

URBAN POLYCENTRICITY IN SOUTHERN EUROPE: A COMPARATIVE ANALYSIS AT THE NATIONAL LEVEL

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Abstract

Polycentricity constitutes a thoroughly discussed notion at the European spatial planning agenda. It is much seen as a tool for balanced regional development, European competitiveness and sustainable development, with main purpose to counterbalance the concentrated urban configurations of northwestern Europe. Many member-states, aligned with the ESDP common framework, have adopted polycentric policies to address detected urban system disparities. However, the analysis of the national urban system trends considering polycentricity shows mixed outcomes for the European continental South between 2000-2011. Despite the undeniably low levels of polycentricity of Greece and Portugal deriving from the urban primacy and rank-size distribution, the trend in both countries favours polycentric development. As for traditionally more polycentric countries, France becomes in fact more polycentric, while the polycentricity rates of Spain and especially Italy decrease. In terms of territorial balance of their urban systems, France, Spain and Greece seem rather polycentric, while Italy and Portugal are characterized as less polycentric, in this respect.

Keywords

polycentricity, functional urban areas, urban primacy, rank-size distribution, territorial balance

Introduction

The concept of polycentricity constitutes a key notion in the European Union's spatial policy. It is utilized as a guiding principle in the European Spatial Development Perspective (ESDP) and the Territorial Agenda (TA) in order to achieve the common goals of efficiency, equity and sustainability. In the ESDP, polycentricity is defined as an opposite to the notions of monocentricity, dispersal and sprawl. The concept is supposed to contribute to balanced regional development, European competitiveness and sustainable development, and facilitate new urban-rural partnerships.

In general, a territory is considered polycentric if its population or employment is not concentrated to a substantial extent in one single centre. According to the ESPON 1.1.1 project (Nordregio *et al.*, 2004), polycentricity is applied to the European level (macro), the national and interregional levels (meso) and the intraregional level (micro). In this article, the analysis is applied at the national level of the examined countries. At this level, almost every country seems polycentric, so it is important to define the degree of polycentricity, which derives from the specific national urban hierarchy. Some countries have few large metropolises which tend to dominate the national urban system (less polycentric), while others are characterized by a large number of urban areas of similar size (more polycentric).

Considering the importance of the notion of polycentric development for the European Union objectives (efficiency, equity and sustainability), this paper aims to capture the change of national polycentricity that has been achieved in recent years in the member-states of France, Greece, Italy, Portugal and Spain (the European Continental South), through the quantification of the degree of morphological polycentricity that characterizes the national urban systems of the examined countries, and the monitoring of its change in the years of the analysis (2000-2011).

For these purposes, it is appropriate to deal firstly with the multidimensional concept of polycentricity and its definition. Subsequently, the degree of morphological polycentricity across the urban system of the countries of the analysis is examined, utilizing the measures of urban primacy and rank-size distribution. Moreover, the quantification of territorial distribution of large urban centres across the country is achieved with certain measures. The data used in the analysis comes from the ESPON 1.1.1. project (Nordregio *et al.*, 2004) and

Eurostat (2017) for 2000 (or 1999)¹ and 2011, respectively. Moreover, in the analysis of territorial distribution of the urban centres data from the Greek census of 2011 is employed.

The structure of the paper is as follows: in Section 1, the concepts of national polycentricity and polycentric development are analyzed in the way they are perceived in the European Union documents and the academic literature. Section 2 focuses on the characteristics of the urban systems under analysis. In Section 3, the methodology for calculating and illustrating polycentricity is discussed, as presented in previous papers on the subject. The last two sections (4 & 5) present the results and the summary of the analysis.

1 The Concepts of National Polycentricity and Polycentric Development in the European Context

Generally, the concept of polycentricity describes an urban structure comprised of several agglomerations, without any specific restrictions for the characteristic in question (population, employment, etc). Even though it constitutes an important notion for the EU spatial planning policy, it is not as clearly defined as one would expect. It can be claimed that this is for the main part due to the multiple dimensions (normative and analytical), its complex structure (of morphological and functional elements), and the several scales of application (national/international, regional, and intra-urban). It has to be underlined that polycentricity at the regional level is the most thoroughly analyzed form of the concept in bibliography, with a special interest in northwestern Europe in particular (see Dieleman & Faludi, 1998; Kloosterman & Musterd, 2001; Hall & Pain, 2006).

Polycentricity in its current form came to the fore in the 1990s, and it was firstly adopted as a policy concept in Germany in 1993. Its first application however –although under a different name- goes back in the 1960s when the French “métropoles d’équilibre” reinforced the development of certain large urban centres around the country. The ultimate goal of the French policy was to counterweight the dominant Paris, in order to achieve economic balance at the national level.

Especially in the European Union documents (see ESDP 1999; TA 2007), polycentricity is comprehended at its normative facet (see Davoudi, 2003). With reference to the French case,

¹ Depending on the availability of the data. Hereinafter the period of the analysis will be referred to as 2000-2011 throughout this paper.

the main concern is the counterbalance of the European urban system that is strongly influenced by the overconcentrated urban configurations of northwestern Europe. Vandermorten (2017), takes a step further regarding the analytical and normative facets of the concept by distinguishing the terms of polycentricity and polycentrism, and appointing them to these respective dimensions of the notion.

The concept of polycentricity according to the ESPON 1.1.1. project contains both morphological -size and spatial distribution of urban areas- and functional elements -networks of flows and co-operation between urban areas on different scales- of equal importance, and it is strongly stated that polycentric systems cannot be formed by nodes without cross relations (Nordregio *et al.*, 2004). On the contrary, in the ESPON 1.4.3. project, polycentricity is perceived as a solely morphological issue.

Polycentric development, even though it is perceived in different ways and under different names, consists a major objective and policy aim pursued by many member states. According to the ESDP, the guidelines of polycentric development are: “the development of a balanced and polycentric urban system and a new urban-rural relationship; securing parity of access to infrastructure and knowledge; sustainable development, prudent management and protection of nature and cultural heritage” (ESDP, 1999). Meijers *et al.* (2007), define the notion as “a policy that addresses the distribution of economic and/or economically relevant functions over the urban system in such a way that the urban hierarchy is flattened in a territorially balanced way”. Last but not least, it is claimed that differences in the application of the concept are subject to the type of the country’s organization and prior spatial planning traditions (Nordregio *et al.*, 2004).

2 Focusing on the Urban Systems of the Examined Countries

The existing urban structure of the countries under analysis is a rather significant element for the morphological assessment and the normative pursuit of polycentricity. Moreover, the structure of the urban system shows the degree of territorial balance and subsequent disparities/opportunities in the country.

