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TERRITORIAL PATTERNS IN THE ACHIEVEMENT OF THE LISBON STRATEGY

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ABSTRACT

The main aim of the Lisbon Strategy was to make the EU "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (European Council, 2000). By 2010, most of these targets were not reached; so many criticisms were addressed at the Strategy. The piece sheds new light on the way EU regions have been achieving these targets: indeed, within the Strategy, the regional dimension has been traditionally neglected. Focusing on 75 regions belonging to France, Germany, Italy and Spain, a principal component analysis (PCA) is performed. PCA sums up the main dimensions characterising the regional performance according to the Lisbon Strategy: e.g., social cohesion, dynamism of labour market, R&D and innovation. As clear territorial patterns emerge, two hypotheses are tested. First, different regional performances are linked to a different extent of regional polycentrism: EU policies have always considered polycentrism as a pre-requisite for a more sustainable and balanced development. In the paper, it is estimated by analysing the rank-size distribution of cities within each region. Secondly, an exploratory spatial analysis is performed, by analysing local and global Moran's I test statistics. Whereas just few correlations between polycentrism and the achievement of the Lisbon Strategy's targets emerge, many components show spatial clustering: spatial location is still important in the achievement of the Lisbon Strategy's targets. In particular, the existence of a core-periphery pattern can be suggested.

JEL classification: O18, O52, R00, R10

Keywords: Lisbon Strategy, PCA polycentrism, rank-size distribution, Moran's I

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1 Introduction

Since 2000, the Lisbon Strategy has played a major role amongst the European Union (EU) policies. Resting on its three pillars, Lisbon Strategy's key goal was to make the EU "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (European Council, 2000). By 2010 (when it was replaced by the Europe 2020 Strategy) most of these goals have not been achieved. In spite of many criticisms targeted to it (e.g., the existence of conflicting or even wrong targets, the lack of a clear governance), this strategy tried to orient relevant EU interventions in promoting employment rates, competitiveness and social inclusion. However, a persistent and major bias has been observed: Lisbon Strategy has been applied at EU and national level, thus totally ignoring the regional dimension. Actually, wide differences exist within Europe, especially when considering Northern and Southern regions.

On the opposite side, regional issues have always been crucial within EU policies: several policies have been targeted at strengthening the territorial dimension of EU policies (CSD, 1999; European Union, 2007; Barca, 2009). In particular, they aim at reducing the economic disparities among EU regions and at promoting social cohesion in the process of EU integration (Neal, 2007). So far, regions have been one of the most important territorial levels of intervention in promoting a greater cohesion within the EU (today, EU's regional policy holds second place as a share of EU total expenditures after the CAP).

In spite of these efforts, differences across EU regions could still affect their performance when dealing with the Lisbon Strategy. The piece focuses on these differences, by considering the regions of Italy, France, Spain and Germany. A multivariate statistical analysis (principal component analysis) detects the main features characterising the regional performances according to the Lisbon Strategy's targets. Then, the wide differences in EU regions' performances are explained by testing two different hypotheses.

Firstly, we focus on the relationships which link the achievement of these targets with the extent of the polycentric development at the regional level. In the 1960s, the concept of polycentrism was first adopted as a theoretical tool in the analysis of the spatial organisation of metropolitan regions (Ostrom *et al.*, 1961). Lately, the concept has assumed a more normative relevance in most of EU territorial documents (Davoudi, 2003; Faludi, 2006) and now a polycentric development is acknowledged to be a main pre-requisite for a more sustainable and balanced development (CSD, 1999). In particular, the economic integration of the areas which are located outside the "Pentagon" (i.e. the area marked by its corners London–Paris–Milan–Munich–Hamburg) is crucial to assure both a greater competitiveness

to the whole EU (CSD, 1999; Faludi, 2006). In the piece, we are interested to a smaller scale of analysis, thus looking at regional polycentrism. To this extent, polycentrism can be considered both as a way of territorial organization and as an output of the local governance generated at an intermediate scale (i.e., a scale greater than the urban one but smaller than the national one). Thus, polycentric regions are economic and political actors as well as large metropolitan areas: as a consequence, regional polycentrism could represent a useful tool in the analysis of the achievement of the Lisbon Strategy's targets. According to these features, both a morphological perspective and a functional one should be considered when measuring regional polycentrism. Unfortunately, measuring functional polycentrism is not an easy task: therefore, the paper just focuses on the morphological perspective.

Secondly, the presence of spatial patterns in the performance of the EU regions according to the Lisbon Strategy is tested. In particular, an exploratory spatial analysis is performed to test the presence of the spatial dependence in the obtained results. Spatial dependence refers to "the existence of a functional relationship between what happens at one point in space and what happens elsewhere" (Anselin, 1988 – p. 11). Thus, what is highly relevant in explaining the value of a given variable in a region is the spatial location of that region compared to that of the other regions. In particular, the obtained results could suggest the existence of a peculiar core-periphery pattern.

The paper is organised as follows. Section 2 sums up the two major theoretical backgrounds on which the paper rests: the characteristics of the Lisbon Strategy (section 2.1) and the development of the concept of polycentrism in EU (section 2.2). Section 3 focuses on PCA and on the results about regional performances according to the Lisbon Strategy's targets. In section 4, the extent of polycentrism within the EU regions is measured according to a morphological perspective (rank-size distribution). Then, the existence of correlations between policentrism and Lisbon Strategy's targets are tested. Section 5 focuses on the presence of spatial correlation in the achievement of the Lisbon Strategy's targets, according to a core-periphery pattern. Section 6 concludes the work.

2 Theoretical background

2.1 The Lisbon Strategy

The Lisbon Strategy was launched at the Lisbon European Council (March 2000). It was aimed at boosting employment, as well as at promoting new economic reform and social cohesion, within the general framework of a knowledge-based economy. Moreover, it was aimed at innovating EU governance, by enhancing different forms of interactions between

national governments and the EU (Natali, 2010). Indeed, the Strategy was considered as a way to transform the EU project, which had been characterized by lack in productivity and innovation (especially when compared to the US) since the 1970s (Sapir, 2004; Rodrigues, 2002, Zeitlin, 2008, Natali, 2010). Such a major transformation was based upon three main dimensions or 'pillars' (European Council, 2000):

i) an economic pillar, devoted to the preparation of the ground for the transition to a more competitive, dynamic and knowledge-based economy. The pillar includes also policies targeted to the economic growth (e.g., the increase in the integration among EU national markets; the promotion of EU competitiveness);

ii) a social pillar with the aim of modernising the European social model through more investments in education and training as well as through the promotion of the employment. The pillar's main target is the increase in EU cohesion;

iii) an environmental pillar (added at the Göteborg European Council in June 2001), that draws greater attention to the impact of the economic growth on the use of natural resources[3].

