AN EXPLORATORY SPATIAL ANALYSIS ABOUT THE SPATIAL DISTRIBUTION OF ECONOMIC ACTIVITIES IN PORTUGAL

A DISTRIBUIÇÃO ESPACIAL DAS ATIVIDADES ECONÓMICAS EM PORTUGAL: UMA ANÁLISE ESPACIAL EXPLORATÓRIA

Pedro Monteiro
pedro.monteiro@ua.pt
Universidade de Aveiro (DEGEI), Campus Universitário de Santiago, 3810-193 Aveiro

Miguel Viegas
mlbv@ua.pt
GOVCOPP, Universidade de Aveiro (DEGEI), Campus Universitário de Santiago, 3810-193 Aveiro

ABSTRACT/RESUMO

Economic activities are not evenly distributed throughout the territory. As such, the geographical concentration of economic activities has aroused a great interest in the academic community, following such famous examples as Silicon Valley (California), Route 128 (Boston), Cambridge (UK), the federal state of Baden Wurttemberg (Germany).

Given the importance of this matter, regarded as a priority in terms of economic development policies, the aim of this paper is to measure and describe the spatial distribution pattern of the main sectors of economic activity in Portugal. For this we follow the methodology of (Guillain & Le Gallo, 2010), combining the locational Gini index with an Exploratory Spatial Data Analysis, applied to the employment data by sector and by municipalities in 2009 and 2010. This approach has the advantage of introducing a spatial dimension to the usual measures of concentration, thus seeking to determine the location pattern of each sector of activity and to measure spatial correlation.

Keywords: Agglomeration, Exploratory Spatial Data Analysis, Locational Gini Index, Portuguese Municipalities

JEL Codes: R10, R12, R58.

As atividades económicas não se distribuem uniformemente em todo o território. Como tal, a concentração geográfica das atividades económicas tem despertado um grande interesse na comunidade científica, na sequência de exemplos famosos como Silicon Valley (Califórnia), Route 128 (Boston), Cambridge (Reino Unido), o estado federal de Baden Wurttemberg (Alemanha).

Dada a importância desta matéria, geralmente aceite como uma prioridade no quadro das diversas políticas de desenvolvimento económico, o objetivo deste trabalho é medir e descrever o padrão de distribuição espacial dos principais setores da atividade económica em Portugal. Para isso, seguimos a metodologia de (Guillain & Le Gallo, 2010), combinando o Índice de Gini locacional com uma Análise Espacial de Dados Exploratória, aplicada aos dados do emprego por setor e por municípios em 2009 e 2010. Esta abordagem tem a vantagem de introduzir uma dimensão espacial nas medidas habituais de concentração, procurando assim determinar o padrão de localização de cada setor de atividade e medir a correlação espacial.

Palavras-chave: Aglomeração, Análise Espacial de Dados Exploratória, Índice de Gini Locacional, Municípios Portugueses

JEL: R10, R12, R58.

1. INTRODUCTION

Economic activities are not evenly distributed throughout the territory. Be that at regional, national or intercontinental level, the history of human civilizations show that communities, through extensive migrations have concentrated increasingly on small geographical area of the planet surface. According to Eurostat data and the latest survey LUCAS (Land Use Cover Area frame Survey, March 2011), the area for residential, commercial and industrial purposes, including infrastructures, occupy only 11% of the total area of the European Union with variation of up to 90% in Inner London or below 5% in Iberian Peninsula or northern Europe.[1] The soil, with its environmental, productive and supportive functions, assumes a central role in ecosystems and biodiversity conservation being also a fundamental resource for economic activities. The distribution of different land uses is influenced by numerous biological, geographical and socioeconomic factors and largely determines its occupation through a constant and mutual interaction.

