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A SPATIAL ANALYSIS OF SERVICE SECTOR: A STUDY FOR MINAS GERAIS AND RIO DE JANEIRO STATES FOR THE PERIOD 1999 AND 2004

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Abstract

The principal aim of this work is describe the spatial distribution and the patterns of spatial association at the service sector located at Minas Gerais and Rio de Janeiro state. The theoretical base of the functional hierarchy of urban centers are the articles about central place (Christaller, 1933), market area (Losch, 1940) and development poles (Perroux, 1967). This theory has as a principal aim the explanation of how one city has a central role in comparison with the neighbors. The centrality criteria were established based on the city capacity measured in terms of service and goods supply for others localities. The index used in this paper was calculated for Minas Gerais and Rio de Janeiro municipalities and we used the value added for the agricultural, industry and service sector for the years 1999 and 2004. We use the spatial data exploratory analysis (ESDA).

Key words: Spatial association; service sector; Minas Gerais and Rio de Janeiro.

JEL Code: R12;

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I – INTRODUCTION

The main theoretical discussion about functional hierarchy of urban centers is the "Central Place Theory" developed by: Christaller (1933), Lösch (1940) and Perroux (1967). This theory has as a principal aim the explanation of the causes of formation and development of urban centers.

Christaller (1996) wants to explain why there are cities with different sizes and distributed in an irregular way. The author assumes that the principal function of an urban

core is being a service center of its immediate hinterland. It will give goods and services for a dependent region (complementary region), which is organized around a central place and have a degree of dependence upon it. The central places can present diversified sizes and different degree of polarization. Thus it can have a bigger or smaller number of complementary regions. It is possible to affirm that as bigger as the centrality, bigger is the importance of place and bigger is the complementary region

For the author the central places were spatially organized in a hierarchically way. Thus places with a superior hierarchical level have to have all the goods and services that the places with a lower hierarchical level has. The existence of lower and superior levels is due to the fact that each good and service supplied in the market is associated with a minimum demand that justifies the supply.

The centers also have polarized levels due to its area and the complexity of its economic structure. According to the author, the population structure that was attended by the center (income, professional characteristics and cultural specificities) determines the demand patterns. In other words, the supply of central goods and services are conditioned giving them bigger or smaller complexity, diversification and as a consequence polarization.

> According to the central place theory of Cristaller; the variety of consumption goods and services supplied by the agents in one city of a specific class or size depend on the number of thresholds that population and its neighborhood can consider (Pred, 1979 cited by FERREIRA, 1996, p:21).

Chistaller also highlights that the consumption of a central good varies due to distance between the consumers and the supplier center. The distance can be diminished through improvements in the transport infrastructure, which can reduce the cost and the time of travels. Thus this will enlarge the area supplied by the central place.

> Thus, the cities network, an inter and intra-urban net characterized in a central places hierarchy is not accidental. This net born due to the socio and spatial relationships based on the size, functions (activities) and interurban distances. It is important to emphasize that the market size of each central place varies direct to the sizes and to the hierarchy of centers. The periphery of small centers is included in the complementary regions of superior's centers. As bigger the centrality of a central place bigger is its neighborhood. Thus as bigger the complexity of services supplied larger is the market area of this center (SIMÕES at al, 2006, p:4-5).

Losch also has the objective to explain how a complex hierarchy of urban centers (supplying centers of goods and services) can appear in a geographical space. This hierarchy is due to the production sector and differs from Cristaller hierarchy that is based on a hierarchy of goods and services.

Losch (1969) bases its analysis on an idea of homogeneity area in which the population is distributed equally by all the territory and has the production of any agriculture product to subsistence. The producer can sell the surplus in all directions in the neighborhood of the area since the production costs and transports are constant. In the short run there will be earnings above the normal level. This situation will attract new players to the market. On the long run there will be new firms in the market. This movement will form new small areas located inside the original net. Thus, the demand will reduce. This reduction determines the smaller market areas of each product. The size of this area will be dependent on the production costs and also transport costs. In the end of this process each center has to attend a circular region with the same area (sub centers).

The circular shape of regions does not exhaust the territory. Thus the solution is not stable. The stability is founded when the producers try to improve the selling volumes, through the increase in the number of consumers, eliminating the open spaces that could exist. As a consequence the market areas have a hexagonal shape, which enables a bigger volume of sells. This enables to supply with a small transport cost (LOSCH, 1969).

In this configuration of the market areas, an urban hierarchy appears when some centers begin to specialize in the production of goods that will be supplied for the other market areas. The centers with a highest hierarchical level will supply different types of goods to serve the various levels of market areas.

> The central place or original urban core is the element that organizes the supply curve and the demand of goods in the space. It delimits the market area in which, occurs a strong intensity of trade (…) (LEMOS et al, 2000, p:6).

Perroux (1961) contributes to develop the concept of polarization of a central place, using the idea of space and region. To the author the economic spaces are abstract spaces constituted by a range of relationships originated in the phenomenal in study. The approach developed by Perroux does not consider the localization in the Cartesian axes. Thus, we will have as much economic spaces as the number of phenomenon studied.

This abstract concept of economic space is important because calls the attention to the perception that economic, social, political and institutional phenomenon and facts are not limited by geographical areas in which they are intrinsic correlated.