By 2010, the Lisbon Strategy has largely missed its main targets. Thus, several criticisms have been lately targeted to it: these became even stronger in the light of the recent economic crisis.

Such criticisms can be grouped into two main analytical dimensions (Natali, 2010). According to the political and economic foundations of the Strategy, the Lisbon Strategy was considered as a wrong strategy for the EU integration: it enhanced convergence between different economies, thus increasing the risk for a 'clash of capitalisms' (Hopner and Schafer, 2007). The same agenda of the Strategy was partially wrong: both its liberal mark and its progressive shift towards a right-centred approach were stressed as critical issues (Amable, 2009; Rodrigues, 2002). The second critical dimension is related to the governance of this strategy. First, EU has not developed proper economic policy institutions to foster its growth. Moreover, the participation in the Strategy was uneven: the Open Method of Coordination (OMC), though emphasizing subsidiarity through new democratic experimentalisms (Smismans, 2008), suffers from methodological ambiguity. However, the OMC made national legislations more and more homogeneous (Zeitlin, 2007; Tucker, 2003).

Other biases can be addressed at the Lisbon Strategy. In dealing with the transformation of the EU social model, the strategy is targeted at the EU level. Actually, the deep differences which

3. The new Europe 2020 Strategy represents a much more effective reform programme, which is based on a smart, inclusive and sustainable growth (European Commission, 2010).

exist amongst the 27 EU Member States have never been considered. Nordic Countries, Mediterranean ones and Eastern ones sharply differ from each other. Sapir (2006) has already stressed these differences at national level[4]. At the same time, deep differences exist within the EU Member Countries, too (i.e. at the regional level). Nevertheless, Lisbon Strategy seems to ignore the existence of any regional dimension, although this is critical in order to change the EU social model and achieve the Lisbon Strategy's targets. Such a bias is even more evident, if we consider that many other EU policies have been addressed at the regional level. Among them, EU policies fostering regional polycentrism could play an important role.

2.2 The polycentric development in EU policies

Since the 1960s, the concept of polycentrism has been adopted as a theoretical tool in the analysis of the contemporary spatial organisation of some metropolitan regions, especially in the US (Ostrom *et al.*, 1961). In the 1990s, the concept assumed a more normative relevance (Davoudi, 2003; Faludi, 2006). Since the presentation of the "European Spatial Development Perspective" (CSD, 1999) and the approval of the "Territorial Agenda of the European Union" (European Union, 2007), a set of normative tools has been applied in order to achieve crucial EU policy objectives. Recommendations were mainly oriented to a more polycentric urban development, which could counterbalance the central role still played by the more central regions in the EU (e.g., the so-called "Pentagon"). Moreover, also explicit and closer urban-rural partnerships were suggested to take place (Guérois and Pumain, 2002).

Therefore, polycentric development was seen as both a main pre-requisite for a more sustainable and balanced development (CSD, 1999) and a key policy goal. In 2009, the report "An Agenda for a Reformed Cohesion Policy" (Barca, 2009) acknowledged the role of networked polycentric regions as a way to promote balanced territorial development as well as to overcome the disadvantages that arise from bigger urban agglomerations. However, in comparison to the US, large urban agglomerations are not a typical feature of the European urban system (Le Galès, 2006)[5].

In spite of these key ideas, definitions about polycentrism are generally quite "vague" (Riguelle *et al.*, 2007 – p. 195). It is a typical multiscalar and multidimensional concept: a region may be polycentric at a given spatial scale but monocentric at a smaller one. In this work, we are mainly interested in regional polycentrism. According to this perspective, there

4. In Sapir (2006), just Western EU countries were considered. In a previous work, Bertolini and Pagliacci (2011) extended the analysis of Sapir also to EU Eastern Member Countries.

5. US urban agglomerations are bigger and less connected to each other than EU ones. In the EU, agglomeration economies are also generated by "dense networks of big or middle sized cities" (Barca, 2009 – p. 18).

is a general consensus among scholars about polycentric regions' main features. Within these regions, cities are usually located in close proximity to each other, even though they maintain clear historical distinctions. Moreover, they constitute independent political entities, lacking a leading city (Kloosterman and Musterd, 2001). At the same time, they are well-connected (Meijers, 2008) and interrelated through co-operation flows (Cowell, 2010).

Moreover, polycentrism represents a way of managing larger urban regions, too: in doing so, it differs from larger single-core metropolitan regions that, since the seminal work of Alonso (1964), have been recognized as key economic actors in regional and urban economics. As a consequence, when dealing with regional polycentrism, both the morphological and the functional perspective have to be considered (Nordregio, 2004; Veneri and Burgalassi, 2010): the former focuses on the distribution of cities according to their dimensions (Lambooy, 1998; Parr, 2004; Meijers, 2008); the latter focuses on the interactions among urban centres, by analysing the flows of people, goods or information (Van der Laan, 1998; Hall and Pain, 2006; Limtanakool *et al.*, 2007).

Polycentrism has not only been used as a tool to describe a specific way to organise land and territory. According to the main EU territorial documents, it represents a strategic tool able to promote economic competitiveness (Hague and Kirk, 2003), social cohesion (Meijers and Sandberg, 2008) and environmental sustainability (CSD, 1999). However, several concerns about polycentric development may arise. First, the positive effects of polycentrism often lack a theoretical rationale (Meijers, 2008; Veneri and Burgalassi, 2010). Then, these effects have not been sufficiently investigated through empirical analysis (Meijers, 2008). Moreover, a more theoretical issue is represented by the coherence of these policies with other EU policies and in particular with the Lisbon Strategy. In particular, the effects of a more polycentric development on the targets of this Strategy are not so straightforward, due to the fact that the Strategy itself does not take this regional perspective into account.

3 Assessing the regional performance according to the Lisbon Strategy through PCA

3.1 The sample of regions

Our sample includes 59 NUTS-2 regions *(Nomenclature of Territorial Units for Statistics)* of 3 EU Countries: France (22 *Régions*), Italy (21 *Regioni*) and Spain (16 Spanish *Comunidades Autónomas*). The sample also includes 16 Germany NUTS-1 regions (*Länder*). Because of their geographical distance, we have excluded the French Départements d'outre-mer (DOM) of Guadeloupe, Martinique, Guyane and Réunion amd the Iles Canarias (Spain). Ciudad Autónoma de Ceuta and Ciudad Autónoma de Melilla (Spain) are excluded, too. When

computing the extent of polycentrism through rank-size index, the total sample is reduced from 75 to 72 regions as 3 German *Länder* are *Stadtstaaten* (i.e., city-states). Therefore, they are considered as belonging to the *Flächenländer* (i.e., area states) containing them.