The geographical concentration of economic activities has aroused a great interest in the academic community, following many famous examples like Silicon Valley (California), Route 128 (Boston), Cambridge (UK), the federal state of Baden Wurttemberg (Germany). Knowledge about the productive system of a country or region is a major concern for public authorities. The information of the location, concentration or specialization of economic activities is essential in the diagnosis of the productive structure. There are several criteria that determine the choice of the geographical location of firms. Proximity to raw materials, market centers or the existence of positive externalities arising from agglomeration may be, cumulatively or not, determinant for firms' location choices. The geographical agglomeration of firms allows, through the intense labor mobility induced by geographical proximity, the generation of economies of knowledge through which companies benefit quickly from the potential of innovation generated by other companies. Thus the geographical distribution of economic activities is a political challenge of great importance. On the one hand, by choosing their optimal location firms weigh economies of scale, the division of labor and transaction costs, thereby determining the competitiveness of economies. On the other hand, an excessive regional or even national specialization may create some vulnerability to asymmetric shocks, especially when the mobility of factors is still low (Aiginger & Davies, 2004). Thus, it is of chief importance to understand if the process of economic integration tends to concentrate certain industrial branches in the core creating a halo of shadow around it, or else, if, through spill-overs effects, this core attracts new firms to the fringe, contributing to territorial cohesion.[2]

In the early 90s, Michael Porter carried out on behalf of the Portuguese government a study on the Portuguese economy which identified seven priority industrial clusters in traditional sectors: wine, tourism, automobile, footwear, textiles, wood and cork (M. Porter, 1994). In 2001, the thematic of clusters was recalled, through the governmental initiative PROINOVA – Integrated Program to Support Innovation, designed to support the development of innovation clusters in key areas (Choringas, 2009). In this context, the program identified seven mega clusters: food, habitat, fashion, leisure, mobility, health and personal services, and information and entertainment, and three clusters: footwear, automobile and Software (Choringas, 2009). Like the Porter report, also PROINOVA was abandoned prematurely. Currently, the program COMPETE – Operational Program Thematic Factors of Competitiveness (2007-2013) mentions within its Collective Efficiency Strategy the existence of «poles of competitiveness and technology» and «other clusters» such as energy, health or agro industrial (Compete, 2009).

Given the importance of this matter, regarded as a priority in terms of economic development policies, the aim of this paper is to measure and describe the spatial distribution pattern of the main sectors of economic activity in Portugal. For this we follow the methodology of Guillain & Le Gallo (2010), combining the locational Gini index with an Exploratory Spatial Data Analysis, applied to the employment data by sector and by municipalities in 2009 and 2010. This approach has the advantage of introducing a spatial dimension to the usual measures of concentration, thus seeking to determine the location pattern of each sector of activity and to measure spatial correlation (Guillain & Le Gallo, 2010).

Our paper is divided as follows: in the next section, we proceed with a short literature review focused on the key concepts and highlighting the most significant empirical results. The third part describes the data and methodology used to estimate the pattern of concentration and location of different sectors of economic activity. The main results are presented in the fourth section and section 5 concludes with some final comments.

2. CONCENTRATION, SPECIALIZATION AND AGGLOMERATION: CONCEPT AND SOME EMPIRICAL EVIDENCES

The terms concentration, specialization, agglomeration or cluster, associated with different patterns of geographic location of economic activities have aroused great interest in the literature. Although the definitions of each of these terms overlap partially, it may be useful to define

[1] For detailed information: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Land_cover_and_land_use_statistics_at_regional_level

[2] For an empirical assessment of manufacturing specialization in the European Union see (Aiginger, 2000).

each term on the behalf of a theoretical and methodological clarification. Thus, specialization occurs when a small number of economic sectors cover a major part of the activity of a country or region, whether measured in gross value added or employment. Geographic concentration is defined as the extent to which some economic activity sectors are concentrated in a specific and limited area. Both concepts can be associated, i.e., a country or a region that tends to specialize their production profile may also tend to concentrate the activity of that sector at the expense of other regions or neighboring countries, thus representing two sides of the same coin (Aiginger & Davies, 2004). Agglomeration economies introduce the territorial dimension in a dynamic perspective, highlighting the benefits of firm to locate close to each other. Paul Krugman, describing the arbitration process between increasing returns and transaction costs, contributed decisively to the recognition of the role of agglomeration economies as a main source of economic growth (Krugman, 1980).

