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REGIONAL HETEROGENEITY IN POPULATION DYNAMICS BY AGE GROUPS IN BRAZIL

HETEROGENEIDADE REGIONAL NA DINÂMICA POPULACIONAL SEGUNDO GRUPOS ETÁRIOS NO BRASIL[1]

Alexandre Alves Porsse[2]
Paulo Victor Bistafa[3]

Abstract

Currently, Brazil has experienced a phenomenon of inversion of its age pyramid, which will influence the composition of the age groups and, possibly, the socio-economic profile of its population, both at the national and regional levels. The main objective of this work is to analyze the changes in the regional population dynamics in terms of their age structure, seeking to identify differentiated spatial effects concerning the process of demographic transition. The empirical investigation was based on the Shift-Share and Exploratory Spatial Data Analysis methods, which were applied in the population data of the microregions according to age groups for the period from 2000 to 2010. The results showed that there is spatial heterogeneity in the dynamics of the process of demographic transition between Brazilian regions. The microregions located in the North region of Brazil showed faster population growth, mainly in the children's and working-age groups. For the elderly population group, the Center-West stood out with higher population dynamics. However, the loss of population dynamics have been more accentuated in Rio Grande do Sul, both for the children's and working-age groups. The reduction of the active age population is the most worrisome element of the demographic transition since it indicates a loss of vigor in the process of economic development. Mapping the spatial distribution of the demographic transition process provides relevant information and represents one important contribution of this study to subsidy the formulation of development policies. On the one hand, this study identifies regions where working-age population is quickly reducing and thus would need more economic stimulus. On the other hand, it also identifies regions with accelerated population aging where the demand for health and social assistance services tends to increase.

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[2] PhD in Applied Economics from the Federal University of Rio Grande do Sul (UFRGS). Professor of the Postgraduate Program in Economic Development at the Federal University of Paraná (PPGDE-UFPR), Curitiba - PR, Brazil. E-mail: porsse@ufpr.br
[3] Master's student at the Graduate Program in Applied Economics (PPGEA) at the School of Agriculture "Luiz de Queiroz" at the University of São Paulo (ESALQ-USP), Piracicaba - SP, Brazil. Email: pvbistafa@gmail.com

Keywords: Demographic Transition. Spatial Heterogeneity. Regional Development.

Resumo

Atualmente, o Brasil está presenciando um fenômeno de inversão de sua pirâmide etária, que influenciará a composição dos grupos de idades e, possivelmente, o perfil socioeconômico de sua população, tanto em nível nacional como regional. O objetivo principal deste trabalho é analisar as mudanças na dinâmica populacional regional em termos de sua estrutura etária, buscando identificar efeitos espaciais diferenciados no que tange ao processo de transição demográfica. A investigação empírica baseou-se nos métodos Estrutural-Diferencial e de Análise Exploratória de Dados Espaciais, os quais foram aplicados nos dados populacionais das microrregiões segundo grupos etários para o período de 2000 a 2010. Os resultados evidenciaram que existe heterogeneidade espacial na dinâmica do processo de transição demográfica entre as regiões brasileiras. As microrregiões localizadas na região Norte apresentaram maior dinamismo populacional, principalmente nos grupos etários infantil e idade ativa. Para o grupo populacional idoso, o Centro-Oeste destacou-se com maior dinamismo. Entretanto, o processo de perda de dinamismo populacional tem sido mais acentuado no Rio Grande do Sul, tanto para o grupo etário infantil, quanto em idade ativa. A redução da populacional em idade ativa é o elemento mais preocupante da transição demográfica uma vez que indica perda de vigor do processo de desenvolvimento econômico. O mapeamento da distribuição espacial do processo de transição demográfica realizado neste estudo fornece informações relevantes que contribuem como subsídio para auxiliar na formulação de políticas desenvolvimento. De um lado, o estudo identifica regiões que apresentam redução da população em idade ativa e tendem a necessitar de estímulos econômicos. De outro lado, também identifica regiões com acelerado envelhecimento populacional nas quais a demanda por serviços de saúde e assistência social tendem a aumentar.

Palavras-chave: Transição Demográfica. Heterogeneidade Espacial. Desenvolvimento Regional.

Introduction

The Brazilian economy is going through an accelerated process of demographic transition if compared to the experience observed in developed countries. According to the population projections provided by the Brazilian Institute of Geography and Statistics, the number of elderly (population aged 65 years or older) will be higher than the number of children (population between 0 and 14 years of age) in 2039. During a demographic transition process in which birth and mortality rates decrease and life expectancy of the population increases, changes on the foundations of economic growth are expected to carry out.

Several studies have risen the severe implications of changing age structure of the population on macroeconomic growth of the Brazilian economy (ALVES, 2008; PAIVA and WAJNMAN, 2005, PEREIMA and PORSSE, 2013; RIOS NETO, 2005; SANTIAGO, 2014, STAMPE, 2013; STAMPE et al., 2017, WONG, 2006). Some of the most important factors affecting economic growth are the reduction of the working-age population, the increase in social security expenses and the reduction of investment savings rates.