3.2 Methodology: the Principal Component Analysis (PCA)

The principal component analysis is performed to sum up the performance of the regions, according to the main targets of the Lisbon Strategy (e.g., economic competitiveness, social cohesion, extent of investments in education and human capital, environmental sustainability). In particular, 25 socio-demographic, economic and environmental variables (periodically available at regional level) are collected, according to several statistical sources: the Regional Statistics of the Eurostat Database (Eurostat, 2011) and the Fifth Report on Economic Social and Territorial Cohesion Report (European Commission, 2010). Data referring to regional accessibility (which refer to the NUTS 3 level) are provided by the ESPON database (2006). Data generally refer to years 2005 to 2009[6]; whereas data on regional accessibility refer to year 2001. In Appendix A, the definition, the statistical source and the reference year for each variable is provided.

Principal components analysis (PCA) is then applied to the dataset. PCA belongs to multivariate statistics: it reduces the number of variables of a system while preserving the most of the information (Pearson, 1901; Hotelling, 1933). Moreover, PCA allows us not to make strong *a priori* assumptions about the best model to be chosen. In particular, PCA can transform a group of p indicators, obtained on a group of n statistical units, into a much smaller group of variables, explaining a high level of variance of the original data (thus avoiding an important loss of information). Moreover, whereas the original variables are highly correlated, the indicators (or principal components) are uncorrelated. We compute the PCA moving from the correlation matrix Then according to the obtained components, we can compute the scores for each statistical unit (the 75 regions of the sample). The k components (where $k < p$) come from the following linear combinations, expressed as a matrix:

$$Y = X A \qquad (1)$$

where Y is the n-by-k matrix, containing the scores of the n statistical units in the k components; A is the vector matrix p-by-k of the normalized coefficients; X is the n-by-p matrix of the standardized data. In order to simplify the interpretation of the factor loadings, principal components are orthogonally rotated (thus maintaining uncorrelation among factors)

6. Thus, the impact of the current economic crisis has been voluntarily neglected.

with VARIMAX. After the rotation, the total variance explained by the components is reduced.

3.3 Main results: the regional performance according to the Lisbon Strategy's targets

Working on the original dataset, the main features of the regional performance according to the Lisbon Strategy's targets are identified. First, KMO test is performed. The test is a measure of sampling adequacy: it tests whether the partial correlations among variables are small. In our case, a value of 0.7633 is considered good. Then, different methods can be used to define the right number of principal components (PCs) to be chosen: i) the Guttman-Kaiser criterion (i.e., taking the components which are able to explain at least 70-80% of cumulative variance); ii) the choice of the PCs with eigenvalue over 1; iii) the analysis of the *elbow* on the scree plot. Combining all these methods, we select 6 components representing 81.9% of the total variance. PCs are then orthogonally rotated with VARIMAX: after the rotation, the total variance explained by the components reduces to 76.5%.

In table 1, factor loadings which are greater than 0.2 are shown. According to them, the following explanation about the extracted PCs can be suggested. PC1, accounting for 21.9% of total variance, is positively linked to the resident population, the share of land used for artificial purposes and the average accessibility. PC1 is negatively linked to the share of agricultural GVA and employment on the total. Therefore, PC1 describes regional urbanization and accessibility. PC2 (15.3% of total variance explained) is positively linked to total unemployment and long-term unemployment rates, as well as to the share of population at risk of poverty after social transfers. On the opposite side, it is negatively related to per capita GDP. Therefore, PC2 identifies a weak economic performance as well as social exclusion. PC3 (12.2% of total variance) is positively associated to employment rates. A negative relation is observed between PC3 and the share of less educated people. Thus, PC3 sums up well-performing labour markets. PC4 (11.6% of total variance explained) is positively associated to a higher level of early school leavers and to a greater share of less educated people on the total. Therefore, it identifies labour markets characterised by a large presence of low-skilled workers. PC5 (8.2% of the total variance) is positively related to GVA and employment in industrial sectors. Therefore, the component highlights the presence of manufacturing at regional level. The last component (PC6, explaining 7.3% of the total variance) is positively linked to tertiary education, to R&D expenditures and to the share of households with broadband connection. Thus, it is a proxy for the general level of innovation and for investments in human capital.

Table 1 – Factor loadings for the 6 PCs (after VARIMAX rotation)

	Factor1	**Factor2**	**Factor3**	**Factor4**	**Factor5**	**Factor6**
Resident Population	**0.716**					
GDP per capita	0.481	**-0.568**	0.247			
GVA of agriculture	**-0.636**			0.225		
GVA of manufacture	0.213		0.236		**0.909**	
Employment in agriculture	**-0.643**	0.246	-0.287	0.258		
Employment in manufacture		-0.325			**0.904**	
Total employment rate		-0.528	**0.765**			
Total employment rate (55-64 y)	0.381		**0.659**			
Female employment rate		-0.430	**0.759**	-0.346		0.240
Unemployment rate		**0.896**		0.266	-0.225	
Long-term unemployment rate		**0.892**		-0.283		
Unemployment rate (15-24 y)	-0.252	0.560	-0.520	0.397	-0.232	
Population with low education	-0.386		**-0.527**	**0.700**		
Population with tertiary education		-0.227				**0.920**
Early school leavers				**0.963**		
R&D expenditures	0.561			-0.271		**0.426**
Patents per million inhabitants	0.687		0.247	-0.297	0.209	
Household with broadband connection	0.496		0.501			**0.405**
Population at risk-of-poverty (after social transfers)		**0.794**	-0.300	0.284		
Concentration of PM_{10}	**0.666**		0.205		0.203	
Land for artificial uses (% on total)	**0.599**					
Passenger cars per 1000 inhabitants		-0.284	-0.211			-0.582
Railroad accessibility	**0.606**		0.248	-0.516		
Road accessibility	**0.562**		0.266	-0.519		
Air accessibility	**0.905**					

Source: elaboration on Eurostat (2011), © ESPON Database (2006), European Commission (2010)