Note however that despite the huge contribution of new economic geography, interest in the factors that determine the pattern of location of economic activity goes back earlier. Since the early contributions of Thunen (1826) about the location of agricultural activities around the pre-industrial city, many authors have sought to describe the factors that determine the distribution of economic activities across the territory. Alfred Marshall opposing the Fordism production model describes an alternative model called the industrial district. The industrial district is defined as a production system, geographically limited, and based on an intense division of labor between small and medium sized enterprises within the same industrial sector (Marshall, 1919). According to Paul Krugman, considered the main pioneer of the New Economic Geography, agglomeration of firms in a restricted area of the territory arises from the interaction between economies of scale, transport costs and the difference in labor costs between sectors («Home Market Effect») in a circular process with positive feedback effects (Krugman, 1980, 1991). The cluster concept, another expression for economic agglomeration popularized by the work of Michael Porter, can be defined as a network of interdependent companies and institutions, geographically close to each other and linked together through trades, technologies and common know-how (M. E. Porter, 1998).

There are many measures of specialization and geographic concentration: coefficients of location and specialization, spatial Herfindhal or entropy indexes, the locational Gini index, among others (Delgado & Godinho, 2011). However, all these measures are disconnected from the physical space, in the sense that all geographical units are treated as independent observations (Guillain & Le Gallo, 2010). By crossing the locational Gini index with an Exploratory Spatial Data Analysis, we explore not only the concentration level but also the pattern of geographical location of this concentration, i.e., how the specific units of high or low concentration are distributed across space. Moreover, we measure potential effects of spatial dependence in order to understand if there is any tendency of agglomeration between contiguous geographical units (Guillain & Le Gallo, 2010). Finally, through the LISA (Local Indicator of Spatial Association) statistics we attempt to describe the pattern of geographical location of agglomerations, i.e., where are the occasional cluster of the various sectors of economic activities studied.

Many articles can be found in the literature that use spatial statistic tools, trying to describe patterns of location and agglomeration effects of various economic sectors with different degrees of geographical disaggregation. Guillain & Le Gallo (2010) apply this methodology to the study of the geographical distribution of 26 industrial and service sectors in the Paris metropolitan area. In a study covering the whole Spanish territory, Viladecans-Marsal (2004) estimates economic and urban agglomeration effects in the location of various industrial sectors (Van Oort, 2002), also using an exploratory spatial data analysis, seeks to test the hypothesis that proximity and agglomeration effects are crucial to promoting innovation in the various sectors of economic activity among the 580 Dutch municipalities. Our last example concerns Italy territory on which (De Dominicis, Arbia, & de Groot, 2007) apply the methodology of Guillain & Le Gallo (2010), exploring several industrial sectors and services.

Concerning the Portuguese case, there are several empirical studies in the literature on the geographical concentration and specialization of industrial sectors and services. Crespo & Fontoura (2006) use municipal and regional data to test the effects of the opening of the Portuguese economy to international trade in the level of concentration and specialization of domestic industry. Using different measures of concentration and specialization (absolute, relative, topographical and geographical), the authors confirmed the hypothesis according to which Portugal trade openness due to the European Union adhesion led to the dispersion of the industry as a whole. Differently, the analysis of individual industrial sectors did not confirm the expected trend of specialization among others by Fujita, Krugman, & Venables (1999). In a similar study on the Portuguese manufacturing industry, (Mira, 2008), using the concentration ratio and the Herfindhal and Entropy indexes (in its absolute versions) applied to several industrial sectors in each of the Nuts II, points to an increase in the level of concentration for the period 1996-2004, with differing results concerning the level of regional specialization. Finally, the only study, to our knowledge, applying an exploratory spatial data analysis to different sectors of economic activity (Martinho, 2011) seeks to measure the effects of spatial dependence (spillovers effects) in the so-called Verdoorn law which links economic growth and productivity increases. However, unlike our study, he still uses a very low level of geographical and sectorial disaggregation. Using a spatial econometric model intended to test the different specifications of spatial autocorrelation (spatial lag and spatial error), the author study separately the industry, agriculture

and services sectors, across the 28 continental Nuts III to confirm the relevance of spatial dependence effects, especially in the 2000-2005 period.

Thus, our work, using a recent methodology not yet fully applied to the Portugal case, measures not only the geographic pattern of concentration of economic activities but also the respective agglomeration tendency across the Portuguese municipalities. As such, we think that it contributes to cover a gap in the literature and opens prospects for further and deeper investigations.