Despite the importance of macroeconomic consequences, little attention has been paid to the implications of the demographic transition process on regional economic growth. It should be noted that demographic characteristics such as fertility and mortality rates are quite different among Brazilian regions, also inducing different patterns in the regional demographic transition process. Another element affecting the regional configuration of the demographic transition dynamic is related to the behavior of the working-age population which tends to migrate to other regions searching better wages. Besides, regions with a high share of the population concentrated in non-productive age groups (children and elderly) tend to allocate relevant amount of public resources to meet the demands and needs of these population groups. This effect could generate an "allocation distortion" that constrains regional growth to the extent that resources are not directed to productive factors.

In this context, the main objective of this study is to identify whether there is spatial heterogeneity in the regional pattern of demographic transition in Brazil. The motivation relays on the importance of knowing how the dynamics of the population evolve in terms of age composition across regions into the national space, seeking to provide subsidies for understanding the nature of this process and its potential regional consequences. This study focuses on the growth dynamics of the main age groups which form the so-called dependency ratio: infant population (population between 0 and 14 years of age), the elderly population (population aged 65 years or older) and working-age population (population between 15 and 64 years of age). The territorial scale of analysis is the Brazilian microregions since it is disaggregated enough to capture regional specificities of the demographic transition process. The period corresponds to 2000 and 2010 since disaggregation of the population by age group for microregions is only available in the demographic census.

The empirical analysis strategy is based on two methodologies. First, we used the shift-share method to decompose population growth according to the structural and competitive characteristics (differentials) of each microregion. Unlike the usual approach that applies the method with information about economic sectors, here the sectors correspond to age groups. This method has the advantage of allowing to isolate the structural components of regional population growth that would be mainly linked to the intrinsic demographic factors of each population group (aggregate fertility and mortality rates, for example) and those factors that would be linked to specific local characteristics. Second, we applied the technique of exploratory spatial data analysis to investigate global and local spatial dependence on the structural and differential components obtained through the shift-share method. The use of these procedures allowed to produce a more precise evaluation of the pattern of regional heterogeneity in the dynamics of the demographic transition in Brazil.

This paper is organized in three sections besides these introductory and final remarks sections. Section 2 presents a brief literature review and describes the expected evolution of the population according to age groups in the coming years. Section 3 presents the methods used for the empirical analysis. Section 4 presents and analyzes the main results.

Literature review

Demographic transition is a phenomenon determined by socioeconomic and cultural aspects that several countries are facing or have already faced. This phenomenon consists in the fall of mortality and fertility rates, causing a reduction in the number of children and young people as well as populational aging (PAIVA e WAJNMAN, 2005; ALVES, 2014). Such dynamic leads to a slowdown in population growth or even population degrowth depending on the intensity of demographic transition.

Conceptually, the demographic transition is defined as a change in the age structure of the population, usually no longer predominantly the young portion and becoming dominant the aging portion. As discussed by Pereima and Porsse (2013), the reduction in the birth rate and increase in life expectancy have a direct impact on the working-age population, affecting the potential supply of labor in the economy.

Several studies have raised the importance of this phenomenon, but the general analysis is concerned with macroeconomic aspects. According to Alves (2014), there are two main explanations for the transition of mortality levels: one that highlights the improvement in the population's standard of living due to the development of productive forces and another that emphasizes the contributions of medical innovation, public health programs, access to basic sanitation and improvement of personal hygiene. In Brazil, life expectancy at birth in 1900 was about 30 years. In the 2000s, it rose to 73 years. The drop in the birth rate in Brazil occurred in an environment of freedom of choice, initiated in the most educated layers of society, and then progressively extended to the entire population. Rios Neto (2005) reinforced the empirical evidence that Brazil's population growth is threatened and will converge to zero in 25 years if it maintains a fertility rate of 2.1 children per woman[4], which is considered as the minimum level of the replacement ratio[5].

[4] Calculated by Rios Neto (2005) with data from the PNAD 2003.

[5] Considering a couple, the minimum replacement rate would be the number of children needed for re-establishing the initial amount of individuals.

Paiva and Wajnman (2005) and Pereima and Porsse (2013) emphasized the analysis of the phenomenon for Brazil in the long-term components of economic growth. The anticipated decline of the working-age population and the end of the demographic bonus are of great interest, because the former directly affects labor market while the second affects the structure of the effective demand, producing impacts on the composition of the Brazilian consumption basket[6], the savings rate, productivity and the potential growth of the economy.

Stampe (2013) and Stampe et al. (2017) analyzed the effects of demographic change for the Brazilian states, evaluating the pattern of spatial dependence between dependency ratio and economic growth. The results indicated an inverse relationship between these variables, that is, the higher the dependency ratio, the lower the economic growth. Doing a specific analysis for Rio Grande do Sul and the aggregate country, it was also found that changes in the age structure may have different impacts on consumption expenditure of specific age groups and the change in consumption patterns can also be differentiated at the regional level.