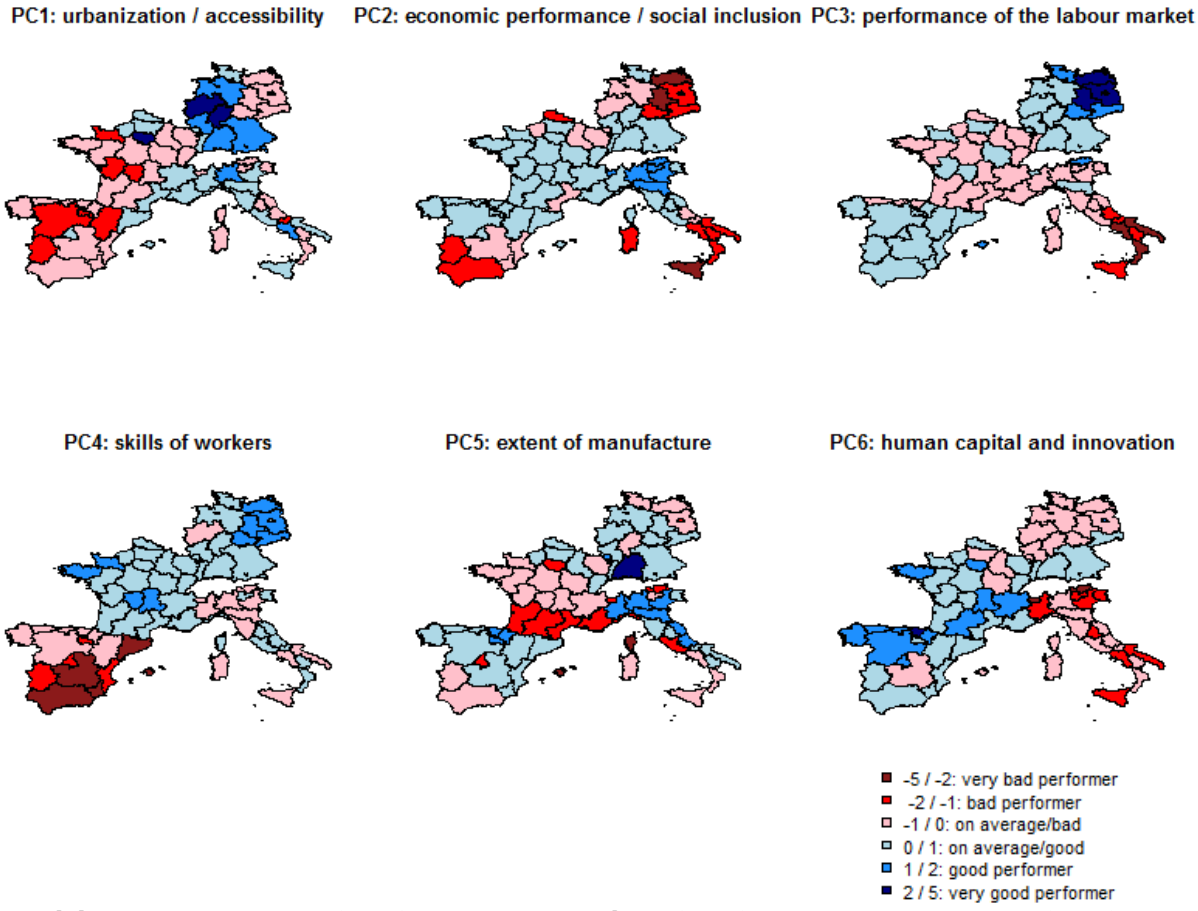
According to these results, we can measure regional performances according to the Lisbon Strategy's key dimensions, by assigning a standardized score on each extracted PC to each region[7]. In figure 1, results according to each PC are shown: worse performing regions (i.e. regions whose score is below the average) are in red colours; better performing ones (i.e. regions whose score is above the average) are in blue colours.

Referring to PC1 (urbanization and accessibility), Western German *Länder* as well as Île de France show the highest scores. On the opposite, rural regions in Western France and many Spanish ones show the lowest scores: they are affected by both low accessibility and rural features. Weak economic performance and social exclusion (PC2) mainly affect four groups of regions: Southern Italy; the German *Länder* belonging to the former German Democratic Republic; regions in Southern Spain (e.g. Andalucia); Nord-Pas-de-Calais (in France). Moving to the labour market (PC3), all the *Länder* in Eastern Germany perform quite well: they show the highest employment rates within the sample. Positive scores for PC3 are also shown in Spanish regions. On the opposite side, regions in Southern Italy are affected by a very poor labour market performance. According to PC4 (low-skilled workers), Spanish regions (and especially Southern ones) perform worse than both French and German one

7. The regression method of Thomson (1951) is adopted.

(whose labour markets generally employ high-skilled workers). Scores for Italian regions are generally on average. PC5 is associated to the presence of manufacture. More manufacturing regions are spatially scattered across the sample: Baden-Württemberg and Saarland in Germany; País Vasco and Navarra in Spain; Northern and Central regions in Italy. Instead, regions hosting capital cities are among the least industrialised of the sample, according to the stronger relevance of services within those regional economies. Moreover, all the Mediterranean regions are amongst the least industrialized regions. Scores for PC6 (investments in human capital and innovation) are lower across Italian regions than across Spanish and French ones. Regions in Northern Germany (with few exceptions) perform below the average, too. Therefore, according to human capital and innovation, a sharp distinction between Northern regions and Southern ones does not emerge.

Figure 1 – Scores for the six obtained PCs



Source: elaboration on Eurostat (2011), © ESPON Database (2006), European Commission (2010)

Therefore, at the EU scale, different territorial patterns according to the three pillars of the Strategy itself seem to emerge. For instance, high employment rates and high investments in human capital are not always positively linked to the level of regional wealth. Two examples

may clarify this issue. In spite of their high employment rates and high-skilled workers, Eastern German *Länder* are affected by low levels of per capita GDP and by high unemployment rates. Rural French regions are well performing according to the Lisbon Strategy's tasks, as they have deeply invested in human capital, R&D and broadband connections. In spite of these efforts, employment rates are still below the average. On the opposite side, Mediterranean regions perform worse than Continental ones: thus, the findings already highlighted by Sapir (2006) at national level are confirmed. In spite of this general pattern, Spanish regions' performance is better than that observed across Italian ones. Spain has deeply invested in innovation and human capital, thus increasing employment rates (note that we are not considering the effects of the current economic crisis). Nevertheless, regions in Southern Spain are affected by a weak economic performance (with high unemployment rates) as well as a stronger presence of low-skilled workers. On the contrary, Italian regions are among the worst performing regions in the sample. Labour market's performance is poor just in Southern regions, but the investments in R&D and the skills of workers are below the average also in the Northern Italian regions.

According to these different patterns, other structural features can be relevant in explaining these regional performances. Therefore, two main hypotheses can be tested. First, regional performance is linked to the extent of polycentrism; then, an exploratory spatial analysis is performed. As the historical core of Europe (also known as Blue Banana) still shows better social economic performance than more peripheral regions, the presence of such a core-periphery model (as suggested by Krugman, 1991) can be tested.