The economic space can be classified in three categories by Perroux: the space as a plan or program. This is the calculus, the project and plan space of a firm or government. The homogeneity space is an abstract space characterized by the elements that presents similar characteristics and the space as a field of forces or functional relationships that refers to abstract spaces that articulates influence zones, through prices, exchanges of goods and services and information.

> As a field of forces, the economic space is formed by centers (poles) from which centrifugal forces emanate and to which centripetal forces are attracted. Each center that is at the same time attraction center and repulse has its own field that is connected with the fields of other centers. (PERROUX, 1977, p:151).

The poles are not isolated units. Each pole has in its neighborhood a market area which is delimited by the transport network and communication network. The degree of attraction is bigger in the nearest neighborhood than in the distant ones. Thus, we can affirm that there is a hierarchy of poles. Each pole of major category dominates the polarized region (ANDRADE, 1987).

Thus the economic space tends to be organized in various poles (with its market areas). They polarized regions in their neighborhood. In this framework the pole tend to play the role of a central place or urban center, the government place, the center of entrepreneurship decisions and high quality services as education, heath for bigger national and international market areas (HADDAD, 1989). In other words, ***due to the power of services centrality, the level* of *tertiarization* of *a specific place is the best indicator of its polarization capacity***[1] (LEMOS, 1998).

The theoretical questions studied by Christaller, Losch and Perroux enable the construction of quantitative and qualitative methods of analysis to measure the level of urban centrality. LEMOS et all (2000) identify the Brazilian poles and its market areas based on the potential of economic interaction between the spatial units and also in the hierarchy correspondence of power of economic attraction from the poles in the space. They use the tertiarization index[2] and they identify twelve macro poles. All of them were located at metropolitan areas that have a specific market area. Using the same process in each macro region some mesoregions was identified. They polarized the micro regions located at the neighborhood. This enables the identification of meso poles.

Thus the main aim of this paper is the description of the spatial distribution and the patterns of spatial association at Minas Gerais and Rio de Janeiro states. In order to reach this objective we will use the exploratory spatial data analysis (ESDA). The analysis will use the Moran's I statistic and the cluster analysis.

This paper is organized as follows: an introduction; the second part describes the methodology and the database; in the third part we analyze the results e in the last part we make some conclusions.

II – DATABASE AND SOME METHODOLOGICAL ASPECTS

II.1. Database

The indicator used in this paper to identify the spatial patterns of service sector was the tertiarization index – It. It was calculated by Lemos (1988) and modified in this paper. We use the sectoral value added (agriculture, industry, service and public administration) for the municipalities located at Minas Gerais and Rio de Janeiro in the period 1999 and 2004. This data were obtained at Instituto Brasileiro de Geografia e Estatística (IBGE).

- *Tertiarization Index*

According to Lemos (1988) the calculus of *It* for all the municipalities located at Minas Gerais and Rio de Janeiro enables us to establish a interregional functional hierarchy based on the urban density of those areas due to the double capacity of loading

[1] Highlighted by the authors.

[2] The authors use a tertiarization index (the wage of service sector is weighted by the total salaries) to define and implement a hierarchical process of the Brazilian poles and then used the gravity model from Isard (1960) to define its influential areas.

and linking of its service sector[3]. Thus the "*It"* is a first reference to identify the economic poles.

Based on the total value added by municipality the It was calculated using the formulae below:

$$It = \frac{Va_s}{(Va_a + Va_i + Va_s + Va_n)} \quad (1)$$

Where: Va_s= Value added of service sector
Va_a= Value added of agriculture sector
Va_i= Value added of industrial sector
Va_n= Value added of public administration sector

For those municipalities which It ≥1 (bigger or equal to one), bigger will be the potential of the municipality to polarize its neighborhood. In the same way, when It <1 indicates that the municipality presents a lower capacity of regional polarization. In other words the municipality has a lower capacity to absorb its income.

In order to avoid distortions in the interregional hierarchy in the municipalities that presents an economic density very low, in other words a small base of production of agricultural and industrial goods can induce a small value at the denominator. This will increase in a spurious form the index. Thus to solve this problem we will use the Adjusted Tertiarization Index.

In order to reach this objective we use a logarithmic scale converser. It attributes to the biggest value added, named referential, a factor 0.95. Thus, the calculus for the other municipalities will consider an inverse logarithmic proportion represented by the expression below:

- *Converted value added*

$$VaT_c = 1 - e^{-\left(\frac{-\ln(0.05)}{VaT_{ref}} * VaT_m\right)} \quad (2)$$

Where: VaT_c = Total value added converted
VaT_{ref} = Total value added of reference
VaT_m = Total value added by municipality

Since we calculated the total value added converted we are able to adjust the tertiarization index (It^*). This is made as follows.

- *Tertiarization index adjusted*

[3] In the case of a city as São Paulo, for example, that is specialized in financial services; the linking of its specialized services comprises all the national territory because they do not occurs in other urban centers due to the minimum efficient scale.

$$It^{*} = It \,.\, VaT_c \tag{3}$$

II.2 Methodological aspects

The ESDA framework is based on the spatial aspects of the database, which means that it deals directly with the idea of spatial dependence (*e.g* spatial association) and spatial heterogeneity. The objective of this method is describing the spatial distribution, the patterns of spatial association (spatial clusters), verify the existence of different spatial regimes or other forms of spatial instability (non stationarity) and identify atypical observations (*e.g. outliers*). It is possible to extract measures of spatial auto-correlation and local auto-correlation from these methods (ANSELIN, 1998).