The types of urban disparities addressed are quite different among the countries. In France, the focus is on the gap between the capital city and the rest of the cities. In Italy, there are North-South disparities, while countries such as Greece and Portugal focus on the need to strengthen the medium-sized cities in their urban hierarchies (Nordregio *et al.*, 2004). As it is

put forward by Meijers *et al.* (2007), the disparities that national urban systems face are generally of two types: the disparities between different categories of cities, which are caused by a limited representation of cities of a certain level of urban hierarchy, and the disparities between cities located in regions with diverging rates of socio-economic development.

The following part records the urban systems of the examined countries, the types of disparities observed, and the degree of territorial balance that characterizes each and every country in terms of large centres spatial distribution.

2.1 France

In France, there are 211 designated FUAs (Nordregio *et al.*, 2004). The population that resides in these FUAs comprises the 71% of the French population and the average size of each FUA is 200,000 residents. France is considered rather monocentric on an urban structure basis. The domination of Paris has been documented as a topic of academic interest since the first half of the 20th century, with Jean-François Gravier's "Paris and the French Desert"² (1947) being the most famous publication addressing the issue. However, the second tier French cities as Lille, Nantes, Bordeaux, Toulouse, Marseille, etc are quite similarly sized and evenly spatially located. To a great extent, this is due to the policies pursued by the DATAR Agency during the second half of the 20th century. In order to counterbalance the dominant Paris, the following have been of great concern in different periods: the redistribution of industrial activity to the rural and traditional industrial regions, the dispersal of higher order functions (Balance Metropolises)³, the decentralization of public services and prioritised infrastructure development for the medium-sized cities (Meijers *et al.*, 2007). The "*Aménagement du Territoire*", of which (former) DATAR was in charge, is a policy perspective for spatial disposition of people and economic activities over the national territory, with the aim of limiting over-concentration (reinforcing polycentricity). The "Networked Polycentrism"⁴, introduced in 2000 by the DATAR "Aménager la France de 2020" document, brought a change of view for development perspectives by shifting the interest from the distribution of wealth to the organization of territories (Guigou, 1995, cit. Nordregio *et al.*, 2003). Under this strategy, the reinforcement of new urban centres is envisaged alongside the further growth of the international metropolis of Paris. However, the "spatial justice" in terms of equal opportunities

² Paris et le Désert Français

³ Métropoles d'équilibre

⁴ Polycentrisme maillé

for the variant urban configurations is a precondition for this parallel development (Baudelle & Peyrony, 2005 cit. Nordregio *et al.*, 2003). The type of disparities identified in the French urban system and addressed by the state policies is the gap between the capital city of Paris and cities in the rest of the country (Meijers *et al.* 2007).

2.2 Greece

Greece has a population of nearly 11 million people. The capital city of Athens constitutes the primate metropolitan configuration of the country (see Konsolas *et al.*, 2001; Nikolopoulos, 2017), in which resides a population of almost 4 millions, while the second largest city of Thessalonica has almost 1 million residents. Apart from the two metropolises, only the urban centres of Patras, Heraklion, Larissa, Volos and Ioannina exceed the population threshold of 100,000, rendering Greece one of the less polycentric countries in the current analysis, although considering territorial balance, Greek urban centres seem to be spread rather equally across the country. Greece has 45 FUAs (Nordregio *et al.*, 2004). The percentage of population inside these FUAs comprises 65% of the country population, one of the lowest percentages among the countries of the analysis. The average population of FUAs is 154,000 residents. As described by Angelidis (2005), the growth of the Greek urban system used to be rather concentrated in the two metropolitan areas (Athens and Thessalonica) and the corridor of Patras – Athens – Thessalonica – Kavala, the so called “Developmental S”. However, in the recent decades, the pattern has become quite more complex, with the growth of the rest urban centres depending on their morphological, locational, economic and functional characteristics. Moreover, the significantly smaller size and less integrated character -into the European economy- of the rest of the urban centres, has a two-way causal -and self-reinforcing relation with their economic importance. Meijers *et al.* (2007) record that Greek policies address the gap between the two largest cities and the next tier of cities, as well as the weakness of the bottom of the urban hierarchy, which seems to be still the case.

2.3 Italy

According to Nordregio *et al.* (2004), Italy has a total number of 235 FUAs, in which resides the 79% of the Italian population –the largest percentage among the examined countries. The average population number of the Italian FUAs is 181,000 residents. In Italy a social and economic division at the spatial level is rather obvious, adding to the North vs South argument, although according to the OECD (2001) territorial disparities in the distribution of wealth have

been slightly decreasing (Nordregio *et al.*, 2003). Italy is characterized by the presence of three main metropolises, a large number of medium-sized cities and a significant number of small cities. The main urban configurations are Rome and Naples in the South and those of Milan and Genoa in the North. So the policies for the Italian urban system face the complex issue of the disparities between the cities in the North and the cities in the South (Meijers *et al.* 2007). The North-South divide has already been the case since the formation of the Italian unitary state in the 19th century, with the northern cities already being industrialized. The decades of 1950s and 1960s were characterized by further urban concentration. When in the 1990s the globalisation of the economy made it imperative for the cities to participate in the international networks, as it is stated by Dematteis (1999), again, the northern cities held a better position (Nordregio *et al.*, 2003). The Italian urban system can be considered morphologically polycentric since it is characterized by the presence of multiple large centres, although it cannot be argued that it is territorially balanced in terms of development, with the northern cities being much more developed than their southern counterparts. Moreover, the largest cities of the North show closer proximity and seem to be much better networked in terms of transport connections than those of the South.

2.4 Portugal

Portugal has slightly more than 10 million inhabitants, with over 4 millions of them concentrated in Lisbon and Porto. Portugal has 46 FUAs (Nordregio *et al.*, 2004), one more than Greece. The percentage of population living in these FUAs comprises 60% of the total Portuguese population, the lower percentage among the countries of the analysis. The average population of the FUAs is 132,000 residents. The country is considered to be rather bipolar, with the Lisbon and Porto metropolitan areas dominating the urban system in economic and other functions, while it also has a large number of small FUAs, with a close proximity to large cities. In terms of population density, Portugal shows a North-South pattern too, as well as a contrast between the coastal areas and inland regions along the border with Spain (Nordregio *et al.*, 2003). All of the examined FUAs belong to coastal regions and grow disproportionately to the rest of the country, which seems to be the case for the activities of industry and services too (Nordregio *et al.*, 2003). Moreover, the domination of the country's urban system by the metropolises of Lisbon and Porto, which simultaneously are lacking in terms of international dynamics, is considered to be a disadvantage. However, medium-sized cities are perceived as crucial nodes for social, economic and territorial cohesion, with polycentric structure being a

main objective for the national urban policies. Finally, the disparities of the Portuguese urban system are detected mainly among the largest metropolises of Lisbon and Porto and the next group of –medium-sized- cities (Meijers *et al.*, 2007), as is the case in Greece.