Finally, the discussion raised by Wong (2006) emphasizes the effects on public finances, both from the perspective of revenue and expenditure. Revenues tend to be positively influenced by the greater the participation of the working-age group in the population structure. Government expenditures tend to be positively impacted increases in the non-working-age groups, especially the elderly population, since spending on transfers in the form of pensions and retirements increases significantly as well as due to the growing demand for health services and quality of life to the elderly people.

The evidence brought by these studies shows there are several transmission channels by which demographic change and economic systems are interconnected. Although the emphasis of the studies is more oriented to evaluate macroeconomic effects, it cannot be disregarded the possibility of relevant regional effects since the dynamics of the demographic transition process there is spatially heterogeneous in Brazil.

Regional evolution of the demographic transition: 2010-2060

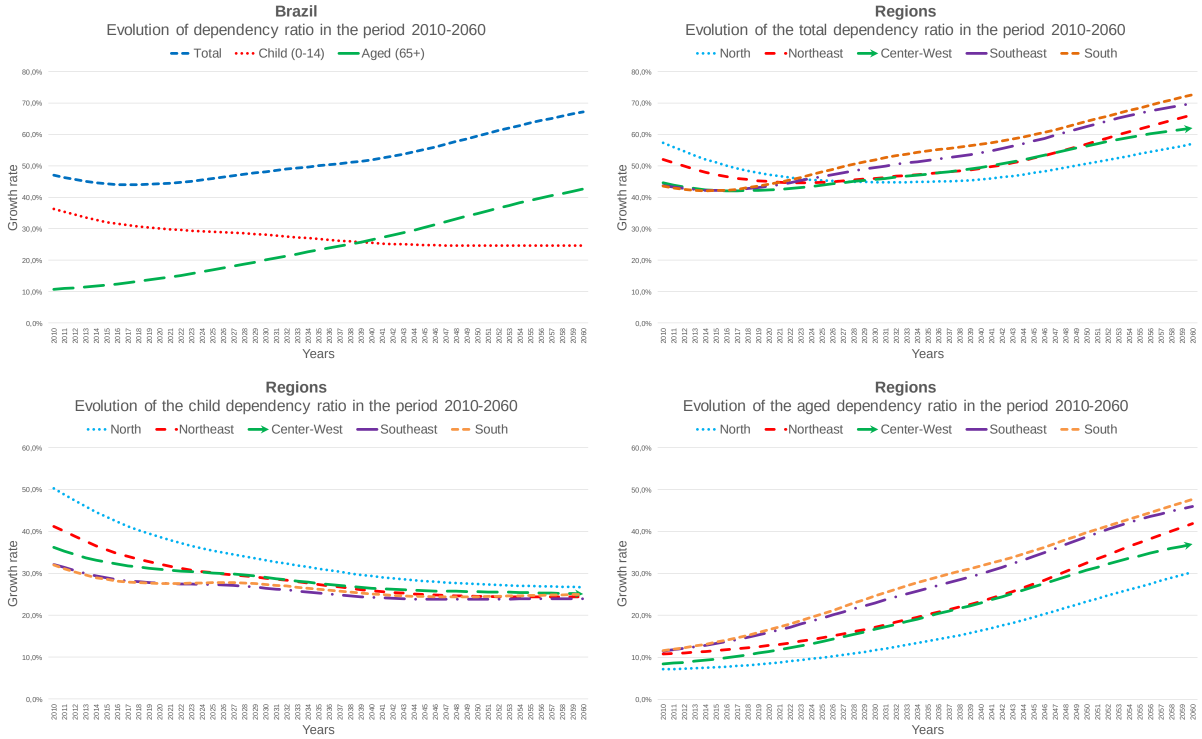
Data in Figure 1 shows how the process of demographic transition should evolve in Brazil and its macro-regions from 2010 to 2060 according to the population projections of the Brazilian Institute of Geography and Statistics (IBGE, 2018). The dependency ratio is defined as the ratio between the child population (population between 0 and 14 years of age) and aged population (population aged 65 years or older) relative to the working-age population (population between 15 and 64 years of age).

The dependency ratio is expected to growth throughout the projection period in the entire country. It is noticed that the intensity is higher concerning to the elderly group because of improvement in the longevity conditions of Brazilians. For the child group, we see a downward trend, reinforcing the idea of the fall in the fertility that has been occurring in the country.

From the regional perspective, the trend behavior of the total dependence ratio as well as the child and aged groups is similar to the national case. However, the speed of transition for these components presents relevant differences among regions. The total dependence ratio evolves more rapidly in the South and Southeast. This result is not unexpected because these are the two most developed regions of the country, where the socioeconomic characteristics and benefits of social progress translate into more accelerated reductions in fertility and mortality rates. Also, it is observed that the aged group will increase its participation in the age structure more intensely in these two regions. On the other hand, these dynamics indicate that the exhaustion of the demographic bonus phase associated with the fall of the share of the working-age population which will occur primarily in these more developed regions. This reinforces the relevance of understanding to what extent the demographic transition process has evolved from the regional perspective, especially for a more detailed territorial scale.

[6] For a more detailed discussion on the consequences of the demographic transition, see Santiago (2014).