Before presenting the measures of autocorrelation two important concepts are presented to develop the ESDA. First, spatial auto-correlation means that similar locations (*e.g.* observations that present a certain degree of spatial proximity) will coincide with the similarity value (correlation). Thus, there is positive spatial autocorrelation when high or low values of a specific variable form a cluster in the space and there will be negative spatial autocorrelation when the neighborhood of certain geographic area presents diverse values. Second, spatial heterogeneity means that the economic behavior is not stable in the space and thus, it is possible to have diverse spatial patterns of economic development. The results can present spatial regimes such as, a cluster of developed regions – core or a cluster of less developed regions – periphery (ERTUR and LE GALLO, 2003).

II.2.1 Global Spatial Autocorrelation

The global spatial autocorrelation can be calculated by the Moran's I statistic. This statistic gives the formal indication of the degree of linear associations between the vector of observed values at time t (z_t) and the weighted average of the neighborhood values, or the spatial lags (Wz_t). I values greater (or smaller) than the expected value $E(I) = -1/(n-1)$ means that there is positive autocorrelation (or negative). Following Cliff and Ord (1981), in formal terms, the Moran's I statistic can be expressed as follows:

$$I_t = \left(\frac{n}{S_o}\right)\left(\frac{z_t' W z_t}{z_t' z_t}\right) \quad t = 1,..n \tag{4}$$

where z_t is the vector of n observations for year t in deviation from the mean. W is the spatial weight matrix: the elements w_{ii} on the diagonal are set to zero whereas the elements w_{ij} indicate the way the region i is spatially connected to the region j. *So* is a scaling factor equal to the sum of all the elements of W.

When the spatial weight matrix is normalized in the row, in other words when the elements of each row sum 1, the expression in (4) will be:

$$I_t = \left(\frac{z_t' W z_t}{z_t' z_t}\right) \quad t = 1,..n \tag{5}$$

It is important to highlight that the Moran's I statistic is a global measure thus it is impossible to observe the structure of spatial correlation at regional level. The index shows the global spatial association. Positive values for the statistics confirm positive spatial autocorrelation, which means that the agents interacted among them. This means that the municipalities that present a high value for the tertiarization index are neighbor of other municipalities that also present a high value for the index.

II.2.2 Moran Scatterplot

According to Anselin (1996), the Moran Scatterplot is a way to interpret the Moran's I statistic, in other words it is a representation of the regression coefficient and it enable us to visualize the linear correlation between *z* and *Wz* using a scatterplot of two variables. In the specific case of Moran's I statistic we have the scatterplot of *Wz* against *z*. Thus, the Moran's I coefficient will be the slope of the regression curve (*e.g.* scatterplot) and this slope indicates the degree of adjustment.

The Moran Scatterplot is divided into four quadrants. These quadrants correspond to the four patterns of local spatial association between the regions and its neighbors. The first quadrant (located at the upper right corner) named high-high (HH) shows the regions that present high values for the variable in analysis (i.e. values above the mean) surrounded by regions that also present values above the mean for the variable in analysis. The second quadrant (located at the upper left corner) classified as low-high (LH) displays the regions with low values but surrounded by neighbors that presents high values. The third quadrant (located at the bottom left corner) is called low-low (LL) and presents the regions with low values to the variable in analysis surrounded by neighbors that also presents low values. The fourth quadrant (located at the bottom right corner) called high-low (HL) displays regions with high values for the variable in analysis surrounded by regions with low values.

The regions located at quadrants HH and LL present positive spatial autocorrelation, meaning that these regions forms clusters of similar values. On the other hand, the quadrants HL and LH present negative spatial autocorrelation meaning that these regions form clusters of dissimilar values.

II.2.3 Local Indicators of Spatial Association (LISA)

According to Anselin (1995) a Local Indicator of Spatial Association (LISA) will be any statistic that satisfy two criterions: a) a LISA indicator has to give, for each observation, an indication of significant spatial clusters of similar values around the observation (*e.g.* region) and b) the sum of LISAs for every regions is proportional to the indicator of global spatial autocorrelation.

According to Le Gallo and Ertur (2003) the LISA statistic can be specified as follows:

$$I_{i,t} = \frac{(x_{i,t} - \mu_t)}{m_o} \sum_j w_{ij} (x_{j,t} - \mu_t) \; com \; m_o = \frac{(x_{i,t} - \mu_t)^2}{n} \tag{6}$$

where $x_{i,t}$ is the observation in the region *i* for the year *t*, μ_t is the mean of observations across the regions in the year *t* and where the summation over *j* is such that only the neighbors values of *j* are included.

The statistic can be interpreted as follows: positive values of $I_{i,t}$ means that there is a spatial cluster of similar values (high and low); negative values means that there is a spatial cluster of dissimilar values between the regions and its neighbors.