3. METHODOLOGY AND DATA DESCRIPTION

IIt is not easy, nor there is consensus on the best methodology to measure or assess empirically the effects of clustering economic activities.[3] In this article, we seek to combine concentration measurements with the new tools of spatial econometrics, based on the methodology followed in Guillain & Le Gallo, 2010 and extensively described in Alamá, Artal, & Navarro, 2011. As a measure of concentration we use the locational Gini Coefficient whose expression is:

$$G_m = \frac{1}{4\bar{\mu}_x}\frac{1}{n(n-1)}\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right| \qquad (1)$$

Where:

G_m represents the locational Gini coefficient of economic sector m;

n, the numbers of municipalities;

$$X_{i(j)} = \frac{\text{Municipality } i'(j') \text{ share of employment in sector } m}{\text{Municipality } i'(j') \text{ share of total employment}}$$

And finally,

$$\bar{\mu}_x = \frac{\sum_{i=1}^{n} x_i}{n}$$

The locational Gini coefficient of a sector assumes a zero value when the distribution of the respective employment is uniform in all the municipalities. If the total employment in a sector of economic activity is concentrated in a single municipality the locational Gini coefficient takes the value 0.5. The locational Gini coefficient is a good indicator of the degree of concentration or dispersion of a sector of economic activity. However it does not reveal information about the pattern of geographic distribution nor on the specific location of possible clusters. That is, assuming that there is a phenomenon of concentration of workforce of a particular economic sector in some cities, it may be useful to know if there is a specific pattern of distribution of these cities and, if so, the location of these clusters or agglomerated cities.

Moran's I statistic seeks to answer the first question. It measures the relation between the normalized deviation of a variable at a specific location and the normalized deviation in neighboring geographic units for the same variable. Considering a row-standardized contiguity matrix (type queen) W, the Moran's I statistic is given by:

$$I_m = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\left(x_i - \bar{\mu}_x\right)\left(x_j - \bar{\mu}_x\right)}{\sum_{i=1}^{n}\left(x_i - \bar{\mu}_x\right)^2} \qquad (2)$$

The spatial weight matrix W is a contiguity matrix in which wi,j=1 if *i* and *j* are neighbors, wi,j=0, otherwise and wi,i=0, by convention. The Moran's I Statistic constitutes a measure of spatial autocorrelation for a given attribute, ranging from -1 to 1 like any other correlation index. A Moran's I Statistic close to zero (technically, close to -1 / (n-1)) indicates a random pattern. When above -1/(n-1) (or toward +1), it indicates a tendency toward clustering and when below -1 / (n-1) (or toward -1) it indicates a tendency toward dispersion.

The locational Gini coefficient and the Moran's I Statistic give us valuable indications on the tendency of economic sectors to concentrate and form clusters (Arbia, 2001). However, it tells us nothing about the spatial location of these specific manifestations of agglomeration. Thus, these global indexes if relevant can be an invitation to explore other local measures of agglomeration. The statistical LISA (Local Indicator of Spatial Association) decomposes the Moran's I Statistic in order to identify the individual contribution of each geographical unit (in our case, each municipality). It measures for each geographical unit the spatial autocorrelation of the variable between this unit and all the neighboring units according to the criteria of the spatial weight matrix. The local version of Moran's I Statistic index for each municipality *i* is given by (Anselin, 1995):

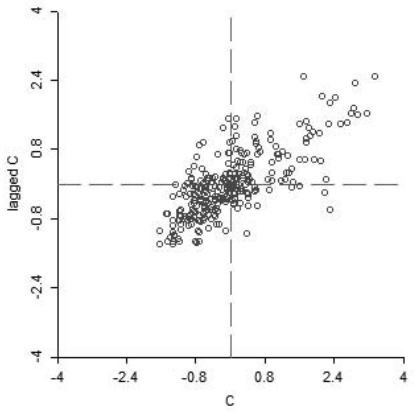
$$I_i = \frac{\sum_{j} w_{ij}\left(x_i - \bar{\mu}_x\right)\left(x_j - \bar{\mu}_x\right)}{\sum_{i=1}^{n}\left(x_i - \bar{\mu}_x\right)^2} \qquad (3)$$

Where notation j concerns only the neighboring values of municipalities i. As such, Local Indicators of Spatial Association (LISA) indicate the presence or absence of significant spatial clusters at a local level. A randomization approach is used to generate a spatially random reference distribution to assess statistical significance with 999 permutations. The observation of the position of each municipality in the four quadrants of the Moran Scatterplot for each sector of economic activity allows the distinction of four different categories (Figure 1 shows, as an example the Moran scatter plot of total manufacturing activities):

- Municipality with a high proportion of workforce in the sector m and positive autocorrelation with the neighborhood: type HH (high-high)
- Municipality with a high proportion of workforce in the sector m and negative autocorrelation with the neighborhood: type HL (high-low)
- Municipality with low proportion of workforce in the sector m and positive autocorrelation with the neighborhood: type LL (low-low)
- Municipality with low proportion of workforce in the sector m and negative autocorrelation with the neighborhood: type LH (low-high)

[3] See, for alternative methods, Ellison & Glaeser, 1994.