4 Regional Polycentrism and the Lisbon Strategy

4.1 Methodology: the rank-size distribution

A polycentric region is an area which is characterised by several cities lacking a clear hierarchy. In literature, several ways to measure this feature have been proposed: some of them focus on the functional perspective; others focus on the morphological one (Nordregio, 2004; Veneri and Burgalassi, 2010). Due to a severe lack in statistical data about flows of people or goods across cities in EU regions, in the paper we mainly refer to the morphological (or geographical) extent of polycentrism. According to this perspective, the rank-size index can be a crude but very useful tool to measure regional polycentrism, which has been widely used (Haggett, 1965; Nordregio *et al.*, 2004; Meijers, 2008; Veneri and Burgalassi, 2010). Following these works, within each region cities are ranked according to their population. Then, the following equation (2) can be estimated:

$$\text{Ln (pop)} = \alpha + \beta \text{ Ln (rank)} \qquad (2)$$

It is the so-called rank-size equation, as expressed in the Lotka form (Parr, 1985). This is a special applications of Zipf's Law (Zipf 1935; 1949)[8]. According to it, when cities within a given region are arrayed by their size (or population) on double-log graph paper, the 'log-normal' distribution takes the form of a straight line, whose slope is close to -1. Although the law seem holding for both big countries (e.g., India, China, the US) and the whole EU, all the suggested explanations pose considerable difficulties. Gabaix (1999) suggests that Zipf's Law for cities follows the same analytical framework proposed by Gibrat's Law for firms' size distribution: cities grow randomly with the same expected growth rate and the same variance, i.e. the growth process of cities is independent of size. However, the rank-size rule is not a law (McCann, 2001): so, the theoretical problem about its economic explanation is still open.

In the paper, we use the Lotka form, as shown in (2), to establish the extent of polycentrism within each region. In particular, β is the slope of the regression line, which is estimated through OLS method. Different values of β provide the level of polycentrism within a given region: the higher its value, the more polycentric a region is. The result is straightforward. In a polycentric region, with little hierarchy, the slope of the OLS regression line is generally greater than -1 (i.e., regression line is flatter). The opposite holds for monocentric regions: in this case, β is smaller than -1 (i.e., the regression line is steeper).

Although it is straightforward, the rank-size index is a quite crude measurement. Several issues can be highlighted. First, when carrying out comparative analysis involving urban areas, basic problems of definition have to be addressed. The adoption of the concept of functional urban region (FURs) should be more appropriate in this identification problem. However, as the paper deals with a great number of urban areas in different countries, administrative units are used. In particular, we refer to Italian *comuni*, Spanish *municipios*, French *communes* or, in some cases, *communautés d'agglomeration*[9] and German *gemeinden*. Data about the population of Italian, Spanish and French cities refer to national Censuses (Italian Census and Spanish one date back to 2001; French Census dates back to 1999). Data about German cities' population refer to 2008[10].

8. The original law simply states that the frequency of any word is inversely proportional to its rank in the frequency table: the most frequent word occur twice as often as the second most frequent one, three times as often as the third most frequent one, and so on. The presence of such a distribution in rankings of cities by population was first noticed by Auerbach (1913).

9. France has a wide number of *communes*. Larger French cities are generally covered by several *communes*. *Communautés d'agglomeration* are groups of *communes* which are in charge of managing greater urban areas, so they are good proxy for urban areas.

10. Urban systems are stable over time: data referring to different years are generally comparable (Batty, 2001).

A second issue is related to the fact that estimations may be affected by the number of cities included in the OLS regression analysis. The regression line can be estimated by adopting: i) a fixed number of towns per region; ii) a fixed size threshold of inhabitants; iii) a size above which the sample accounts for some given proportion of regional population. Following Meijers (2008), option i) has been selected, as regions in the sample are heterogeneous[11]. According to this option, another issue deals with the exact number of cities to be included within the OLS model. Meijers (2008) suggests selecting few cities per region, so we measure the extent of polycentrism by estimating the slope of the regression line of the rank-size distribution according to the five, eight, ten, twelve and fifteen largest cities within each region. In particular, our main 'Polycentrism Index' is based on the estimations on the ten largest cities per region. Although it may seem arbitrary, this choice has been taken to counterbalance two opposite effects: the influence of national patterns when the number of cities included in the sample is greater than 12 and the influence of too local patterns, when such a number is below 8.

4.2 Main results: polycentric and monocentric regions in EU

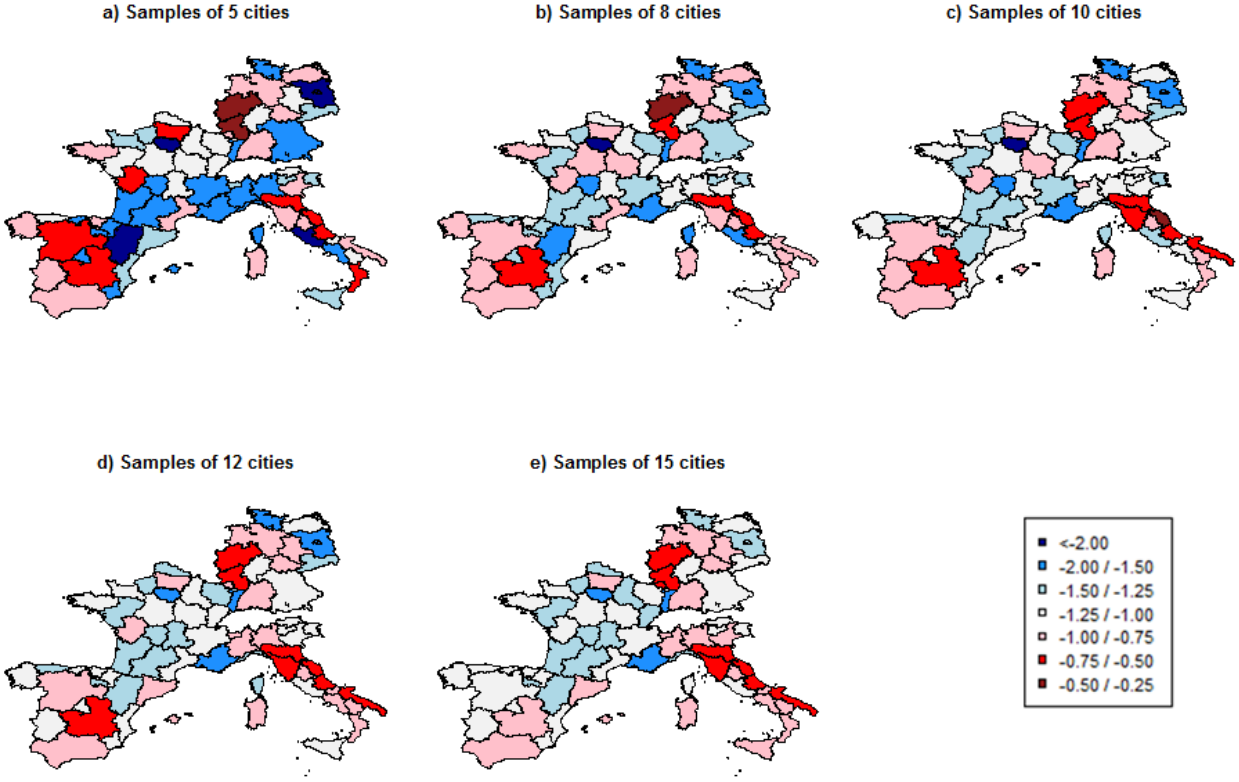
The extent of regional polycentrism is provided by estimating β in (2), through OLS method. When running OLS regressions on the 5, 8, 10, 12 and 15 largest cities per region, the obtained scores deeply change. When just considering the five largest cities per region, the average slope of the regression line equals to -1.2288. When the number of cities within each region is increased, the average slope moves toward -1, so validating the main results observed in literature: it equals to -1.0683 for the regression line based on 15 cities per region. Standard deviation strongly decreases in the latter case[12].