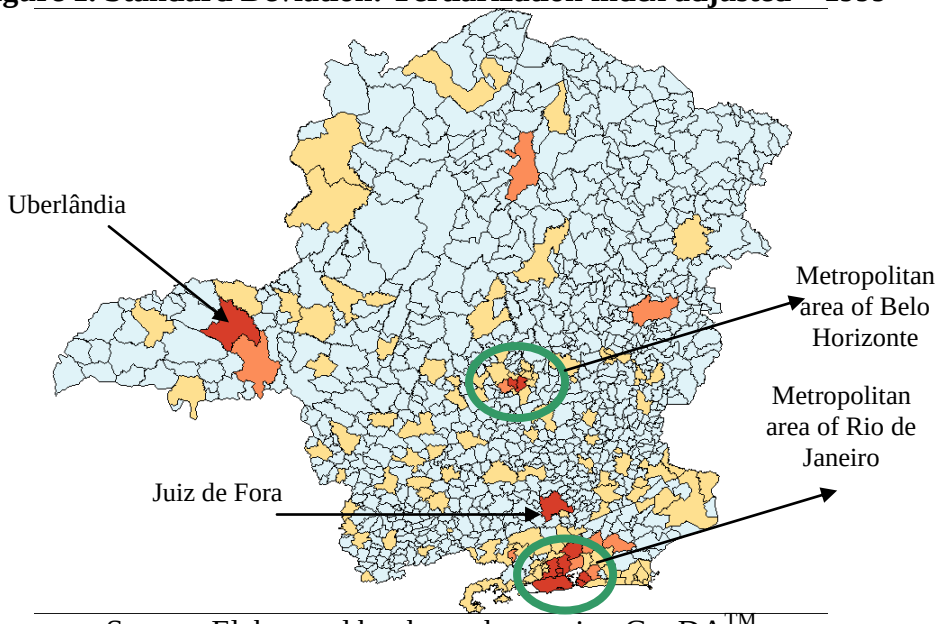
According to Anselin (1995), we can use the LISA statistic in order to measure the null hypothesis of no local spatial association. It is important to highlight that the general results on the distribution of a generic LISA may be hard to obtain, as it is the derivation of distributions for global statistics. In order to deal with this problem we have to work with the asymptotic results that are available. Thus, the alternative is the use of conditional randomization or permutation approach to yield empirical so-called pseudo significance levels. So, the significance levels of the marginal distributions will be approximated by Bonferroni inequalities or by the approach suggested in Sidák (1967) *apud in* Anselin (1995). *"This means that when the overall significance associated with the multiple comparisons (correlated tests) is set to* α*, and there are m comparisons, then the individual significance* α_i *should be set to either* α/m *(Bonferroni) or* $1-(1-\alpha)^{1/m}$ *(Sidák)"* (ANSELIN, 1995 p. 96). In this paper we will use the Bonferroni's approach.

III – RESULTS

III.1 Descriptives analysis

At this part we will implement a descriptive analysis based on the standard deviation of the index for the 1999 and 2004 year. At the Figure 1 we can see that the municipalities colored by red (above the mean) are located at metropolitan area of Belo Horizonte (Belo Horizonte and Contagem), at the metropolitan area of Rio de Janeiro (Duque de Caxias, Rio de Janeiro, São Gonçalo, Niterói and Belford Roxo), Petrópolis, Juiz de Fora and Uberlândia.

Figure 1. Standard Deviation: Tertiarization index adjusted – 1999

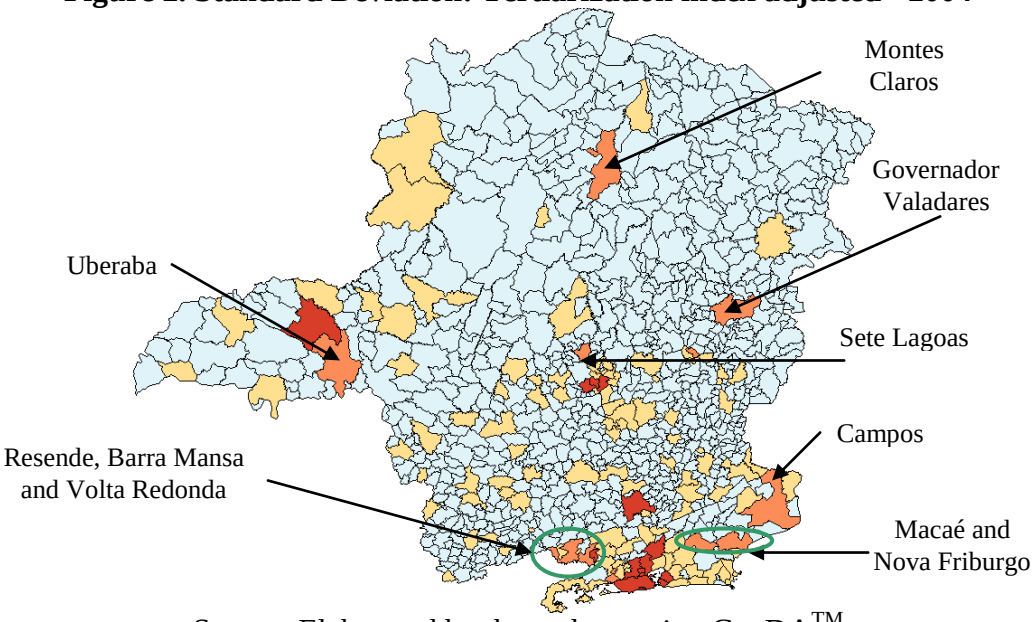


Source: Elaborated by the authors using GeoDA™

Figure 2 show the results for 2004 year. We can highlight that the results are stable. In other words the municipalities with the biggest positive standard deviation are located at