FIGURE 1. MORAN SCATTER PLOT (SECTOR C, TOTAL MANUFACTURING ACTIVITIES).



The Moran Significance Map, unlike the Moran Map shows only those geographical units where the LISA is significant and identifies each type of unit with a color. In our analysis, we are particularly interested in the types HH and HL. The first type represents the centrifugal dynamics while the second the shadow effect on the neighborhood.

The study area corresponds to the Portuguese continental territory. For this study we used data of workforce employed in enterprises according to the CAE-Rev.3 (Classification of Economic Activities) available in the Regional Statistical Yearbook of the National Statistics Institute (INE, IP, System Integrated Business Accounts) for the biennium 2009-2010, and disaggregated across the 284 municipalities of mainland Portugal. In a first level of aggregation, we studied the manufacturing sector taken as a whole (sector C), the construction sector (sector F) and the tourism sector (sector I). In a second approach, we disaggregate the manufacturing industry in various subsectors, namely: footwear (15), textiles and clothing (13+14), wood, cork and furniture (16 +31), chemical and rubber (20+21+22+23), metallurgy and basic metal products (24+25), automobile (29+30+33), food and beverages (10+11) and machinery and equipment (26+27+28). These choices were strongly influenced by the availability of data which forces us to aggregate several related subsectors.

4. RESULTS AND DISCUSSION

Based on data for the eleven sectors and subsectors described above, we proceed with an analysis of the more global measures of concentration and agglomeration (locational GINI index and Moran 'I statistic), followed by the analysis of local clusters.

Table 1 shows for each sector and subsectors the locational Gini index, the Moran's I Statistic and the respective rankings.[4] For the three global sectors (tourism, construction and manufacturing), we found lower activity concentration, which is natural considering its higher degree of sector aggregation. As for the Moran's I Statistic, we found that it is in the manufacturing sector that agglomeration effects are higher, followed by tourism and construction. The case of tourism should be interpreted with caution since this tendency for aggregation of municipalities may be related only to geographical and climatic factors rather than socioeconomic dynamics. As for construction, like other people-oriented service sectors, the phenomenon of agglomeration reflects mostly the population densities rather than sectorial dynamics.

TABLE 1. CONCENTRATION AND AGGLOMERATION MEASURES.

Activities	Gini	Ranking	Moran 'I	Ranking
Footwear	0,4729	1	0,2533	9
Textiles and clothing	0,4075	2	0,5684	1
Machinery and equipment	0,3978	3	0,2684	8
Automobile	0,3740	4	0,1559	11
Chemical and rubber	0,3164	5	0,3712	5
Wood, cork and furniture	0,2876	6	0,2840	7
Food and beverages	0,2645	7	0,2385	10
Metallurgy and metal products	0,2296	8	0,4758	3
Tourism	0,1916	9	0,4641	4
Construction	0,1813	10	0,2963	6
Manufactory sector	0,1465	11	0,5595	2

Observing the various sub-sectors of the manufacturing sector, and crossing the locational Gini index and the Moran's I Statistic, we can distinguish four patterns of concentration/agglomeration. Firstly we have the subsectors with high concentration of activities with a strong tendency to aggregate. Textiles and clothing fall into this category. In these municipalities we have a high proportion of workers in those subsectors and this concentration tends to spread across other neighboring municipalities. Secondly we have the subsectors with high concentration of activities but with a lower tendency for agglomeration.[5] Footwear, automobile and machinery and equipment sectors belong to this group. In this case, technological factors associated with economies of scale seem to be dominant, despite some sprawl dynamic. Thirdly, we have economic sub-sectors less concentrated but with a strong tendency to agglomerate represented by a single subsector, metals and metal products. In this pattern, the dynamics of agglomeration between several municipalities supersede the measures of concentration that remain moderate. Finally, there is a rather undefined pattern with low concentration

[4] All Moran's I Statistic proved highly significant.