2.5 Spain

The Spanish population numbers approximately 46.5 million people, and the country is divided in 17 Autonomous Communities, each with its own Parliament and Government (Nordregio *et al.*, 2003). Spain has a total of 110 FUAs (Nordregio *et al.*, 2004), with the population that lives in a FUA approaching 75% of the national population and the average FUA size being at 274,000 residents. The Spanish urban system is a rather hierarchical one, with the national metropolises linked to the smaller cities via regional metropolises and middle-sized cities.⁵ The largest urban configurations of Madrid and Barcelona are totally integrated not only into the European urban networks, but also into the international networks. The metropolis of Madrid, in addition to the political and economic functions that exhibits, it is characterized by its geographical location in the centre of the country, and it is considered to be the radial centre of the national transport network (Lanaspa *et al.*, 2003). On the other hand, Barcelona counts on its knowledge-based economy and its role as the largest Mediterranean port. Even though the second tier cities have significantly lower population size and economic importance, the Spanish urban system can be characterized as territorially balanced. Spain does not pursue any polycentric policy at the national level, only in some cases at the regional level (Nordregio *et al.*, 2004). Moreover, the Spanish urban system -being already quite polycentric- seems not to address the size gaps in the hierarchy as disparities, with the constituent urban configurations of different magnitude having assumed different functional roles.

3 Quantifying and Illustrating Polycentricity

Wegener (2013) suggests that the completeness of a polycentricity measure lies in the inclusion not only of the population size of centres, but of their distribution and connectivity as well. This way, a quantification of both dimensions of the notion is achieved, which comes however with the cost of dealing with more complex measures, and consequently with a larger quantity of more and more sophisticated data. The first attempt to enrich the European normative agenda of polycentricity with analytical tools, taking all three aforementioned factors into account, was made by the ESPON 1.1.1 project (2004). The ESPON 1.4.3 project

⁵ Linkages represent major flows of capital, information and goods.

(2007) took on the analysis, but does not build on the previous ESPON project methodology for the quantification of polycentricity.

Meijers *et al.* (2007), drawing heavily on the ESPON 1.1.1. project, use rank-size betas⁶ for monitoring cases of national spatial disparities in order to draw conclusions for a better harmonization of national and European polycentric development policies. Following further Meijers *et al.* (2007), the polycentric development of a country may either be pursued by increasing growth of the examined characteristic relatively more in less favoured cities or by dispersing growth from most favoured cities to the lower-ranked ones.⁷

Meijers (2008), briefs and comments on the results of both the ESPON 1.1.1 and 1.4.3 projects that attempted to quantify the national urban system polycentricity, and moreover makes suggestions on how to proceed with the polycentricity research agenda. Eskelinen & Fritsch (2009) follow Finland's process of adoption of polycentricity at the national level, and explore the spatial characteristics and development of the country as far as polycentricity is concerned, also.

Veneri & Burgalassi (2012) define and measure polycentricity at the NUTS2 regional level, by comparing functional and morphological methods. Their study examines the relationships between the degree of regional polycentricity and the key economic variables of performance, namely competitiveness, social cohesion and environmental sustainability. They conclude that functional and morphological methods lead to similar results. In addition, they observe a correlation between polycentricity, more unequal distribution of income and a higher level of productivity, especially when polycentricity is measured in functional terms.

Brezzi & Veneri (2015), using a harmonized definition of functional urban areas in OECD countries, provide definitions of polycentricity for each spatial scale, and highlight the links of different scales with different policies. Also, they provide measures of polycentricity and explore the economic implications of different spatial structures. Results show that relatively more monocentric regions have higher GDP per capita than their more polycentric

⁶ It is widely accepted that the hierarchy of urban centres in a country follows the rank-size distribution, a log-linear pattern that can be illustrated as a straight regression line with a certain –negative- slope.

⁷ The first policy option can diagrammatically be illustrated by an eccentric relocation of the regression line only on the side of the lower-ranked cities, whereas in the latter option, the change of the regression slope results from an eccentric change on both sides of the regression line.

counterparts. At the country level, on the other hand, polycentricity is associated with higher GDP per capita.

The main criteria for the measures used in this paper have been the clarity and substantiality for the pursued purpose of monitoring national morphological polycentricity. So this paper uses the measures of urban primacy and rank-size coefficient in the countries of southern continental Europe to estimate the change in the degree of polycentricity among their main FUAs for the period 2000-2011, as well as the spatial distribution of FUAs in order to identify the territorial balance at the national level. Adapting the Veneri & Burgalassi (2012) method to the national level, the primacy degree is calculated as the ratio of people living in the main city over the total urban population of the country (primacy), as shown in equation (1), where $n=1$ indicates the primate city and N indicates the number of urban centres taken into consideration:

$$primacy = \frac{pop(1)}{\sum_{n=1}^N pop(n)} \quad (1)$$

This indicator can be applied to describe the dominance of the primate city in relation to the country: the higher the primacy, the more monocentric the country, and vice versa. A more useful indicator is given by taking into account the size distribution of the national cities. Brezzi & Veneri (2015), measure polycentricity on the national scale through the beta coefficient of the following equation

$$\ln(rank) = a + b \ln(size) \quad (2)$$

where *size* is the population of each FUA within a country, and *rank* is the size ranking of each FUA, computed at the national level. The slope of the regression line, given by the estimated beta, indicates the level of hierarchy among FUAs, and thus the level of polycentricity for each country. No matter which of the characteristics is placed on each axis of the graph, the slope is a negative one, because as the city size diminishes, the city ranking increases. What differs is the interpretation of the slope change. When size (in this case population) is placed on axis y and the rank on axis x , the country becomes more polycentric when the slope decreases in absolute value, and vice versa (see Nordregio *et al.*, 2004; Meijers *et al.*, 2007; Meijers, 2008). On the contrary, when population is placed on axis x and the rank on axis y , the country

becomes more polycentric when the slope increases in absolute value, and vice versa (see Brezzi & Veneri, 2015), as it is case for the present analysis.