Figure 1: Evolution of the dependency ratio for Brazil and the regions: 2010-2060



Source: Elaboration by the authors using population data projections of IBGE.

Empirical strategy

The empirical analysis will be performed by applying the shift-share method (shift-share) and the Exploratory Spatial Data Analysis (ESDA) technique. ESDA is a technique that allows identifying patterns of global and local spatial dependence and will be applied to the results obtained from the shift-share analysis. The data used were collected from the Demographic Censuses of 2000 and 2010, representing the population by age groups that form the dependency ratio for the microregions of Brazil as previously commented. The following subsections present these methods.

Shift-share method (Shift-Share)

Originally, the shift-share method has been used to decompose regional economic growth in terms of national participation, industrial *mix* (structural effect) and regional differences (differential effect).[7] Usually this method is applied based on employment data, but in this study we will use population data by age groups to decompose the population variation into two components. The first component refers to the structural effect, capturing forces linked to external factors that could affect the dynamics of the population. The second component refers to the differential effect, capturing internal factors influencing the dynamics of the population, also linked to the intrinsic characteristics of the regions. The method has been adapted from the literature for applications on demographic variables (MULLIGAN and MOLIN, 2004; FOTH, 2010).

In this study we will use the classic version of the shift-share method. The analysis is based on the possibility of comparing population growth within each region for a given age group from their perspectives: the real growth that is observed in the region and the theoretical growth that would happen if the region would behave equally to the aggregated reference area, in this case, Brazil.. The difference between real and theoretical growth reflects the behavior and dynamism of the population in each region. In turn, the degree of dynamism captured will be subdivided into two factors: structural and differential. For the structural factor, we have an effect associated with the population composition of the region according to the age group structure. For the differential factor, we have an effect linked to specific regional conditions. This component can capture both locational

[7] For a critical review see Stevens and Moore (1980).

characteristics linked to specific demographic regional factors as well as fertility and mortality rates, which are more relevant to the dynamics of the child and aged groups of the population, as well as factors related to population migration (attraction or repulsion), an aspect more relevant for the working-age population which can migrate in search of better employment and income opportunities.

The method breaks down the population variation for the age group and microregions, between one initial year and another final year, to evaluate the portion of the variation associated with structural and differential factors. Briefly, the net population variation (real growth deduced from the theoretical growth) is decomposed as follows:

$$(P_{ij}^t - P_{ij}^0) - P_{ij}^0 p = P_{ij}^0 (p_i - p) + P_{ij}^0 (p_{ij} - p_i) \quad (1)$$

where:

P_{ij}^t = population of the age group i in the microregion j in the final period (t = 2010);

P_{ij}^0 = population of the age group i in the microregion j in the final period (t = 2000);

$p = (P^t - P^0)/P^0$ is the growth rate of the national population;

$p_i = (P_i^t - P_i^0)/P_i^0$ is the growth rate of the population for each age group;

$p_{ij} = (P_{ij}^t - P_{ij}^0)/P_{ij}^0$ is the growth rate of the population for each age group in each microregion;

i = [child population, working-age population, aged population];

j = microregions.

On the left side of equation 1, first component represents effective population variation of the region while the second represents the theoretical variation. Thus, the net variation will be positive if the regional population growth overcomes the national population growth. On the right side of equation 1, the first component represents the structural effect and the second one represents the differential effect.

Exploratory spatial data analysis

According to Almeida (2012), ESDA is a set of techniques used to detect patterns of association and spatial distribution, allowing the identification of atypical localities and spatial patterns for a given selected data. These techniques can be used to identify global spatial dependence based on the statistic known as Moran's I or local spatial dependence patterns based on the LISA (Local Spatial Association Indicator) statistics. In this study, we investigate the presence of global and local spatial dependence on the components obtained from the shift-share method.

According to Anselin (1995, 1997), the univariate Moran's I statistic measures the degree of spatial linear association for the observed values of a given variable of interest between regions. This statistics is calculated as follows:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_{j=1}^{n}(y_i - \bar{y})^2} \quad (2)$$

where the y is expressed through the deviation from the mean $(y_i - \bar{y})$, w_{it} represents the spatial weights associated with the neighborhood relationship of the data and regions, and n the number of observations of the sample. Different criteria can be adopted to define the weights in the W matrix, and in this study we chose a specification known as queen matrix of the first order. In this case, neighborhood relations are assigned by the contiguity criterion identified for the polygons of microregions that have a common border.

The LISA statistic for a variable observed in a given location can be expressed as follows:

$$I_i = z_i \sum_{j=1}^{J} w_{ij} z_j \quad (3)$$

where z_i and z_j are the standardized values of y and w_{ij} represents the spatial weights such previously mentioned. The statistically significant values of this statistic are classified into four spatial regimes: High-High (HH), Low-Low (LL), High-Low (HL) and Low-High (LH). Applying LISA analysis on the components of the shift-share method allows the identification of homogeneity or heterogeneity in the spatial distribution of each age group. Thus, it is possible to evaluate to what extent the spatial distribution of the demographic transition process is differentiated between the Brazilian regions and which components are most important in each region.

