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REGIONAL DISPARITIES IN THE EUROPEAN UNION AND THE ENLARGEMENT PROCESS:
AN EXPLORATORY SPATIAL DATA ANALYSIS, 1995-2000

by

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REAL 04-T-7 August, 2004

Regional Disparities in the European Union and the Enlargement Process: An Exploratory Spatial Data Analysis, 1995-2000

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May 2004

Abstract:

The aim of this paper is to study the space-time dynamics of European regional per capita GDP in the perspective of the enlargement of the European Union. We find strong evidence of global and local spatial autocorrelation as well as spatial heterogeneity in the distribution of regional per capita GDP in a sample of 258 European regions including regions from acceding and candidate European countries over the period 1995-2000. However, contrary to previous results obtained in the literature highlighting a North-South polarization scheme, the enlargement process leads to a new North-West – East polarization scheme. The economic dynamism of EU15 regions and acceding or candidate regions is also investigated by exploring the spatial pattern of regional growth. Implications for regional development and cohesion policies are finally explored.

JEL classification: O18, O47, O52, R11, R12

Key words: European Union, Exploratory Spatial Data Analysis, regional disparities, spatial autocorrelation, spatial heterogeneity

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* A previous version of this paper has been presented at the 3rd Spatial Econometrics Workshop in Strasbourg, June 9th, 2004. We would like to thank J. Le Gallo for her valuable comments. We would also like to thank A. Behrens from the regional statistics section (division E4) as well as J. Recktenwald and I. Dennis for the help they provided on the Eurostat-Regio database. The usual disclaimer applies.

1. Introduction

The European enlargement process to Central and Eastern European countries as well as to Malta and Cyprus in 2004 (EU25) and then to Bulgaria and Romania in 2007 (EU27) poses a previously unprecedented challenge to both regional and social cohesion policies in the European Union. The European Union will actually have to face a substantial widening of economic disparities as well as a modification of the relative spatial distribution of wealth.

This geo-economic challenge can be illustrated with the following figures. First, as highlighted in the Third Report on Economic and Social Cohesion (2004) and the Second Progress Report on Cohesion (2003), the enlargement will induce an increase of about 30% of the total European area and an increase of more than 25% of the population, whereas in the same time GDP will increase by only 5% in Purchasing Power Standards (PPS). Second, a new group of States will emerge in the enlarged Union: those with income of less than 40% of the European Union average. The centre of gravity of cohesion policy will also shift to Eastern Europe. Finally, regional inequalities will substantially increase as the ratio between the richest and the poorest region was about one to five for UE15 in 2000, while it will be of one to nine in EU25 and one to thirteen in EU27.

Moreover, the enlargement process will seriously complicate the implementation of the future European regional policy in 2004 and then in 2007. It will be necessary to contribute to the development of the regions most in need in the new Member States, but also continue providing assistance for the enduring difficulties in the presently lagging behind regions in EU15. Several propositions have been made to the European Commission to give an answer to these new problems. However, it may seem surprising that the spatial dimension of the distribution of regional disparities in the enlarged European Union have been neglected. Trade between regions or countries, technology and knowledge diffusion, and more generally local externalities and spillovers involve spatially dependent regions or countries. Conley and Ligon (2002) develop an empirical approach that explicitly allows for interdependence among countries, and they underline

the importance of cross-country spillovers in explaining growth using an international dataset. Spatial dependence or autocorrelation can be defined as the coincidence of value similarity with locational similarity (Anselin 2001). Therefore, there is positive spatial autocorrelation when high or low values of a random variable tend to cluster in space and there is negative spatial autocorrelation when geographical areas tend to be surrounded by neighbors with very dissimilar values. Another spatial effect that is of interest in this framework is spatial heterogeneity, which means that economic variables are not stable across space and that polarization or stratification patterns may be relevant under the form of spatial regimes: a cluster of poor regions contrasting with a cluster of rich regions.

Spatial interactions between regions can be evaluated using Exploratory Spatial Data Analysis (ESDA), which is a set of techniques aimed at describing and visualizing spatial distributions, at identifying atypical localizations or spatial outliers, at detecting patterns of spatial association, clusters or hot spots, and at suggesting spatial regimes or other forms of spatial heterogeneity (Haining 1990; Bailey and Gatrell 1995; Anselin 1998a, 1998b). These methods provide measures of global and local spatial autocorrelation. Rey and Montouri (1999) apply these spatial tools to US State data on per capita income throughout the period 1929-1994 and Ying (2000) analyzes growth rates of production in the Chinese provinces since the late seventies using ESDA. They all find strong evidence in favor of spatial autocorrelation. Armstrong (1995), López-Bazo et al. (1999, 2004) and Le Gallo and Ertur (2003) also apply these spatial tools to European regional data on per capita GDP and growth rates and reach analogous conclusions. However, their concern is not the European enlargement process, hence the samples used are limited at best to the 12 first acceding countries and the different time period studied end at best in 1996. Hence, they do not take into account new Central and Eastern European member States and candidate countries.