[5] A small tendency yet positive and significant.

and low tendency to aggregate, in which fall the remaining sub-sectors of the manufacturing industry: chemical, rubber, wood and cork furniture and food and beverages.

Figures 2-9 represent the Moran Significant map and help us to understand better the several patterns of geographic location. The different types HH, LL, LH and HL appear on maps in a grey scale (black for the HH type and light gray for the HL type). We have chosen not to display the maps relating to the construction and machinery and equipment because we have not found any clear pattern of clustering. This result is in line with the global indices previously revealed. Indeed, either the construction or the machinery and equipment sectors have low values of spatial autocorrelation. Concerning the construction sector, the concentration ratio is also low and their geographic location depends mainly on the level of urbanization. As for the machinery and equipment construction industry, the level of concentration is high taking into account the impact of economies of scale. In this sense, we find that companies in this sector are located mainly in the industrial belts of the major cities of Lisbon and Porto. However, we do not found any agglomeration dynamic or intra sector spill-over effects.

The first map (Figure 2) represents the manufactory sector. It clearly shows a pattern of industrial location in three relatively distinct poles: the first corresponds to the municipalities of Leiria and Marinha Grande, the second corresponding to the district of Aveiro and the third covers a number of municipalities between Porto and Braga, thus comprising the regions of Grande Porto and Ave. The second map (Figure 3) corresponds to the tourism sector, with a clear geographic concentration in the south (Algarve) and in the Alentejo coast, motivated, in our view, essentially by climatic factors and sea proximity.

The next maps (Figures 4-9) illustrate the spatial distribution of the several manufactory subsectors described above. Figure 4 corresponds to the Moran Significance Map of textiles and clothing subsector and identifies two industrial spots. The first one is localized in the north of Porto and includes the Ave Valley, and part of the Cávado and Minho-Lima regions. Therein lays the stronghold of the Portuguese textile industry. The second spot, in the central region, covers part of the Serra da Estrela and Cova da Beira regions and also includes the Guarda municipality. The first case is not surprising, reflecting all the efforts made on modernization in order to convert and adapt the textile industry to globalization. These have been achieved mainly through multiple partnerships with various private and public research units.[6]

FIGURE 2. MANUFACTURING SECTOR.

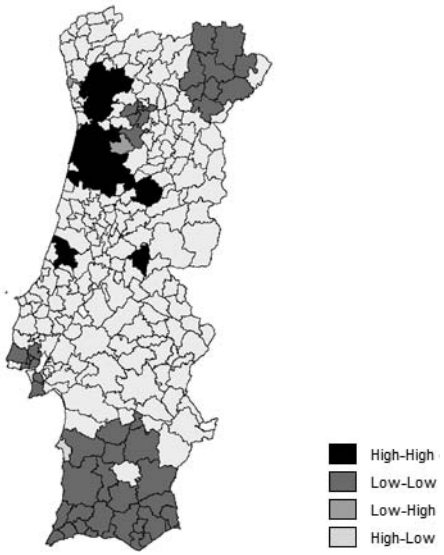
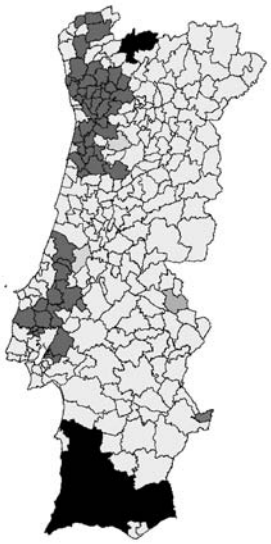


FIGURE 3. TOURISM.



The second case isn't so obvious and requires a closer look at the existing dynamics. Indeed, recent events of this sector of the inland country point to a generalized depression with industrial unit closures, general decrease of economic activities and severe demographic losses. However, the results confirm the existence of a spatial agglomeration in the Moran Significance Map. This can translate specific dynamics strongly rooted in the social, cultural and economic substrate of that region. As such, this leads us to believe that the wool sector, which dominates the textile industry in that region, is eventually resisting despite major closures that have dominated the last decades.