Results and discussion

First, we will present the results obtained by applying the shift-share method. With the method it was possible to capture how total population variation behaved, positively or negatively, in each microregion of the country. Figure 1 represents the quantitative maps illustrating all components of the shift-share analysis (net variation, structural effect and differential effect) providing a picture on the intensity of the changes as well as the gain and loss of dynamism for regions according to the growth rates[8]. The results of each component of the method are presented in a disaggregated way to provide a more detailed view of the forces driving population dynamics in each component of the shift-share analysis.

For the net variation, the child and working-age groups reflect high similarity. The observed negative growth rates reflect the loss of dynamism while the positive growth rates reflect gains of dynamism. Spatially, the highest growth rates are located in North and Center-West, while the lowest growth rates are concentrated in the South and Northeast, especially in the states of Bahia and Rio Grande do Sul. Growth rates are negative to the child population in all regions, evidencing the drop in fertility rates in the country as a whole as exposed by Alves (2014).

For the aged population, the lowest growth rates are concentrated in the North and Northeast, especially in the states of Amazonas, Pará and in the so-called semi-arid region located in Northeast. The highest growth rates are concentrated in microregions mainly located in Center-West, Southeast and South as well as in Roraima state. It is worth noting that the result of the net variation expresses the synthesis of regional population dynamism as a combination of the evolution of the three age groups evaluated. Observing the maps respective to net variation, the spatial distributions of changes in the child and working-age populations seem to be more correlated, while the spatial distribution of changes in the aged population differs from the other population groups evaluated.

Regarding the structural effect, which reflects the degree of dynamism as a function of the national population composition of the age groups, it is noticeable by the sum of the groups (total structural effect) that Rio Grande do Sul and São Paulo states present strong dynamism. Analyzing each age group, it is observed loss of dynamism in all microregions for the child population, mainly in Brazilian Legal Amazon and the Northeast, while the most benefited microregions in terms of growth are located in Southeast and South. The spatial distribution of growth changes for child and working-age groups presents a strong correlation. However, the spatial distribution for the aged group is different, with the greatest gains in dynamism representing a corridor of microregions concentrated in the eastern border of the national territory. Thus, in the structural effect, we observed a North-South dichotomous pattern for the dynamics of the child and aged population, while the dynamics observed for the aged population suggest an East-West dichotomous pattern.

For the differential effect, which reflects the degree of dynamism as a function of regional factors, spatial heterogeneity seems to be more relevant than that observed in the structural effect. However, North and Center-West regions dominate population growth for all age groups, while the reverse occurs in other regions of the country, at least in terms of intensity. The lowest growth rates are located in the South and Southeast regions, but with great coverage in the State of Rio Grande do Sul. These regions present relevant losses of dynamism.

The data presented in Table 1 shows the results obtained for Moran's I statistic in all components from the shift-share method. The values of Moran's I indicate there is strong global spatial dependence for the structural component, either for the total structural effect or for each age group. It is also observed the existence of global spatial dependence for the total differential effect and its age groups, but with lower intensity. As net variation corresponds to the combination of structural and differential effects, it is natural that it presents the least values for Moran’s I. Nevertheless, all the results obtained for Moran's I were statistically significant, indicating the presence of global spatial dependence and revealing that there are relevant regional specificities in the demographic transition process.

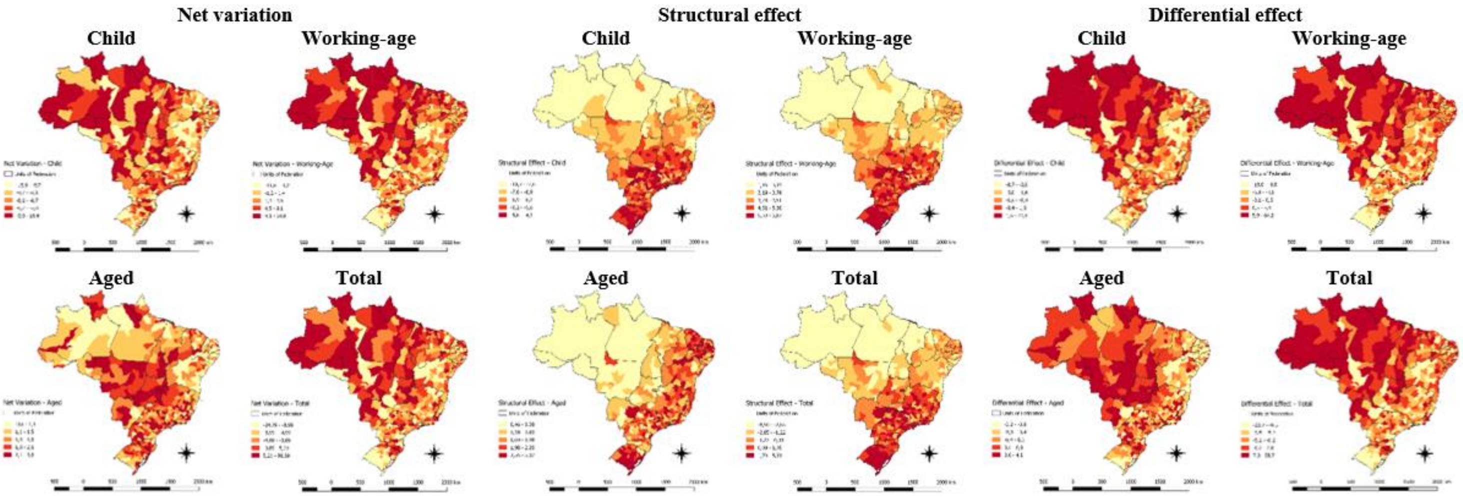
[8] The results of the method represent absolute variations, generating great variability due to differences in population size among microregions. For better visualization, we standardized the results of the method to the initial level of the population in 2000. Thus, the results of each component of the method were converted into growth rates.