the same area. They are: a) Metropolitan region of Belo Horizonte, b) Metropolitan region of Rio de Janeiro, c) Petrópolis, d) Juiz de Fora and e) Uberlândia. It is important to emphasize the cities colored by orange. They present a positive standard deviation (above the mean). Those cities can be classified as a second cluster and they are located at: a) Uberaba, Montes Claros, Governador Valadares, Coronel Frabiciano and Sete Lagoas localized at Minas Gerais state and b) Campos, Macaé, Nova Friburgo, Resende, Barra Mansa and Volta Redonda all localized at Rio de Janeiro state.

Figure 2. Standard Deviation: Tertiarization index adjusted - 2004



Source: Elaborated by the authors using GeoDA™

III.2 Global spatial autocorrelation

Table 1 show the results for the Moran's I statistic for the yeas 1999 and 2004 for the tertiarization index. It is possible to verify that the point under analysis present spatial autocorrelation. In other words, the distribution forms clusters for the both periods. The municipalities with high (low) tertiarization index are located near to other municipalities with high (low) tertiarization index. We can also verify that there is a decrease in the value of the indicator during the period of analysis.

Table 1. Moran's I statistic

Year	Moran's I	Moran's I without outlier
1999	0.1626	0.6137
2004	0.1186	0.3417

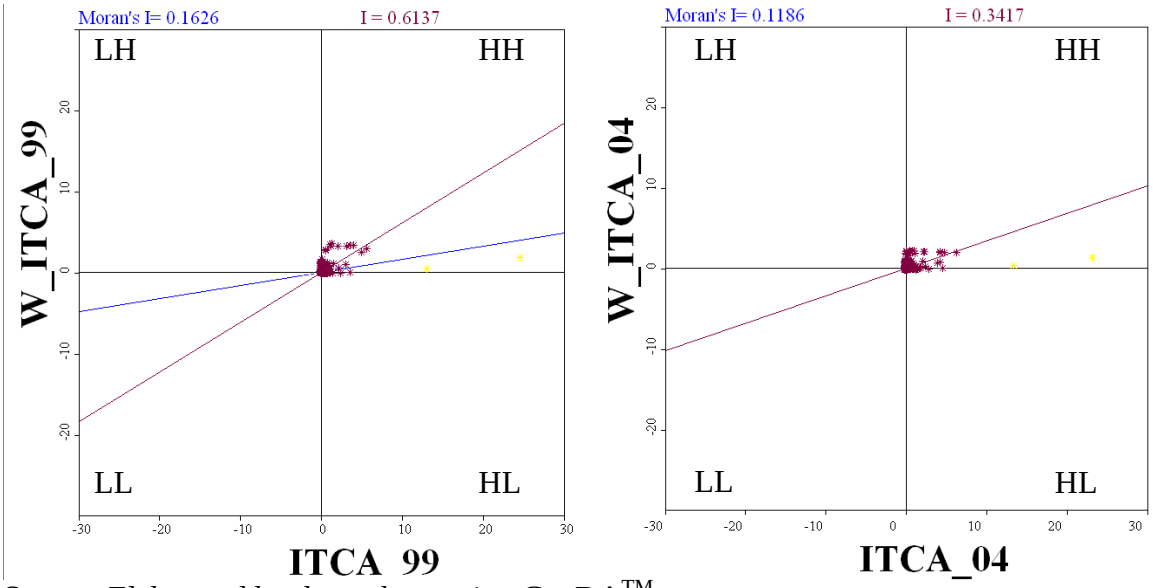
Source: Elaborated by the authors

When the municipalities of Belo Horizonte and Rio de Janeiro (outliers) are excluded, it is possible to verify an increase in the Moran's I, which means that the spatial autocorrelation increases.

III.2 Moran Scatterplot

The Moran Scatterplot (Figure 3) presents at the horizontal axes the tertiarization index for both periods respectively and at the vertical axes the spatial lag of tertiarization index for the same period. Figure 3 shows the index results for both years using *K=15* nearest neighbors.

Figure 3. Moran Scatterplot: 1999 ad 2004



Source: Elaborated by the authors using GeoDA™.

The results for spatial autocorrelation (Moran's I) can be corroborated due to the presence of a great number of municipalities located at the quadrant HH. At the Figure 3 is possible to identify four spatial regimes at the both periods.