[6] The CITEVE – Technological Centre for the Textile and Clothing Industries of Portugal is an establishment localized in Famalicão created in 1986 aims to support the development of technical and technological capacities of textile and clothing, and by fostering the diffusion of innovation, promoting quality improvement and instrumental support for the definition of industrial policies for the sector.

FIGURE 4. TEXTILE AND CLOTHING.

FIGURE 5. MANUFACTURING FOOTWEAR.

FIGURE 6. RUBBER AND CHEMICALS PRODUCTS.

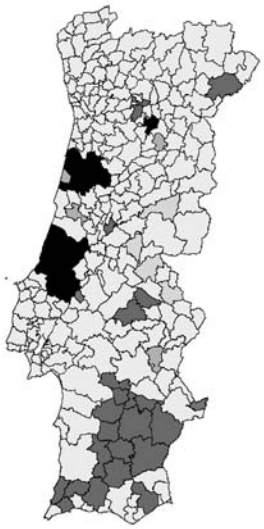


FIGURE 7. WOOD, CORK AND FURNITURE.

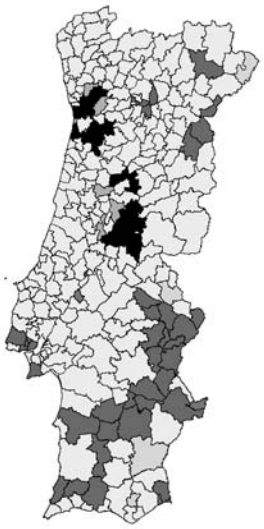


FIGURE 8. METALLURGY AND METAL PRODUCTS.

FIGURE 9. AUTOMOBILE INDUSTRY.

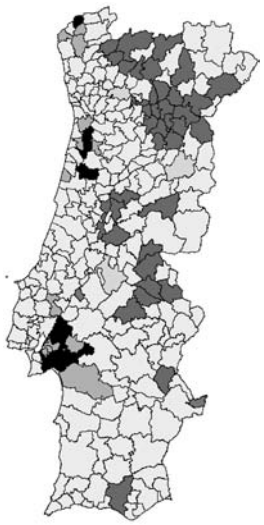


Figure 5 describes the footwear sector and also displays two regional clusters, one located in the north of Portugal covering the municipalities of Vale do Ave (Guimarães, Fafe) and Tâmega (Amarante etc.), and a second one in the region of Entre-Douro-e-Vouga (with the municipalities of Ovar, Feira, S. João da Madeira, Oliveira de Azeméis and Arouca). Generally, we found several structures in both areas that may have originated these geographical agglomerations. Through such structures, local actors seek to collectively develop strategies in important areas such as research and development, vocational training or internationalization.[7]

The subsector of rubber and chemicals products, corresponding to the map in Figure 6 includes chemicals and synthetic fibers, pharmaceuticals, rubber and plastics activity being one of the most diversified. The map shows two agglomerations. The first comprises municipalities of the regions of Baixo-Vouga and Baixo-Mondego (Aveiro, Cantanhede, Mortágua etc.). The second covers an extensive area including coastal municipalities ranging from Oeste to Pinhal Litoral and Lezíria regions (from Santarém to Pombal). The map also reveals some HL municipalities with a high concentration of workforce in this sector, but without sprawl effects in neighborhood. Usually they correspond to inland municipalities in which a single company can employ a significant proportion of the local workforce. Such is the case in Portalegre with the IMG Group, dedicated to the production of resin. The subsector of wood, cork and furniture (Figure 7) identifies three geographical agglomerations. The first is located in the center region (Serta, Proença-a-Nova, Oleiros and Pampilhosa da Serra) while the second covers municipalities in the Baixo Vouga and Entre-Douro-e-Vouga regions. Finally, the third case, located in the north region, corresponds to the most important cluster of furniture, with epicenter in the municipality of Paços de Ferreira (known as the furniture capital), sprawling to neighboring municipalities of Tâmega region. The lack of disaggregated information about the cork sector does not allow to confirm the existence of cork clusters, namely in the municipality of Santa Maria da Feira where the most important cork plant are concentrated. Figure 8 identifies patterns of location for the sub-sector of metallurgy and metal products, with two spots, the first covering partially the municipality of Leiria and the second covering the regions of Baixo Vouga (Aveiro, Anadia, Agatha, among others), Entre-Douro-e-Vouga (Oliveira de Azeméis, Vale de Câmara etc.) and also de municipality of Tondela. This subsector comprehends several activities such as the molding industry (in Marinha Grande), manufacture of metallic structures, pipes and profiles, or even more differentiated sectors such as motorcycles or bicycles (with particular emphasis on the municipality of Águeda). Finally, we have the sub-sector of the automobile industry with a cluster clearly identified in the peninsula of Setúbal (Setúbal and Palmela municipalities among others) with epicenter in the Autoeuropa complex (Ford-Volkswagen). Other spots of the automobile industry appear in the Center in the municipalities of Oliveira de Azemeis, Albergaria-a-Velha and Oliveira do Bairro, mainly related to the components sector. The map also identifies some individual municipalities HL, like Guarda, which was an important center of automobile industry due to the localization of Renault plants. Despite the de-location of the Renault plant, there remain some component producing companies (like copper conductor cable).