The Functional Urban Area (FUA) is utilized as an urban unit for reasons of data availability and comparability between different countries,⁸ as is the case in several previous similar analyses (see Nordregio *et al.*, 2004; Meijers *et al.*, 2007; Meijers & Sandberg, 2008; Brezzi & Veneri, 2015). In addition, and regarding the criteria for selecting the number of FUAs for the analysis, there are some alternatives discussed in bibliography. Nordregio *et al.* (2004), utilized large number of FUAs per country, different selection criteria for the FUAs used and omitted from their analysis the most populated national FUA. Meijers *et al.* (2007), reject the adoption of a specific population FUA threshold of 50,000 people, because of the influence that small provincial cities would have on the results; instead, they propose a fixed and limited number of FUAs for international comparisons, which includes urban areas of analogical size for each country. The present analysis is based on the examination of 9 FUAs for each country, since this was the maximum number of FUAs for the country with the least available data in 2011 (Greece).

Moreover, concerning the convexity of the rank-size distribution, a concave distribution shows high concentration of economic activity, hence a disproportionately high concentration of population in a single or a few centers (primacy); a linear rank-size distribution represents a dispersion of economic activity and of population among cities that are systematically escalating in size; and finally, a convex distribution reflects dispersed concentrations of economic activity and of population among a number of centres (Ettlinger & Archer, 1987).

Finally, the fact that a country is polycentric in morphological terms does not mean that these centres are equally dispersed in the national space. In order to examine the issue of territorial balance at the national level, and following Meijers & Sandberg (2008), who suggest that the spacing of cities is important for estimating polycentricity, it is further tested to what extent the largest national FUAs are evenly located across the NUTS2 regions of a certain country. So the spread of FUAs across the national territory is considered to make the urban system more polycentric while, on the other hand, the clustering of FUAs in a few regions indicates a system that favours polycentricity less. Meijers & Sandberg (2008), perceive these centres as “growth poles”, which could reinforce the economic development of the region. The number of –larger

⁸ Even though the techniques and reasoning for designating a Functional Urban Area may vary among different countries.

national- FUAs used for this application is equivalent to the number of NUTS2 regions that each country has.

Even though this paper uses only 9 FUAs for Greece, for which there are currently available contemporary official data, it abusively employs another four urban configurations for the purposes of the spatial distribution analysis only. Taking into account the perspective of the ESPON projects for polycentricity (see Nordregio *et al.*, 2004; IGEAT *et al.*, 2007), which utilized municipalities (currently LAU2, formerly NUTS5 level) as corresponding spatial units for smaller FUAs, and the merge of local authorities -and its borders- following the “Kallikratis” administrative reform program, the lower, “municipality section” units were here employed using population data from the latest census (2011). This digression in the employment of the largest national urban areas is considered to have minimal impact on the results and the integrity of the analysis, since its nature is ordinal rather than quantitative. If the latter were true, which would be the case if the four informally added urban areas were utilized at the rank-size distribution analysis, the results would be certainly affected.

Moreover, since the data used concern the year 2011, and mainly because the finest partitioning of the national territory allows for a clearer view of space heterogeneity, the analysis of the French urban centres utilises the prior to 2016 number of French continental NUTS2 regions.⁹ The employment of the overseas French territory seems redundant and irrelevant to the current analysis.

4 The Results of the Analysis

This section contains the results of the analysis of primacy rates, the degree of polycentricity according to rank-size betas and the spatial distribution of FUAs over the national territory.

Considering primacy rates (see Table 1), Greek FUAs exhibit the highest values since Athens contains a significantly large portion of the Greek population in comparison to the rest of the FUAs. On the contrary, among the Spanish and particularly the Italian FUAs one can notice a dispersion of population rather than a concentration in the capital city. Finally, France and Portugal present quite considerable rates of urban primacy, but lower than these of Greece, all of which decrease during the examined period.

⁹ As of 1/1/2016, the French continental territory is comprised of 13 NUTS2 regions, instead of 22, which was the case prior to that date.

Rank	Country (Primate city)	2011	Country (Primate city)	2000
1	Greece (Athens)	0.656	Greece (Athens)	0.675
2	France (Paris)	0.544	Portugal (Lisbon)	0.571
3	Portugal (Lisbon)	0.517	France (Paris)	0.569
4	Spain (Madrid)	0.354	Spain (Madrid)	0.342
5	Italy (Rome)	0.240	Italy (Rome)	0.230

Table 1: Primacy rates for 2011 and 2000.

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

Considering the changes in the population and their varying impact on the degree of polycentricity through the rank-size distribution analysis the following can be deduced.

The French FUAs included in the analysis are Paris, Lyon, Marseilles, Lille, Toulouse, Bordeaux, Nantes, Nice, and Strasbourg. France is strongly dominated by Paris. In 2000, there were only three other FUAs with a population of over 1 million, which became five as of 2011. All of the French FUAs increase their population, except Nice. Paris seems to achieve stability in terms of population, but in the next tiers of cities significant growth takes place. Especially, in FUAs such as Toulouse, Bordeaux, Nantes, and Strasbourg there is a considerable increase.

French FUAs show almost the same degree of polycentricity with their Spanish and Italian counterparts in 2011. However, the French urban system is characterized by a limited increase of the coefficient during the examined period -in contrast to the rest two urban systems- which is illustrated on the graph as an imperceptible clockwise relocation of the regression line. The metropolis of Paris is significantly greater than what is predicted by the regression. Moreover, the convex part of the distribution for the medium-sized FUAs reflects dispersed concentrations of population among a number of large centres. Finally, the concavity on the upper part of the rank-size distribution shows a disproportionately high concentration of population in a few smaller centres.