Table 1: Moran's I for the shift-share components

Age group	Moran's I		
	Net variation	Structural effect	Differential effect
Child	0,35919	0,74185	0,46565
Working-age	0,27577	0,79125	0,33684
Aged	0,28857	0,59022	0,37043
Total	0,28611	0,76879	0,37632

Source: Elaboration by the authors using Geoda software.

Figure 2: Components of shift-share analysis by age groups

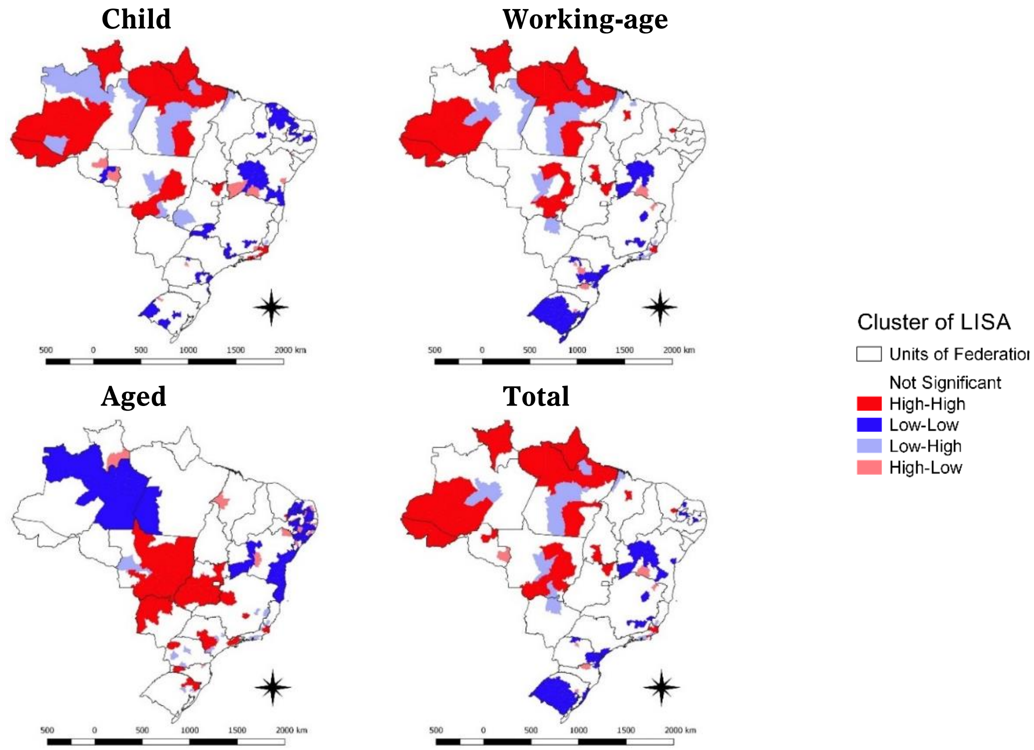


Source: Elaborated by the authors using QGis software.

These specificities become clearer from the LISA analysis. The maps in Figure 3 shows the statistically significant spatial regimes for the net variation and its age subcomponents. The HH clusters are more apparent in North and part of the Center-West for the child and working-age populations, while for the aged population the HH clusters seem more concentrated in the Center-West. Regarding the aged population, it is worth mentioning that the historical process of settlement and economic exploitation of the Center-West stars to produce aging effects related to the migrant population. This may explain the pattern of the spatial regime observed in this region.

LL clusters are visually more distinct. For the child group they are sprayed on the east area of the national territory, while for the working-age population of they are more dominant in the Rio Grande do Sul, eastern Paraná and western Bahia. It is noteworthy that the spatial location of the LL cluster in Rio Grande do Sul in the case of the working-age population is the determining factor influencing the LL cluster observed for the total net variation in this state. This result suggests that Rio Grande do Sul is where the process of demographic transition evolves more rapidly. The losses of dynamism for the working-age population is worrying since it composes the workforce into the productive system.