In figure 2, a broader picture the extent of mono-/ polycentrism within the 72 regions when changing the number of cities included in the analysis is shown. Some results may be highlighted.

11. In this case, the application of a fixed size threshold would be inappropriate: in larger regions a town of 10,000 inhabitants could be insignificant, whereas a similar town could be of a greater importance in smaller regions. Also the number of cities comprising a given proportion of the population may distort the analysis.

12. When estimating the coefficients on the basis of few cities per regions, scores are not normally distributed, whereas, when increasing the number of cities, they appear more and more normally distributed.

Figure 2 – Regions and their extent of mono-/ polycentrism, measured for samples of five, eight, ten, twelve and fifteen cities



Source: personal elaboration on Insee (1999), Istat (2001), Ine (2001), Destatis (2008)

When just considering the five largest cities within each region, the extent of mono-/ polycentrism seems to be deeply affected by location-specific features, e.g., by the peculiar distribution of the biggest cities in a given region. Therefore, extreme values in the estimated scores are common. On the opposite side, when considering a greater number of cities per region different, national patterns emerge. These patterns affect regional estimations, too: so, most of Italian and German regions are quite polycentric, whereas French regions are monocentric.

Therefore, these opposite effects are counterbalanced by referring to the estimations of the slope of the rank-size distribution based upon the ten largest cities per region (figure 2.c). Other estimations are used to check for robustness. In France, the most monocentric region is Île de France (β = -2.096), due to the presence of Paris. Also Alsace, Provence-Alpes-Côte d'Azur and Limousin are monocentric regions dominated by a single greater city. On the opposite side, only Poitou-Charente, Picardie and Bourgogne show polycentric features. German regions are generally more polycentric than French ones: Nordrhein-Westfalen and Rheinland-Pfalz are the two most polycentric German regions (β = -0.520 and β = -0.649,

respectively). These *Länder* are located along the River Rhein, including the Ruhr area, i.e. one of the most polycentric areas across Europe (Romein, 2004). Brandenburg and Schleswig-Holstein, on the contrary, are quite monocentric *Länder*, due to the presence of the two biggest German cities (Berlin and Hamburg). In Italy, the most polycentric region is Marche, which is the most polycentric region in the whole sample, too. However, also other regions belonging to the so-called *Third Italy* (Bagnasco, 1977; 1988) show typical polycentric features (e.g., Emilia-Romagna, Toscana, Abruzzo). Lazio, Liguria and Friuli-Venezia Giulia are monocentric regions. In Spain, South-Western regions (e.g., Andalucia, Castilla-y-Leon and Extremadura) are more polycentric than North-Eastern ones (Aragona, Asturias and La Rioja). In spite of the presence of Barcelona, Cataluna does not show very monocentric features.

4.3 Correlating the achievement of the Lisbon Strategy's targets to the extent of polycentrism

Moving from previous results, regional performance according to the Lisbon's Strategy is linked to the extent of polycentrism. According to literature, polycentrism is aimed at fostering an evener distribution of economic activities amongst regions. In particular, it would play a positive role on economic competitiveness and social cohesion (CSD, 1999; Hague and Kirk, 2003; Meijers and Sandberg, 2008).

Unfortunately, empirical results do not support this hypothesis. Polycentrism Index (estimated according to the 10 largest cities per region) is not significantly correlated to any key economic or social variables, such as per capita GDP, unemployment rate or total employment rate. Nor environmental indicators (such as the PM_{10} concentrations and the share of land used for artificial purposes) seem to be correlated to the Polycentrism Index[13]. A more complete analysis can be developed by observing the correlation amongst each PC from section 3 and the Polycentrism Indexes (table 2).

PC1 is not correlated to polycentrism: urban and central regions as well as more rural and peripheral ones can be polycentric regions. Furthermore, polycentric regions are not more inclusive than monocentric ones: PC2 ("weak economic performance and social exclusion") is positively correlated to Policentricity Index, even though such a correlation is not statistically significant. Referring to PC3 (labour market performance), no evidence emerges about the presence of a better labour market performance in polycentric regions. On the

13. Referring to environmental variables, several outliers may affect our estimations.

opposite side, polycentric regions tend to employ low-skilled workers. The correlation between PC4 and 15-cities Polycentrism index is positive and significant, although this result could be affected by the presence of stronger national patterns. Similar results emerge when considering PC6 ("human capital and innovation"). The component is significantly and negatively correlated to 10-cities Polycentrism Index. Thus, more polycentric regions host less investments in human capital, R&D and innovation An even more significant correlation emerges between PC5 ("extent of manufacture") and 10-cities Polycentrism Index. Polycentric regions are more manufacturing than monocentric ones. The correlation is significant and it holds whatever the Polycentrism Index is estimated (table 2).

Therefore, the extent of manufacture within the economy seems to be the most relevant feature of polycentric regions across Europe The opposite is also true: monocentric regions, which are characterised by the largest metropolitan areas in Europe (e.g., Île de France or Lazio), are more focused on tertiary activities. The relationship affects policies' effectiveness, too: manufacturing activities seem to represent one of the most relevant obstacles to fulfil the Lisbon Strategy's targets, thus creating new emerging divides amongst regions. Indeed, most manufacturing regions are still amongst the richest ones in Europe, but they are not fostering human capital investments at the same pace than in past decades. This phenomenon is clear especially among Italian regions. On the opposite side, less industrialized regions (e.g., most of French ones) show a better performance in terms of investment in R&D and human capital.