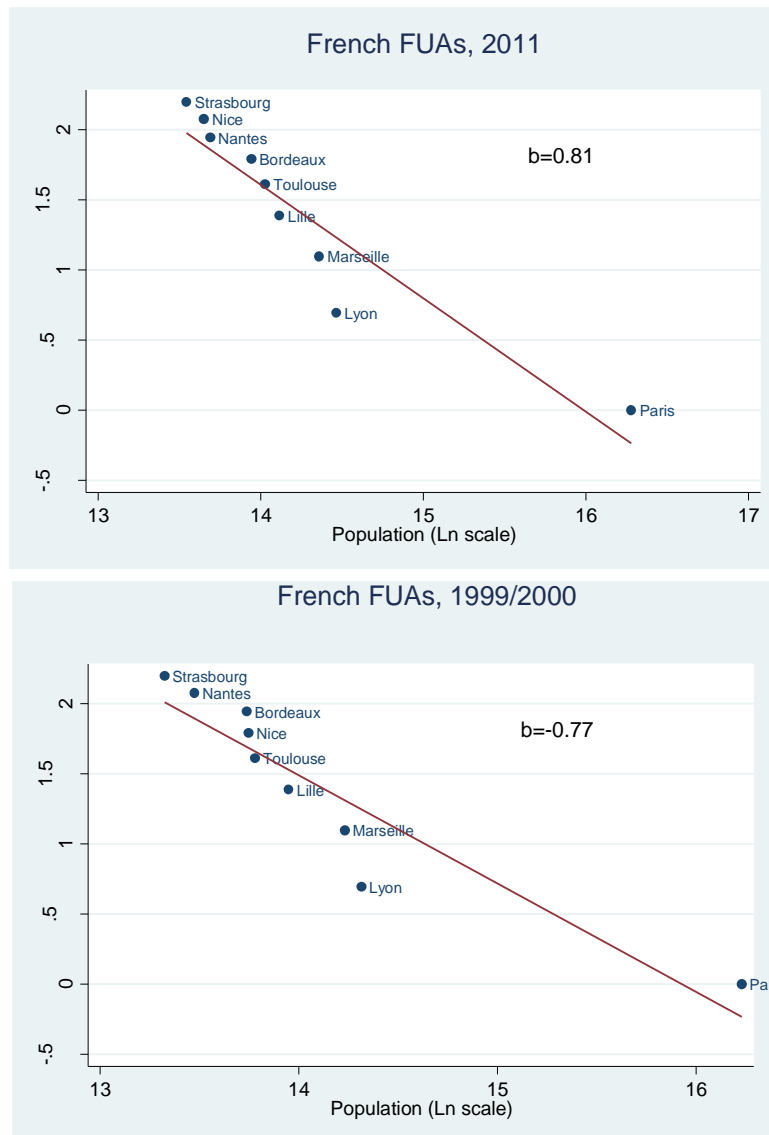


Figure 1a: Degree of Polycentricity (rank size coefficients) in France.

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

The Greek FUAs included in the analysis are Athens, Thessalonica, Patras, Heraklion, Larissa, Volos, Ioannina, Kavala, and Kalamata. A significant part of the population is concentrated in Athens, which increased further between 2000-2011. Apart from Thessalonica, the rest Greek FUAs –which are far smaller- grow in terms of population too, with the FUAs of Heraklion, Larissa, Volos and Ioannina showing the greatest change in this respect. This leads to the increase of beta coefficient and consequently of polycentricity, which is depicted on the graph as a minor clockwise relocation of the regression line. The Greek urban system is characterized as the least polycentric in comparison to the rest of the countries presented in this paper. The rank-size distribution for the Greek urban system seems less linear for 2011. Thessalonica shows slightly larger population than expected. Moreover, the convexity in the middle part of

the distribution reflects dispersed concentrations of population among medium-sized centres. Finally, the concavity on the upper part of the rank-size distribution shows a disproportionately high concentration of population in a few small centres for both 2000 and 2011.

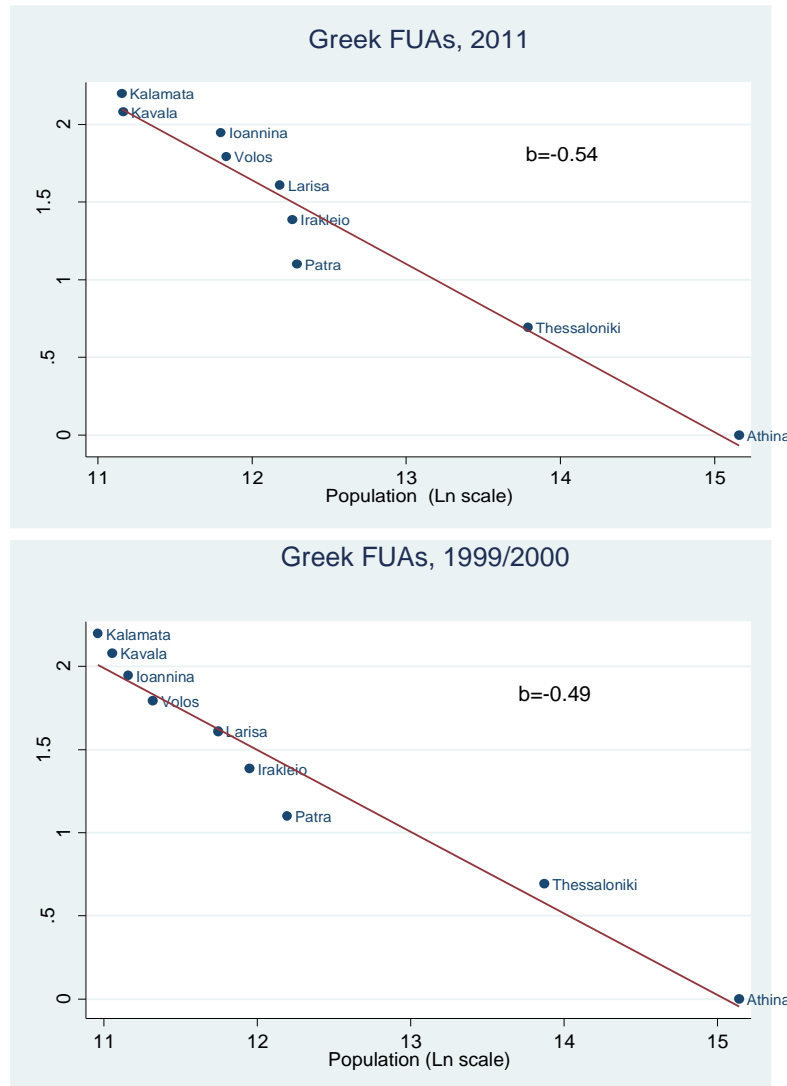


Figure 1b: Degree of Polycentricity (rank size coefficients) in Greece

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

Italy is represented by the FUAs of Rome, Milan, Naples, Turin, Palermo, Bologna, Florence, Genoa, Catania (included in the 2011 FUA list only), and Bari (included in the 2000 FUA list only). Metropolises such as Rome, Milan and Naples show a rather significant growth of population, while Turin grows also, but at a slower pace. A differentiated population growth change is also noticed, which affects the rankings of Palermo, Bologna, and Catania. Finally, the populations of Bari, Florence and Genoa diminish, while Bari does not fall into the group of the 9 largest FUAs in 2011.