Figure 3: Cluster maps for total net variation



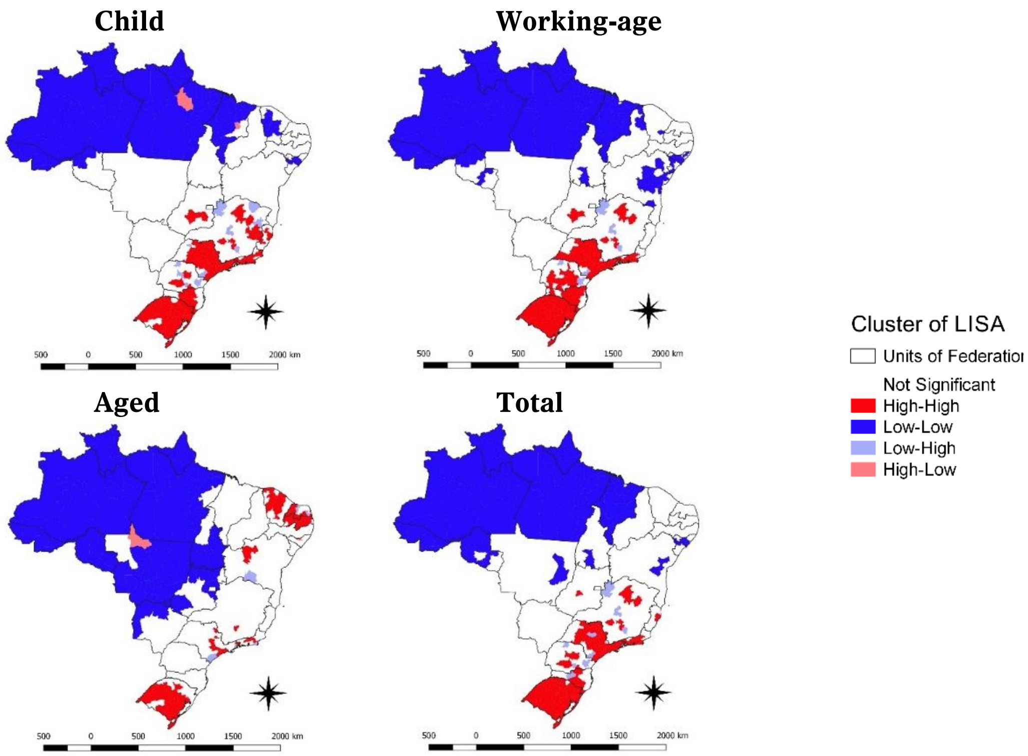
Source: Elaborated by the author using QGis software.

Data in Figure 4 shows the spatial regimes statistically significant for the structural effect and its age subcomponents. For the structural effect, we observe a dichotomous picture for the configuration of spatial regimes regarding localization across the national territory when compared to the results achieved for the net variation. The LL clusters occur mostly in North for the three groups, spreading to the Center-West for the aged group. The HH clusters occur especially from the State of São Paulo towards Rio Grande do Sul, where it is more intense. It is worth mentioning that the variability of the structural component only accounts for 4.2% of the total variability of the net variation. Thus, this component is not the main force affecting the demographic transition process as well as population dynamics for the Brazilian microregions. In this case, the structural effect only captures what would be expected of the regional population dynamics if the structural-demographic factors of these regions were similar to the national demographic factors. Due to heterogeneity of regional demographic factors (fertility rates, mortality rates, migratory patterns), it is the differential component that becomes more relevant in the dynamics of the regional population change and regional demographic transition.

Data in Figure 5 shows the spatial regimes statistically significant for the differential effect and its age subcomponents. Initially, it is worth noting that the distribution of the HH and LL spatial regimes for the differential effect has distinguished similarity with that observed for the net variation. This is not surprising given that the differential effect is the main component of the net variation. The HH cluster occurs mainly in the Northern region for the child and working active age groups. Regarding the aged group, HH clusters are concentrated in Center-West and some microregions of the North region.

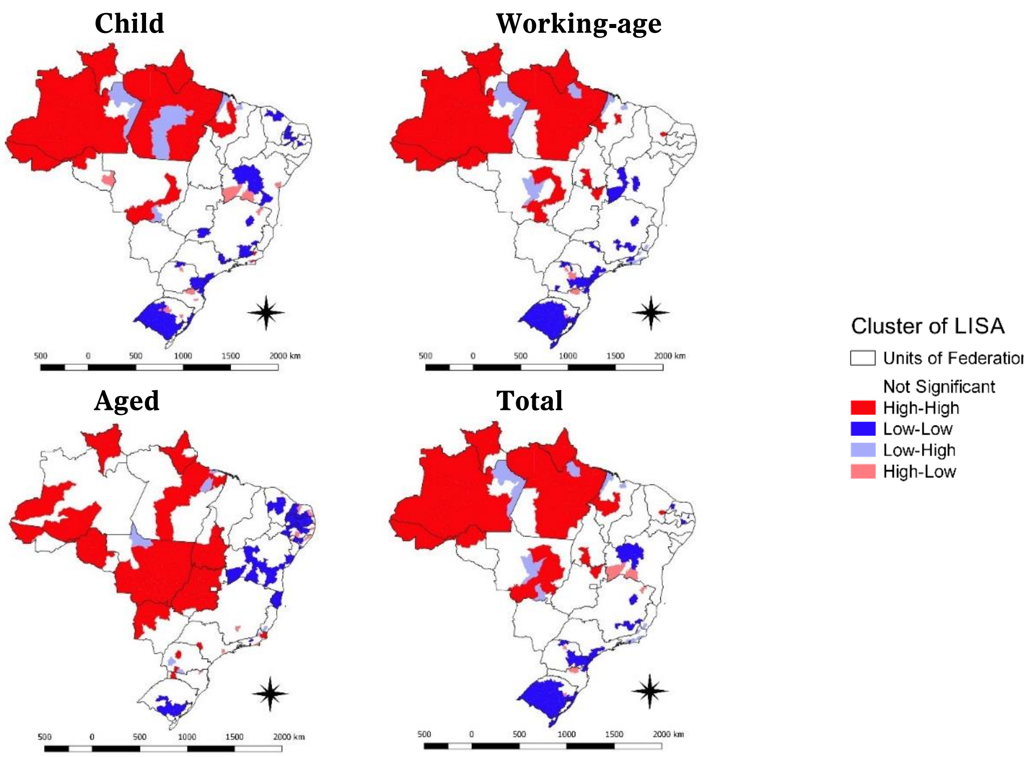
The LL clusters predominantly occurs in the Rio Grande do Sul for the child and working-age groups, reflecting losses in population dynamism. Again, regarding the regional perspective, these results show the State of Rio Grande do Sul tends to experience more rapidly the consequences of the demographic transition process.