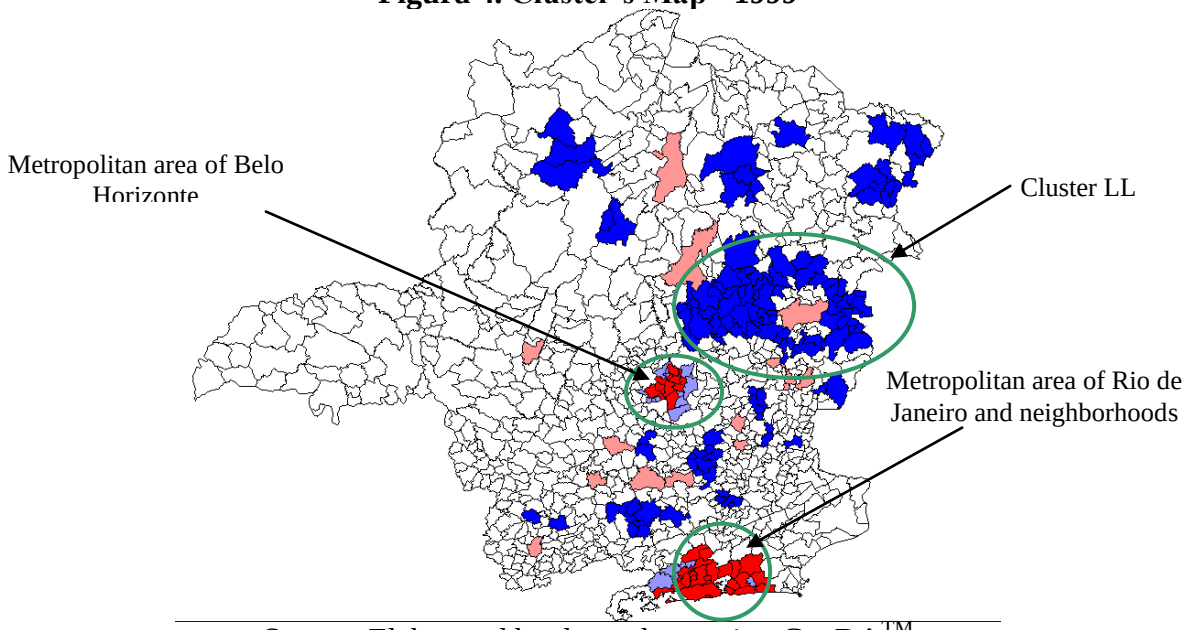
III.3 Local indicator of spatial association

Local indicators of spatial association (LISA) for the tertiarization index for the years 1999 and 2004 are at clusters maps (Figures 4 and 5), for a significance level of 5%. This means that clusters at this significance level deserves more attention.

The distributions of clusters are classified as follows: a) Cluster HH – represented in red; b) Cluster LL – represented in blue; c) Cluster HL – represented in light red; and d) Cluster LL – represented in light blue.

For the year 1999 it is possible to verify that there is a concentration of regions of HH pattern in the following regions: a) at the Metropolitan area of Rio de Janeiro and in its neighbors (Vassouras, Paty do Alferes, Miguel Pereira, Petrópolis, Teresópolis, Duque de Caxias, Nova Iguaçu, Itaguaí, Mangaratiba, Rio de Janeiro, São Gonçalo, Niterói, Saquarema, Maricá, Rio Bonito, Itaboraí and Belford Roxo) and b) at the Metropolitan area of Belo Horizonte (Lagoa Santa, Santa Luzia, Vespaziano, Esmeraldas, Betim, Nova Lima, Contagem, Ribeirão das Neves, Belo Horizonte and Sabará). It is also important to highlight the cluster LL located at Minas Gerais state.

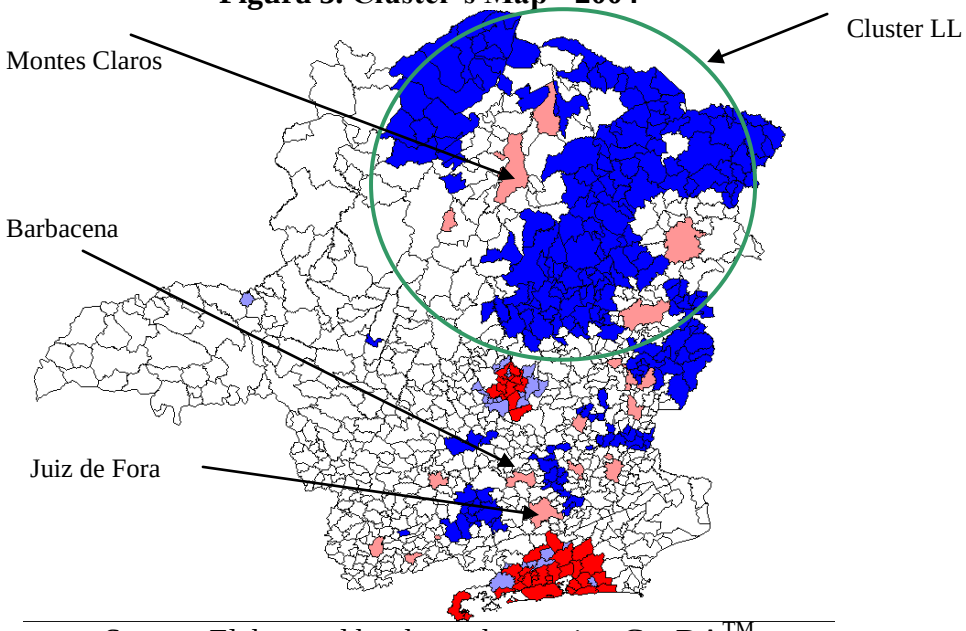
Figura 4. Cluster's Map - 1999



Source: Elaborated by the authors using GeoDA™

The analysis of Figure 5 enables us to verify that: a) cluster LL localized at Minas Gerais state increase the number of municipalities, b) Cluster formed by the metropolitan area of Belo Horizonte is stable, c) Cluster formed by the metropolitan area of Rio de Janeiro and its neighbors is also stable and now is formed by cities localized near to the Minas Gerais frontier (Paraíba do Sul), d) there is a great number of municipalities classified as HL mainly at Minas Gerais state (Juiz de Fora, Barbacena and Montes Claros).