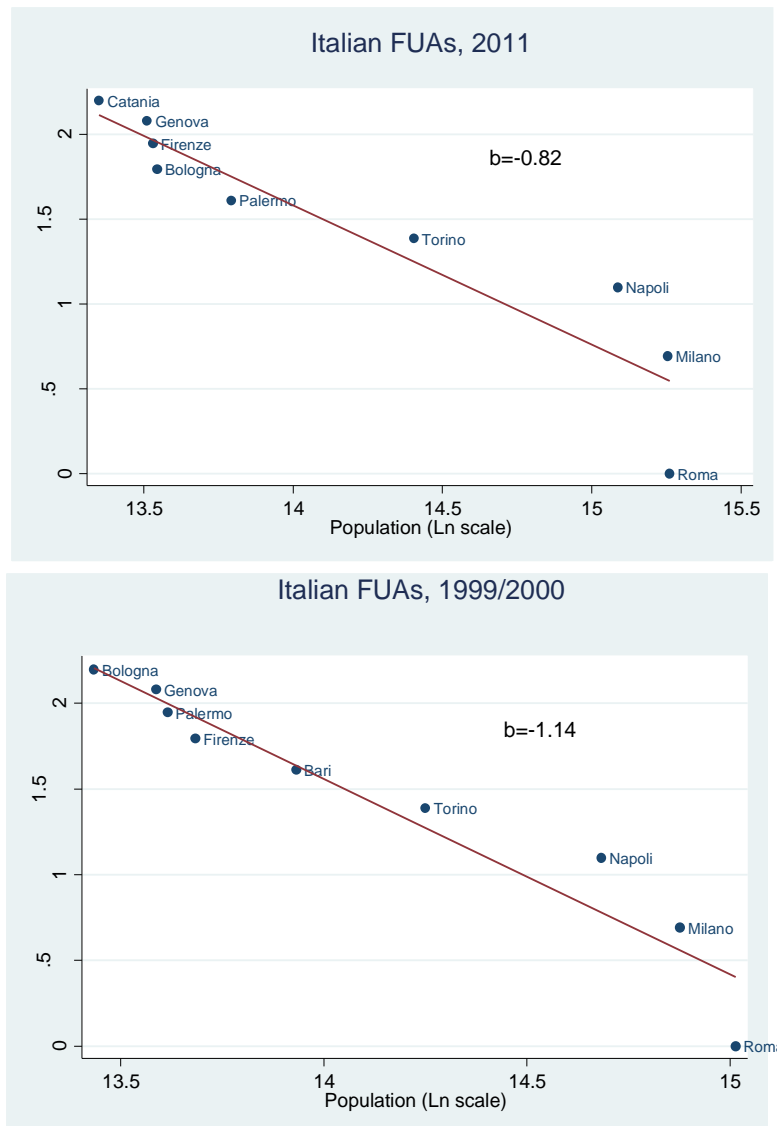


Figure 1c: Degree of Polycentricity (rank size coefficients) in Italy.

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

The Italian urban system presents an important decrease of polycentricity in terms of population during the examined period, which is depicted on the graph as a clear anticlockwise relocation of the regression line, caused mainly by the relatively more intense increase of population in the larger cities. Regarding the convexity of the distribution, it can be claimed that Rome is far less developed in terms of population than it is predicted by the regression line. The concavity of the Italian rank-size distribution can be interpreted as a disproportionately high concentration of population in the FUAs of Milan, Naples and Turin, for both years of the analysis.

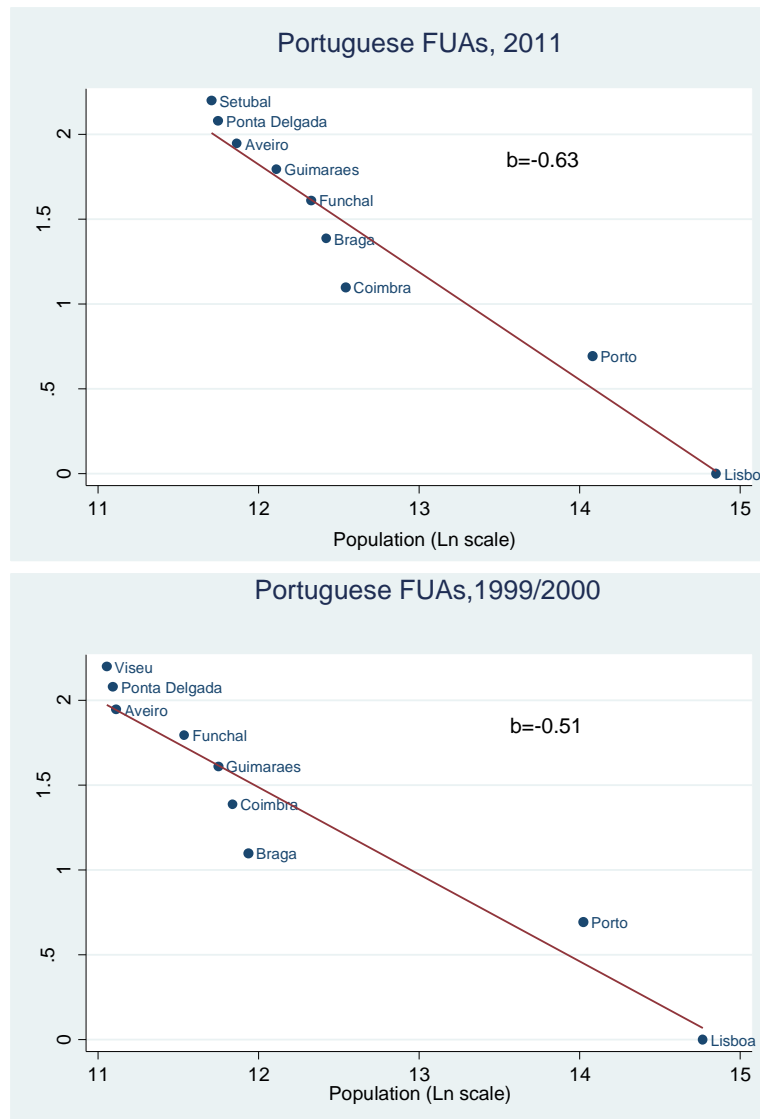


Figure 1d: Degree of Polycentricity (rank size coefficients) in Portugal.

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

The FUAs of Portugal included in the analysis are Lisbon, Porto, Coimbra, Braga, Funchal (Madeira), Guimaraes, Aveiro, Ponta Delgada (Azores), and Setubal (included in the 2011 FUA list only), and Viseu (included in the 2000 FUA list only). The population of all the examined FUAs grows, although Viseu is missing from the list of the 9 most populated Portuguese FUAs in 2011. Characteristically, in terms of population, the growth of the top tier urban areas seems rather mitigated while the growth of the rest large FUAs seems rather remarkable.