Table 2 – Correlations amongst extracted PCs and Polycentrism indexes

	Polycentr. Index – 5 cities	**Polycentr. Index - 8 cities**	**Polycentr. Index - 10 cities**	**Polycentr. Index - 12 Cities**	**Polycentr. Index – 15 cities**
PC1: urbanization and accessibility	-0.215	-0.160	-0.101	-0.049	0.020
	(0.064)	(0.1695)	(0.3893)	(0.6745)	(0.8664)
PC2: weak economic performance and social exclusion	0.101	0.086	0.091	0.116	0.142
	(0.3897)	(0.4613)	(0.4361)	(0.3232)	(0.2256)
PC3: performance of labour market	-0.128	-0.109	-0.118	-0.112	-0.090
	(0.2729)	(0.3515)	(0.3114)	(0.3379)	(0.4447)
PC4: low-skilled workers	0.007	0.091	0.159	0.216	**0.265**
	(0.9526)	(0.4393)	(0.1726)	(0.06219)	**(0.02151)**
PC5: extent of manufacture	**0.409**	**0.428**	**0.430**	**0.436**	**0.430**
	(0.0002743)	**(0.000128)**	**(0.0001197)**	**(0.00009)**	**(0.0001184)**
PC6: human capital and innovation	-0.187	**-0.288**	**-0.351**	**-0.417**	**-0.484**
	(0.1072)	**(0.01219)**	**(0.00199)**	**(0.0001955)**	**(0.00001)**

p-values in parentheses

Source: elaboration on Insee (1999), Istat (2001), Ine (2001), Destatis (2008) and on Eurostat (2011), © ESPON Database (2006), European Commission (2010)

5 Spatial patterns in achieving Lisbon Strategy's targets

In section 4, links between polycentrism and the achievement of the Lisbon Strategy's targets were found to be rather weak. Moreover, some links are not as expected: polycentrism has just related to the extent of manufacturing activities, to low levels in R&D investments and to low levels in workers' skills.

From figure 1, however, clear geographical pattern seem to emerge, and in particular by a strong core-periphery pattern. So geography matters when dealing with the Lisbon Strategy. In this section, we explore this geographic dimension by using an exploratory spatial data analysis (ESDA) approach. First, we test global spatial autocorrelation for the 6 obtained PCs, by using Moran's I statistics (Cliff and Ord, 1981). This is a synthetic measure of spatial autocorrelation, according to the following definition:

$$I = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \qquad (3)$$

In (3), *y* is the variable under analysis (each PC); $\bar{y}$ is the mean of the sample; *n* is the size of the sample (75 regions) and w_{ij} is an element of a row-standardized spatial weights matrix W, defined as:

$$w_{ij} = \frac{w_{ij}^*}{\sum_j w_{ij}^*} \qquad (4)$$

The generic element w_{ij}^*can take different values:

w_{ij}= 0 if *i=j and* if $j \notin N(i)$

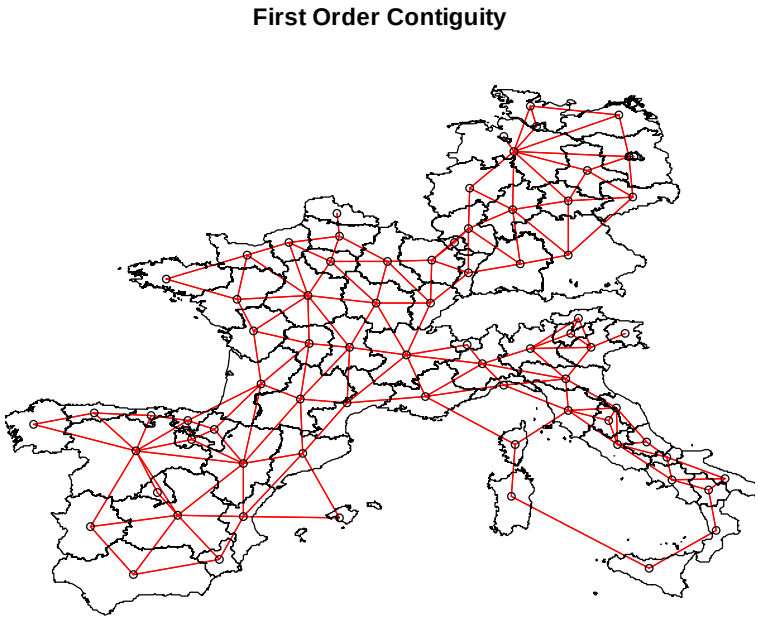
w_{ij}= 1 if $j \in N(i)$

N(i) is the list of neighbours of the region *i,* according to a first order queen contiguity matrix (i.e., two regions are considered as neighbours if and only if they share a common boundary or vertex[14], as suggested by Anselin, 1988). Islands have been artificially connected to other regions according to geographical and institutional features (figure 3).

Then, when computing the values of I for the 6 PCs previously defined, interesting features emerge (table 3). Each PC shows high values for the test. They are well above the null hypothesis of no spatial correlation (as suggested by p-value). Thus, each obtained component is spatially correlated: positive spatial dependence is even greater for the economic performance (PC2), the performance of labour market (PC3), the presence of low-skilled workers (PC4).

14. A distance matrix, based on the 4 nearest neighbours, has been used to check for robustness.

Figure 3 – The first order contiguity matrix



Source: personal elaboration

Table 3 – Global Moran's I statistics and p-value for the 6 extracted PCs

	Moran's I	**p-value**
PC1: urbanization and accessibility	0.3500	6.02E-06
PC2: weak economic performance and social exclusion	0.6333	3.65E-15
PC3: performance of labour market	0.7355	<2.2E-16
PC4: low-skilled workers	0.7053	<2.2E-16
PC5: extent of manufacture	0.1880	0.0078
PC6: human capital and innovation	0.5738	8.26E-13