Figura 5. Cluster's Map - 2004



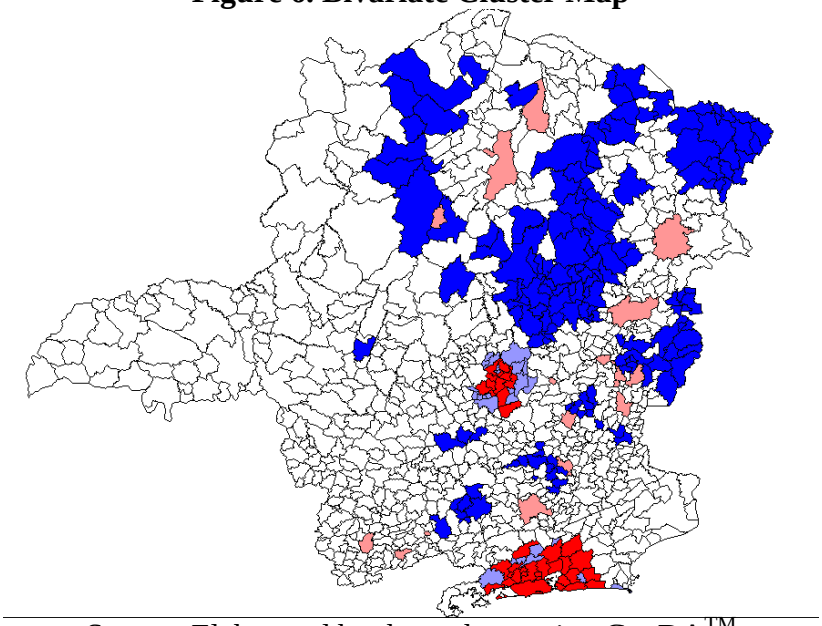
Source: Elaborated by the authors using GeoDA™

III.4 Bivariate Analysis

The analysis in this section wants to identify the spatial patterns in temporal terms. In other words we want to verify if the spatial autocorrelation pattern, when founded, are stable during the period of analysis. This analysis will be implemented through the Cluster maps (LISA)

The analysis of Figure 6 enables us to affirm that there is a certain degree of stability in the results for the tertiarization index. In other words, it is possible to verify that the cluster LL located at Minas Gerais present meaning results. The clusters HH at metropolitan area of Belo Horizonte and also at metropolitan area of Rio de Janeiro are stable during the period of analysis. Juiz de Fora and Montes Claros can be considered HL municipalities. In other words they present a good degree of services measured by the index but its neighbors are poor in terms of the index.

Figure 6. Bivariate Cluster Map



Source: Elaborated by the authors using GeoDA™

IV - DISCUSSION

The clusters located at Rio de Janeiro and Minas Gerais states enable us to make some considerations.

IV. 1 Clusters located at Rio de Janeiro state

Rio de Janeiro state always played an important role in the national economy, however after the change in the national capital to Brasilia, in the begging of the 60s, the state diminishes its importance in national terms. In the middle of 90s the state economy, gradually, begins to gain importance in national terms again (NATAL, 2004). The share of "Fluminense" GDP in national GDP was 7.8% in 1987 and was 12.2% in 2003 (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2006).

The state economy does not present strong links among the regions and also present a high degree of concentration, in terms of production and population, in the metropolitan area[4], mainly in its capital (SANTOS, 2003).

The metropolitan area is the main state pole due to the growth of Rio de Janeiro municipality. The city was the first economic, cultural and political center in the country. The initial development of Rio de Janeiro city was associated to the port and military. The second phase was based in the role played by the city as capital in the colonial (since 1763) until republic (up to 1960). After this period the growth path was based on the role played by the consumption of sophisticated and high complexity services. (LOUREIRO, 2006).

The metropolitan region was responsible for 59.3% of total GDP in the year 2003. It is important to highlight the service sector representing 83% of metropolitan area GDP. This value was stable during the period 1999 to 2003. There is a high correlation between this share and population share. The metropolitan area concentrates 80% of total state population. The metropolitan area is also the most important one in industrial terms (36.2%) (Table 2).

Table 2 – Rio de Janeiro state: GDP and Population in percentage terms

Regions	1999		2003		Population	
	Industry	Service	Industry	Service	1999	2003
Sul Fluminense	14,1	6,2	10,9	6,5	6,5	6,6
Metropolitana	57,8	84,2	36,2	83,0	80,1	79,9
Baixadas	7,3	2,5	15,5	2,6	3,1	3,5
Centro Fluminense	3,3	2,4	1,3	2,3	3,2	3,1
Norte Fluminense	15,4	3,4	35,5	3,9	4,9	4,9
Noroeste Fluminense	2,0	1,3	0,5	1,3	2,1	2,0

Source: (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2006)

In the last years the metropolitan area is losing importance in the state. This happens mainly due to the growth of petroleum extraction and natural gas production at the North part of the state (Campos). The expansion of extractive activities, that is responsible for the economic increment and for the growth of the inner regions, explains the recent development of a cluster at the Macaé and Campos cities.