The Portuguese urban system is characterized as relatively monocentric since it presents the second lower beta coefficient, after the Greek urban system. The increase of population of the lower tier FUAs between 2000-2011 increased the beta coefficient, with the urban system

becoming consequently more polycentric, which is depicted as a clockwise relocation of the regression line. Regarding convexity, the Portuguese distribution looks very similar to the Greek one. The second largest FUA shows larger population than expected. Apart from that, the convex middle part of the distribution shows dispersed concentrations of population among the medium-sized centres. Finally, the concavity on the upper part of the distribution shows a disproportionately high concentration of population in a few smaller FUAs for both 2000 and 2011.

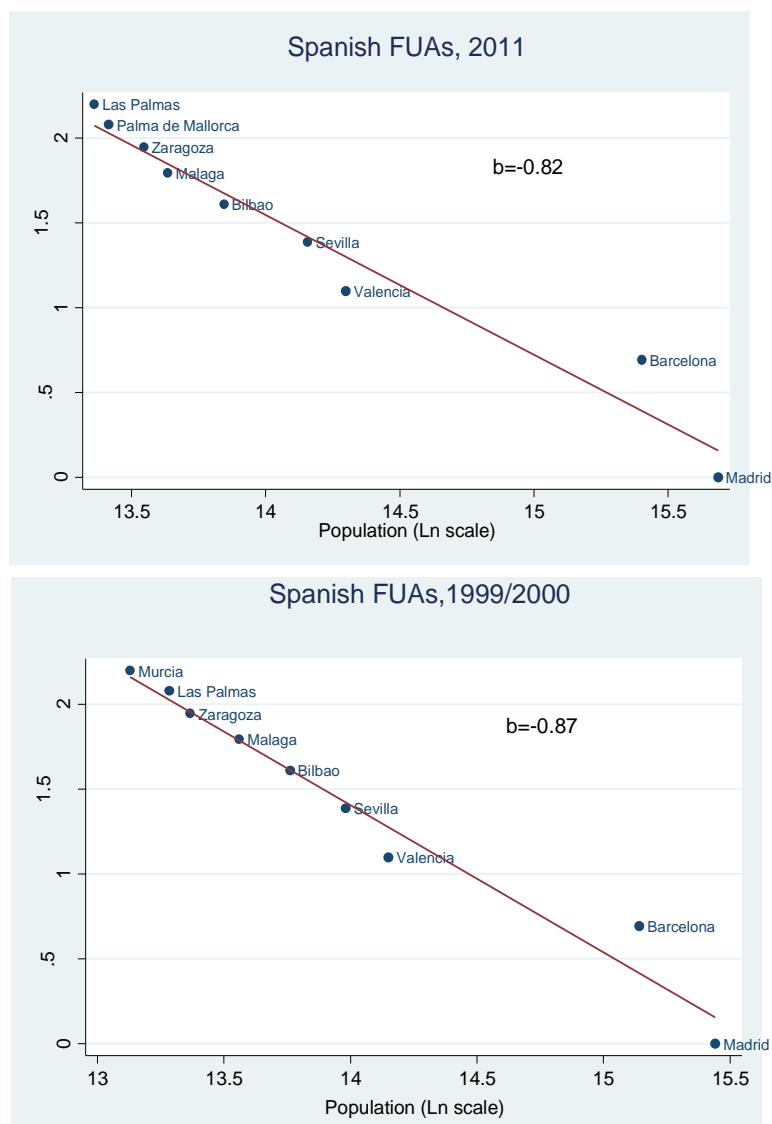


Figure 1e: Degree of Polycentricity (rank size coefficients) in Spain.

Source: Authors' elaboration on data from Eurostat and the ESPON 1.1.1 project.

The FUAs of Spain included in the analysis are Madrid, Barcelona, Valencia, Seville, Bilbao, Malaga, Zaragoza, Palma de Mallorca (included in the 2011 FUA list only), and Murcia (included in the 2000 FUA list only). The country has two large FUAs (Madrid and Barcelona), and only three other FUAs over 1 million in 2011 (Valencia, Seville and Bilbao). All the FUAs of the analysis tend to grow in terms of population in the period 2000-2011, even though Murcia is substituted in the list of the most populated FUAs by Palma de Mallorca in 2011. The most significant changes in population take place in the large metropolitan areas.

The examination of the rank-size distribution for the Spanish FUAs indicates significant polycentricity for 2000 and 2011. Even though the beta coefficient for the examined period diminishes, it still is of a considerable magnitude. The influence of the population growth of the major FUAs (Madrid, Barcelona) is more noticeable in the overall population growth, than this of the rest FUAs. This explains the lower degree of polycentricity in the second year of the analysis, which is depicted on the graph as an anti-clockwise relocation of the regression line. The distribution of the Spanish urban system seems rather consistent in terms of linearity, which is more clearly depicted on the upper part of the distribution and the first year of the analysis. However, the metropolis of Barcelona is significantly greater than what is predicted by the regression line.



Figure 2: The relationship between indicators of the rank-size distribution and the spatial distribution of FUAs across the national territory (2011).

Source: Authors' elaboration on data from Eurostat, the ESPON 1.1.1 project and the Greek Statistical Authority.

For a more detailed look at the national polycentricity, in the above diagram (Figure 2) the examined countries are presented depending on the standardized z-scores of both the degree of polycentricity (rank-size betas) and the spatial distribution of FUAs across their national territory for 2011. Even though Meijers & Sandberg (2008) suggest that it is not appropriate to assign an absolute designation to an urban system as to whether it is polycentric or not, a moderate nomenclature for the purposes of the current analysis is presented below. Starting from the upper right quadrant and continuing clockwise, the urban system of a country may be respectively characterized as: a) Sufficiently Polycentric (polycentric and territorially balanced), b) Potentially Polycentric (not polycentric and territorially balanced), c) Monocentric (or Oligocentric) (not polycentric and not territorially balanced), and d) Insufficiently Polycentric (polycentric and not territorially balanced), always considering solely the morphological polycentricity. Regarding the designation of the less clearly defined cases, potentially polycentric urban systems may achieve polycentricity by allocating resources to the less developed centres whereas in insufficiently polycentric urban systems, although there are already multiple centres, new centres have to emerge in order for the systems to get territorially balanced.

Drawing from the above, France and Spain are characterized as sufficiently polycentric (polycentric on the basis of both their rank-size and spatial distributions of their urban centres), while Italy is proving to be insufficiently polycentric (polycentric depending on its rank-size beta but monocentric considering its spatial distribution of urban centres). On the other hand, Greece is characterized as potentially polycentric (its rank-size beta suggests strong monocentricity, while it shows a rather polycentric territorial distribution of its urban system). Finally, Portugal cannot be characterized as polycentric at all neither in terms of rank-size distribution nor in terms of spatial distribution of its urban centres. Even though the analysis above draws a quite accurate picture of the territorial balance for the urban systems of the examined countries, it cannot be overlooked that the method employed cannot result in a thorough distribution of the largest cities across the national space. For instance, the fact that the largest FUAs spread across the half of national NUTS2 regions may suggest either a rather monocentric or a rather polycentric national reality, depending on the exact location of the aforementioned centres across the national territory as a whole.