Source: personal elaboration

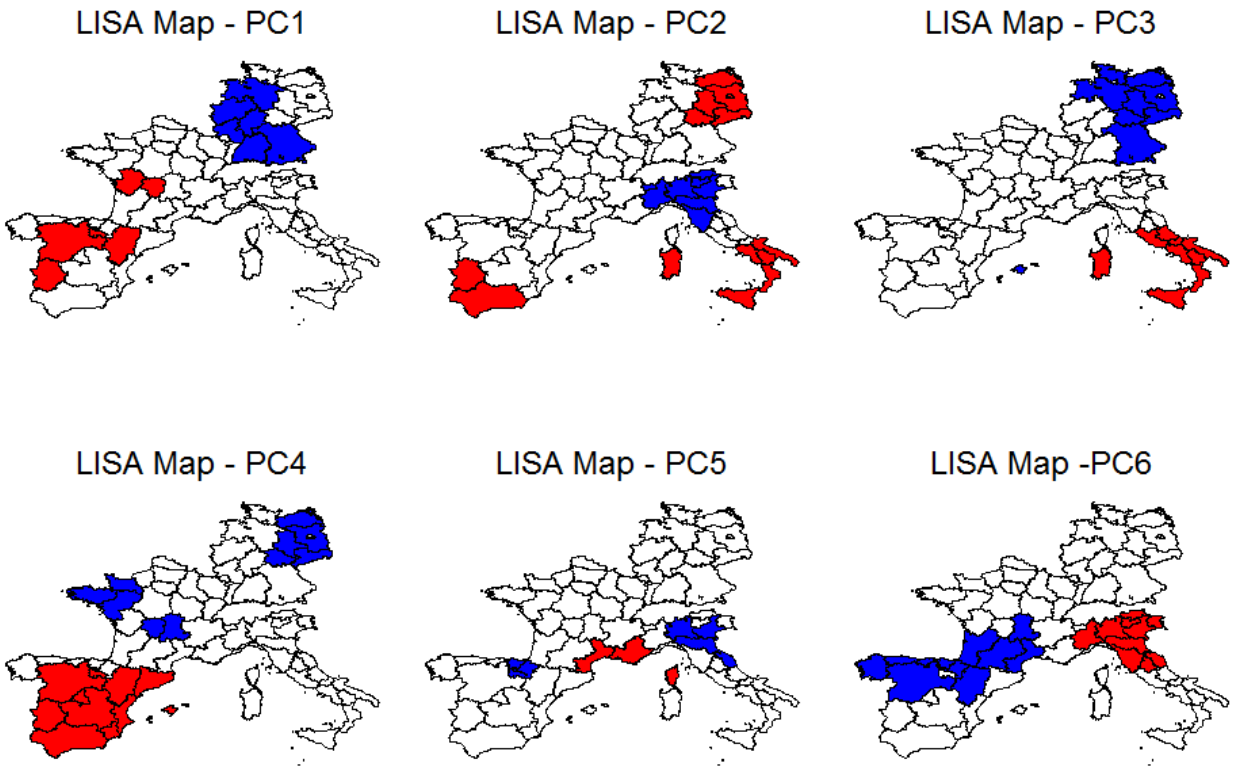
In order to detect geographic patterns we perform a local Moran test (Anselin, 1995). In figure 4, the LISA (local indicators of spatial association) cluster maps are reported. For each PC, they provide the significant locations color coded by type of spatial autocorrelation: in our case, blue for high-high and red for low-low (no high-low or low-high cases are reported). The adopted level of significance is p = 0.05.

According to these results, some conclusions may be drawn. First, a core-periphery pattern at the EU level partially emerges. In spite of the EU efforts towards an improvement in the territorial cohesion (CSD, 1999), more 'central' regions (more populous, more accessible and generally wealthier regions) still perform better than peripheral ones. Looking at the economic (PC2) and labour market (PC3 and PC4) performance, poor performing regions are

spatially clustered in peripheral regions, especially within Mediterranean ones. Therefore, the differences pointed out by Sapir (2006) between the Continental social model and Mediterranean one also hold at the regional level.

Within this general pattern, strong differences are also observed within each observed country Regional differences are even wider across the Italian regions and the German *Länder*. In these two countries, the divide between central regions and lagging behind ones (which are respectively the Southern 'Mezzogiorno' and the Eastern *Länder*) has stronger historical roots. On the opposite side, France seems to be characterised by a more homogeneous pattern at sub-national level, with smaller clusters.

Figure 4 – LISA cluster maps for the 6 PCs



Source: personal elaboration

6 Conclusions

In spite of the strong criticisms against the Lisbon Strategy, it has played a key role among EU policies, since 2000. A major bias, however, deals with the absence of any regional approach in the strategy. The paper tries to fill this gap, by focusing on the performance of the regions of four EU Countries according to the Strategy's main targets. Through PCA, wide

differences within EU regions' performances emerge. These differences are then explained by testing two different hypotheses: the effect of the extent of polycentrism and the presence of spatial effects.

Our analysis does not support the hypothesis that a more polycentric development at the regional level could really foster the achievement of the Lisbon Strategy targets. A more polycentric development does not remove the new emerging divide between innovative poles and manufacturing regions. One of the main findings is just the fact that regional polycentrism is deeply related to manufacturing activities, which are spread across the territory.

On the contrary, spatial and geographic patterns seem to play a more important role in describing regional performance according to the Lisbon Strategy. In particular: i) the core-periphery pattern at the EU scale has not been totally removed yet: more central regions are still the best performing areas within the continent; ii) patterns at the national level are still important in explaining different regional performances. Thus, it is quite hard supporting the hypothesis that a more polycentric development could bring more social cohesion and long-term economic competitiveness to EU regions, as suggested by the ESDP (CSD, 1999).

At the same time, the clear lack of any regional approach to the Lisbon Strategy has represented a deep bias in the application of the strategy itself. It has been unrealistic to consider the whole EU as a homogeneous area, able to tackle the same challenges in a similar way. Thus, this lack has hindered the fully achievement of the Lisbon Strategy targets by 2010. Now, there is a stronger need for a general re-framing of the policy agenda of the EU: regions should be treated separately and Europe 2020 Strategy should take into account these region-specific features and issues. In particular, Europe should become a stronger global economy thanks to its heterogeneity and not in spite of it.

7 Appendix A

Table A.1 provides the list of the 25 social, economic and demographic variables which are used for PCA. Statistical sources and reference year are also shown.

Table A.1 – Description of variables used for PCA

Variable	**Source**	**Refer. Year**
Resident Population	Eurostat	2009
GDP per capita (EU-27 = 100)	Eurostat	2008
GVA agriculture (% on the total)	Eurostat	2007
GVA industrial sect. (% on the total)	Eurostat	2007
Employment in agriculture (% on the total)	Eurostat	2007
Employment in industrial sect. (% on the total)	Eurostat	2007
Total employment rate	Eurostat	2008
Employment rate (55-64 years)	Eurostat	2008
Female employment rate	Eurostat	2008
Unemployment rate	Eurostat	2008
Long-term unemployment rate	Eurostat	2008
Unemployment rate (15-24 years)	Fifth report on cohesion	2008
Population at risk of poverty after social transfers (% of total population)	Fifth report on cohesion	2008
Early school leavers aged 18-24 (in % on the total of the same age)	Fifth report on cohesion	2007-2009
Population aged 25-64 with low education (% on the total)	Fifth report on cohesion	2008
Population aged 30-34 with tertiary education (% on the total)	Fifth report on cohesion	2008
Expenditure on R&D (% of GDP)	Eurostat	2008
Patent application to EPO per million inhabitants	Fifth report on cohesion	2006-2007
Households with broadband connection (% of all households)	Fifth report on cohesion	2009
Land for artificial uses (% on total)	Eurostat	2009
Railroad accessibility (average value of Nuts 3)	Espon	2001
Road accessibility (average value of Nuts 3)	Espon	2001
Air accessibility (Nuts 3 with max accessib.)	Espon	2001
Passenger cars per 1000 inhabitants	Eurostat	2008
Yearly average concentration of PM_{10} ($\mu g/m^3$) (average value of Nuts-3)	Fifth report on cohesion	2009

Source: elaboration on Eurostat (2011), © ESPON Database (2006), European Commission (2010)

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