Figure 4: Cluster maps for structural effect



Source: Own elaboration, using the QGis *software.*

Figure 5: Cluster maps for differential effect



Source: Own elaboration, using the QGis *software.*

The results found here out in evidence that the process of demographic transition is advanced in Brazil as highlighted by Alves (2014), but also demonstrates the dynamic of this process is differentiated among regions. Thus, the challenges and opportunities linked to the demographic transition process, notably regarding the so-called demographic bonus as discussed by Rios-Neto (2005) and Paiva and Wajnman (2005) become even more relevant in the regional context. For instance, regions in which the aging process evolves more rapidly could reorient spending on education by changing the approach of application to increase the quality of education. On the other hand, these regions also need to strengthen their health care policies, mainly to the elderly population. Expanding the coverage of the health care system to respond to the growing demands due to the prevalence of chronic diseases is more relevant for those regions.

The long-term dynamics of economic growth must also be structurally affected by the demographic transition. According to Pereima and Porsse (2013), the relative reduction of the working-age population implies that economic growth will be increasingly dependent on factors that increase labor productivity such as investments in human capital, technology and innovation. From this perspective, the effects in the context of regional economic dynamics tend to be more pronounced since the working-age population is more sensitive to migration (OLIVEIRA and JANUZZI, 2005). The combination of migratory patterns and demographic transition can reinforce regional disparities in such a way that economically dynamic regions attract relatively more people of the working-age group, an aspect which indirectly may present greater acceleration of the increased dependency ratio in less economically developed regions. Thus, the regional specificities of the demographic transition also need to be on the radar of policies aimed to sustain economic growth through improvements in labor productivity.

Final remarks

This study was motivated by the process of demographic transition that Brazil has been experiencing. The expressive reduction in fertility and mortality rates occurred in recent decades have implied an accelerated dynamic for the demographic transition in the country. Considering that socioeconomic and demographic characteristics are regionally quite heterogeneous in Brazil, this study investigated the evolution of population dynamics and regional demographic transition using the shift-share method and the technique known as exploratory spatial data analysis. The phenomenon of demographic transition produces structural consequences in the fundamentals of the dynamics of economic growth and impact the allocation of productive factors and public resources, whether on the national or the regional spaces.

Regarding the regional dimension, the demographic transition can evolve in different patterns. Therefore, our objective was to investigate this issue at a higher level of regional disaggregation. We found that spatial dependence is a very relevant characteristic of the structural effects conditioning regional population dynamics, although these effects are less expressive to explain most of the variability of net population growth observed in Brazilian microregions. However, spatial dependence revealed to be also relevant for the differential component of regional population dynamics, although at a lower intensity. The differential effect also revealed to be the more important component affecting the demographic change process either in aggregate terms as to the all age groups considered in the demographic transition.

In summary, the results achieved show that the spatial pattern of the demographic transition process in Brazil is regionally unbalanced, and the differential effect overlaps the structural one. The microregions located in the North region present greater population dynamism, especially in the child and working-age groups. This shows how the socioeconomic performance of this region has favored the expansion of these population groups. In the case of the aged group, Center-West presents greater growth. This result may indicate an exhaustion of the process of population growth linked to the expansion of the agricultural frontier. It also indicates this region may suffer from continuous demand pressures on public policies related to elderly people, such as in the field of health care and social security.

Regarding the decline observed in the population dynamism, the most critical situation is located in Rio Grande do Sul. Both the child and the working-age population present a strong reduction across microregions of this state. The decline of working-age population is more worrisome because it may be linked to losses in the dynamic of socio-economic development. Finally, the results provided by this study highlight the need to continue advancing in research agenda searching to better understand the consequences of the demographic transition process from a regional perspective.

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