[7] Examples: Footwear Technology Centre of Portugal in S. João da Madeira and APICCAPS – Portuguese Association of Manufacturers of Footwear, Components, Leather Goods and their substitutes based in Oporto.

5. CONCLUSION

The current policy guidelines for economic policies regarding sectorial development recognize the importance of physical space or geographical proximity as one of the crucial factors of success. Strategies for Collective Efficiency, launched by public authorities, mention the poles of competitiveness and clusters as structural elements of the development strategy. This article does not seek to explain the social or economic mechanisms underlying geographical aggregation dynamics. Our aim is to give a contribution in the quantitative approach of these matters, thus seeking to assess as objectively as possible these agglomeration effects, combining instruments for measuring concentration with spatial statistics techniques.

The results indicate different levels of concentration, not always correlated with the tendency to agglomerate. That is, we can have highly concentrated sectors with strong contagion effects to neighboring municipalities (textiles) and other sectors that equally concentrate, but with less tendency to sprawl (automotive and footwear). Nevertheless, it should be emphasized that, to a greater or lesser degree, all sectors showed positive autocorrelation with a high degree of significance.

We identified several clusters at the regional level, highlighting tourism, textiles and clothing, footwear, wood and furniture, metallurgy and metal products and automobile production. Thus, we find a similar pattern in the geographical distribution of the most significant industrial activities already described in Crespo & Fontoura (2006) and Mira (2008) with the existence of important industrial agglomerations, strongly polarized around the North and Central Coast regions. Although sectors present different levels of disaggregation, we can recognize clusters of habitat, plastics, agriculture and food, automobile and finally the creative industries and tourism that support the strategies of collective efficiency of the COMPETE program. The existence of these clusters, some of which representing traditional activities, also invites us to recall the Porter report whose recommendations pointed to the potentialities of some of these sectors (M. Porter, 1994). Although these results claim for a deeper analysis, if possible with higher levels of sector and geographical disaggregation,

they point to important geographical agglomeration. Some of these agglomeration are struggling with difficulties and should deserve more attention.

The geographical location of economic activities is an important variable for development policies. However, much of the literature deals with this issue in terms of concentration and specialization, i.e. without directly integrating the physical dimension of territory, despite the fact that geographical proximity and agglomeration effects are known to be important for promoting innovation and knowledge transmission. The present work, being mainly descriptive, does not intend to explain the determinants of a given structure of activity. This structure usually rests on economic behavior and institutions determined by a more or less remote historical and cultural heritage. Our aim is thus to complement the theoretical analysis with statistical tools capable of measuring not only the concentration and specialization, but also the effects of agglomeration and spill-over.

The detection of clusters in sectors of activities with specific locations in Portuguese territory should grant attention from the competent authorities to the extent that this result implies the existence of social, economic and institutional dynamics that need to be observed, understood and possibly supported. The importance of new emerging industries must not be overlooked. But, as Porter states, we must support our traditional sectors, with an innovative view, seeking to explore new technologies, new products and new processes, increasing in this manner the value chain of firms. By assuming the importance of territorial and geographical proximity for the success of economic activities, we are, implicitly mentioning the importance of the tacit part of knowledge that is not coded. This know-how is normally transmitted through organic or informal channels, between different generations, and characterizes the culture and the social values of a region. This characterization takes decades to build and should not be despised.

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