	-0.094	2,114.584	-0.175	0.073
Mt -Centro-Sul MT	Δdis	-5,997.0	0.501	-0.843	-0.200	0.327	1,347.217	0.008	0.231	5,798.825	0.127	-0.124	-2,156.564	-0.276	0.070
Mt -Sudeste MT	Δadm	5,691.1	-0.786	0.371	0.074	0.007	-1,235.304	0.243	-0.131	1,313.037	-	-	-	0.118	-0.306
Mt -Sudeste MT	Δdis	3,149.9	0.388	-0.670	-0.020	0.063	-609.955	-0.035	0.115	234.218	-	-	-	-0.258	0.101
Go -Noroeste Goiano	Δadm	616.1	-0.571	0.261	0.006	0.001	-132.624	0.019	-0.010	514.849	-	-	-	-	-
Go -Noroeste Goiano	Δdis	-426.4	0.151	-0.417	-0.011	0.017	102.169	0.002	0.011	335.586	-	-	-	-	-
Go -Norte Goiano	Δadm	1,718.8	-0.387	0.042	0.022	-0.010	-393.752	0.037	-0.003	28.111	-	-	-	-0.196	-0.061
Go -Norte Goiano	Δdis	-628.8	0.320	-0.609	-0.015	0.024	147.381	-0.002	0.040	-316.747	-	-	-	-0.101	-0.063
Go -Centro Goiano	Δadm	50,629.3	-0.745	0.129	0.611	0.016	-12,374.084	0.825	0.005	-3,420.089	-0.216	-0.027	23,452.171	-	-
Go -Centro Goiano	Δdis	-56,801.4	0.030	-0.461	-0.224	0.491	13,124.889	-0.223	0.591	9,959.773	0.092	-0.167	2,191.609	-	-

Region	Serie	Intercept	Adm_{-1}	$Desl_{-1}$	Adm^*_{-1}	$Desl^*_{-1}$	$lindProd_{-1}$	Δadm*	Δdis	ΔlindProd	Δadm^*_{-1}	Δdis^*_{-1}	$\Delta lindProd_{-1}$	Δadm_{-1}	Δdis_{-1}
Go -Leste Goiano	Δadm	10,996.4	-0.645	0.030	0.072	0.036	-2,608.636	0.075	0.005	3,354.424	-0.043	0.022	1,932.896	-	-
Go -Leste Goiano	Δdis	-3,516.0	0.176	-0.558	-0.057	0.102	804.088	-0.061	0.136	157.681	-0.024	-0.031	970.431	-	-
Go -Sul Goiano	Δadm	10,912.4	-0.495	0.211	0.160	-0.067	-2,501.573	0.345	-0.107	-3,449.606	0.090	-0.001	-5,951.995	-0.117	-0.124
Go -Sul Goiano	Δdis	-29,458.7	0.590	-0.885	-0.292	0.318	7,038.806	-0.108	0.419	-3,133.851	0.144	-0.015	-4,090.013	-0.453	0.084
Go -Distrito Federal	Δadm	8,773.0	-0.628	0.189	0.134	-0.002	-2,012.109	0.224	0.010	2,147.759	-	-	-	-	-
Go -Distrito Federal	Δdis	-1,267.0	-0.027	-0.614	-0.031	0.218	295.032	-0.053	0.283	8,659.292	-	-	-	-	-

Source: elaborated by the author. Original data from: CAGED and IpeaData

APPENDIX C – DOMINANT UNIT ESTIMATES

Table 10: OLS estimates of augmented regressions

Region	Series	Intercept	$\Delta lindProd_{-1}$	Δadm^*_{-1}	Δdis^*_{-1}	Δadm^*_{-2}	Δdis^*_{-2}
Dominant Unit	ΔlindProd	0.00051	-0.32177	0.00001	-0.00003	0.00002	-0.00004

Source: elaborated by the author. Original data from: CAGED and IpeaData

Δadm*: Aggregated employment; Δdis*: Aggregated umemployment