Conclusions

Compliant with its aims, this paper quantifies the degree of morphological polycentricity in the national urban systems of the European Continental South using simple and straightforward measures, and monitors the respective alterations in the aforementioned countries regarding polycentric development during the examined period of 2000-2011. According to primacy rates, the primate cities become less significant in the urban development for countries such as France, Greece and Portugal while, on the contrary, in Italy and Spain the population of the primate cities has increased, with the role of the rest of the cities becoming accordingly less significant. In addition, and drawing from the rank-size distribution analysis, during the examined period polycentricity shows an increase in France, Greece and Portugal, while one can notice a decrease in Spain and particularly in Italy, again as far as polycentricity is concerned.

Moreover, in 2011, France and Spain are characterized as polycentric not only in terms of rank-size distribution but also regarding their spatial distribution, with their cities spreading rather evenly throughout their regions. No matter the significant portion of population concentrated in their primate cities, their urban systems seem rather balanced. Italy, despite its recorded polycentricity in the rank-size distribution, seems monocentric in terms of territorial balance, as it has several centres of considerable size, which however spread over only a few of its regions. Greece proves to be a monocentric country as far as the population distribution among the largest cities is concerned, indicating the excessive concentration in the capital city of Athens and Thessalonica; however, the Greek urban system seems to be rather territorially balanced, since it shows a considerably even distribution of its large centres across the national space. Finally, Portugal can be defined as monocentric considering both the rank-size distribution and territorial balance, denoting the roles of its capital, Lisbon, and of the city of Porto in the urban development and the spread of its FUAs in a rather small number of regions.

References

ANGELIDIS M., (2005), Polycentricity in policies: the Greek case, *Built Environment*, vol. 31, n°2, p. 112-121.

BREZZI M., VENERI P., (2015). Assessing Polycentric Urban Systems in the OECD: Country, Regional and Metropolitan Perspectives, *European Planning Studies*, vol. 23, n°6, p. 1128-1145.

DAVOUDI S., (2003). EUROPEAN BRIEFING: Polycentricity in European Spatial Planning: From an Analytical Tool to a Normative Agenda, *European Planning Studies*, vol. 11, n°8, p. 979-999.

DIELEMAN F.M., & FALUDI A., (1998), Polynucleated metropolitan regions in Northwest Europe: theme of the special issue, *European Planning Studies*, vol. 6, n°4, p. 365-377.

ESKELINEN H., & FRITSCH M. (2009), Polycentricity in the North-eastern Periphery of the EU Territory, *European Planning Studies*, vol. 17, n°4, p. 605-619.

ETTLINGER N., & ARCHER J. C. (1987), City-size distributions and the world urban system in the twentieth century, *Environment and Planning A*, vol. 19, n°9, p. 1161-1174.

EUROPEAN COMMISSION (1999), *ESDP: European Spatial Development Perspective: Towards Balanced and Sustainable Development of the Territory of the European Union*, European Commission, Brussels.

EU MINISTERS RESPONSIBLE FOR SPATIAL DEVELOPMENT (2007), *Territorial Agenda of the European Union*. Agreed on 25 May 2007, Leipzig.

HALL P., PAIN K., (eds.) (2006), *The Polycentric Metropolis: Learning from Mega-city Regions in Europe*, Earthscan, London, 246 p.

INSTITUT DE GESTION DE L'ENVIRONNEMENT ET D'AMENAGEMENT DU TERRITOIRE, ULB (Lead partner) (Ed), (2007), *ESPON 1.4.3: Study on Urban Functions, Final report*, Brussels/Luxembourg: ULB/ESPON Monitoring Committee, https://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/Studies/ScientificSupportProjects/UrbanFunctions/fr-1.4.3_April2007-final.pdf (visited on 5/6/15).

KLOOSTERMAN R.C., MUSTERD S., (2001), The Polycentric Urban Region: Towards a Research Agenda, *Urban Studies*, vol. 38, n°4, p. 623-633.

KONSOLAS N., PAPADASKALOPOULOS A., PLASKOVITIS I., (2001), *Regional Development in Greece*, Springer, Berlin, 216 p.

LANASPA L., PUEYO F., SANZ F., (2003), The evolution of Spanish urban structure during the twentieth century, *Urban Studies*, vol. 40, n°3, p. 567-580.

MEIJERS E., (2008), Measuring polycentricity and its promises, *European Planning Studies*, vol. 16, n°9, p. 1313-1323.

MEIJERS E., SANDBERG S., (2008), Reducing regional disparities by means of polycentric development: Panacea or Placebo. *Scienze Regionali*, vol. 7, n°2, p. 71–96.

MEIJERS E. J., WATERHOUT B., ZONNEVELD W.A.M., (2007), Closing the gap: Territorial cohesion through polycentric development, *Refereed Articles, Oct 2007, 24, European Journal of Spatial Development*.

NIKOLOPOULOS P., (2017), *The Metropolitan Development of Athens: The Role of the 2004 Olympic Games*, Support for training and career development of researchers (Marie Curie Program) Evaluation of the legacies of sporting megaevents on social capital, General Secretariat of Research and Technology, Greece.

NORDREGIO (Lead partner) (Ed), (2004), *ESPON 1.1.1. Potentials for polycentric development in Europe* (Stockholm/Luxemburg: Nordregio/ESPON Monitoring Committee), https://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/Polycentricity/fr-1.1.1_revised-full.pdf (visited on 5/6/15).

NORDREGIO (Lead partner) (Ed), (2003), *The Role, Specific Situation and Potentials of Urban Areas as Nodes in a Polycentric Development*, ESPON Project 1.1.1, Third Interim Report, Stockholm: Nordregio, https://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/Polycentricity/3.ir_1.1.1-full.pdf (visited on 18/10/15).

VANDERMOTTEN C., (2017), Polycentricity, *The International Encyclopedia of Geography*, p. 1–4.

VENERI P., BURGALASSI D., (2012), Questioning polycentric development and its effects, Issues definition and measurement for the Italian NUTS-2 regions, *European Planning Studies*, vol. 20, n°6, p. 1017–1037.

WEGENER M., (2013), *Polycentric Europe: More efficient, more equitable and more sustainable?*, In International Seminar on Welfare and Competitiveness in the European Polycentric Urban Structure (Vol. 7).