The existence of secondary's clusters in the South of the state is high correlated to the development of an automotive pole at Resende (Volkswagen trucks) and Porto Real (Peugeot-Citroen) and also to the steel pole at Volta Redonda. At the central part of the state we can highlight a textile cluster formed by small and medium firms at Nova Friburgo city.

Thus the recent process of growth in the state economy shows, by one side, the development of secondary clusters in the inner part of the state. This could enable the reduction of economic concentration at the metropolitan region. On the other side, the economic dynamism of metropolitan area is a source of complementarities in the commercial and productive relations with its neighborhood up to cities located at Minas Gerais states.

[4] In 2003 the GDP of Rio de Janeiro Municipality was bigger than the rest of Rio de Janeiro regions. This show the high degree of concentration in the industrial sector. (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2006).

IV. 2 Clusters located at Minas Gerais state

Minas Gerais state presents in this inner part a high degree of heterogeneity in economic terms. The development process of its municipalities presents different degrees of articulation with the national economy and does not occur inside the state. This is true also in terms of its main city (Belo Horizonte) [5].

Despite Belo Horizonte together with its Metropolitan area are the main pole at Minas Gerais state we can affirm that its market area (or influential area) is mainly located at its neighborhood. The main pole of the state Minas Gerais does not generate strong relations with areas outside the metropolitan area (LEMOS and DINIZ, 2000).

Minas Gerais have two secondary clusters that are: Uberlândia and Juiz de Fora. Those cities are located near to São Paulo state and Rio de Janeiro state. Uberlândia is located 563 km from Belo Horizonte and 603 km from São Paulo. The economic development of Uberlândia is strongly connected with São Paulo, the main Brazilian economic center. (INSTITUTO DE PESQUISA ECONÔMICA APLICADA, 2002). The productive and commercial integration and the municipality dynamism are based on transport network and the strength of the inner part of São Paulo state.

Juiz de Fora is located 273 Km from Belo Horizonte and 184 Km from Rio de Janeiro and is located inside the influential area of Rio de Janeiro, which polarized Juiz de Fora. Juiz de Fora's industrialization is associated to the Brazilian industrialization process occurred in the end of XIX and in the beginning of XX (textile) and is not a location option due to the linking effect of Rio de Janeiro city. In other words, "*there is an urban polarization and there is not an industrial one. There is an absence of productive integration in the industrial framework between the secondary and superior pole*" (LEMOS et al, 2000, p. 320). Thus, the polarized effect of Rio de Janeiro is restricted to the supply of a range of urban services inducing a weak level of regional integration.

The possibility of regional integration exists and it can be based on the load and link capacity of services located at Rio de Janeiro state to Juiz de Fora. This capacity was classified as a small one up to the end of 1990's due the crisis at the Rio de Janeiro's economy. But the process of strengthening in the service sector located at Metropolitan area shows the linking capacity of this sector to its neighborhood (Niterói, Petrópolis, Nova Iguaçu and Juiz de Fora).

A third range of municipalities that can be considered medium size poles at Minas Gerais state are: Uberaba, Montes Claros, Governador Valadares, Coronel Fabriciano and Sete Lagoas). Those clusters are distributed in an irregular form inside the state. We can highlight that the process of development of Uberaba is well connected with Uberlândia. In the case of Sete Lagoas we can verify that the Metropolitan area exerts a big influence upon the city. Thus those municipalities present a low degree of polarization. Actually those municipalities are polarized by bigger centers.

The expansion of low-low cluster located at the north and east part of Minas Gerais state is associated with the lack of external impulses that could give some dynamism to the region.

Final Remarks

[5]For Lemos et al (2000) in the Brazilian spatial aspect the national poles, formed by Rio de Janeiro and São Paulo have a limited degree of influence in national terms.

This article wants to identify the spatial and temporal behavior of service sector located at Minas Gerais and Rio de Janeiro states. The results enable us to verify that the service sector presents a heterogeneity distribution in that specific region and that there are not modifications at clusters during the period of analysis.

It was also possible to see that there are dichotomy in the spatial regimes both at Minas Gerais and Rio de Janeiro. In both states the main cluster is located at Metropolitan area. In the case of Rio de Janeiro state the formation of secondary clusters are well connected to the development of petrochemical and automotive poles. In the case of Minas Gerais state this phenomenon occurs at areas located at the neighborhood of São Paulo and Rio de Janeiro states.

We can highlight two results. At first place, the expansion of HH clusters at Metropolitan area of Rio de Janeiro. The spatial dimension of this expansion was from Metropolitan area to the municipalities located near to Minas Gerais state. At second place the expansion of cluster LL located at Minas Gerais state.

It is important to emphasize that this paper has an exploratory approach and can be expanded in the following aspects: a) an improvement in the construction of tertiarization index; b) incorporation of municipalities that are located at the border of Rio de Janeiro and Minas Gerais state in the database and c) construction of a spatial econometric model to verify the behavior of causality relations.

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