In this paper, using an extended EU27 sample of 258 European regions including regions from acceding and candidate European countries over the period 1995-2000, we find strong evidence in favor of both global and local spatial autocorrelation for per regional capita GDP in the

enlarged European Union. Furthermore, we also show that accession of Central and Eastern European countries disturbs the previous North-South polarization pattern of the European Union. The geographical dynamics of EU15 was indeed dominated by an increasing clustering of population and wealth in a central area delimited by North Yorkshire (UK), Franche-Comté (France) and Hamburg (Germany), known as the core. In the enlargement context, this previous North/South polarization pattern is replaced by a new North-West/East pattern in EU27.

Therefore, in our opinion, the geographic localization and spatial environment of each region have indeed to be taken into account when analyzing economic disparities at a regional scale and also for the implementation of efficient regional policies.

In the next section, the economic and social cohesion policies implemented by the European Commission are presented and some new orientations made in the context of the enlargement process are discussed. In section three, data and the spatial weight matrix used in the Exploratory Spatial Data Analysis are briefly presented. The results for global and local spatial autocorrelation for the distribution of the levels of regional log per capita GDP are presented and compared in section four for the 1995-2000 period using two samples: 203 regions for EU15 and 258 regions for EU27. Results for average growth rates for the same samples are then presented in section five. Some implications for regional development and cohesion policies are finally explored in the conclusion.

2. The European regional and cohesion policies

2.1 Structural Funds

The aim of the European Union is to promote economic and social progress and to gradually eliminate regional differences in standards of living. In this respect, Objective 1 of the Structural Funds is the main priority of the European Union's cohesion policy. In accordance with the treaty, the Union works to "promote harmonious development" and aims particularly to "narrow the gap between the development levels of the various regions". This is why more than 2/3 of the

appropriations of the Structural Funds (more than EUR 135 billion) are allocated to helping areas lagging behind in their development ("Objective 1") where the gross domestic product (GDP) is below 75% of the Community average in PPS.

Puga (2002) underlines the fact that if a similar criterion was applied to the United States, only two States (Mississippi and Virginia) would have been eligible, that is to say that only 2% of the total population would have been concerned. In contrast, following the Second Progress Report on Cohesion (2003), 48 regions from current Member States, accounting for 18% of EU15 population (68 million), had income below 75% of the EU15 average per capita (in PPS) in 2000. This indicates the weakness of the regional cohesion in the European Union compared to the United States. The inequality between regions increases with the enlargement process as a total of 67 regions in EU25 will fall below the 75% threshold, representing 26% of total population (116 million). The accession of Bulgarian and Romanian regions after 2007 is likely to widen still more this inequality. In the face of this new configuration, the question is to decide if the European Union must maintain or not the same regional policy goals.

However, the results of the cohesion policy are very uneven and very difficult to evaluate precisely. Methodological problems are raised when trying to get evidence of the efficiency of Structural Funds in regard with regional development (Fayolle and Lecuyer, 2000). Assume that the allocation of structural funds are strongly related to the initial lag in development of each region, measured by initial per capita GDP and that convergence reflects an actual and strong catch-up of lagging behind regions: how could we discriminate between what is due to structural funds and what is due to more general factors? Thus catching-up will seem to be correlated to the allocation of structural funds but these would neither necessarily explain the catching-up process nor that we could exclude that catching-up regions would anyway catch-up even without receiving any structural funds.

However, it is possible to conclude that regional cohesion policies implemented since 1989 by the European Commission have failed. There is actually strong empirical evidence in favor of

persistence of regional inequalities and in favor of North-South polarization in the European Union (Armstrong, 1995; López-Bazo et al., 1999; Boldrin and Canova, 2001; Le Gallo and Ertur, 2003). Moreover, from the theoretical perspective, Martin (2000) shows that the economic argument that underlies the European regional policy is rather unclear. The European political decision-makers, at the national and regional levels, have put too much faith in regional policies: reducing regional inequalities and increasing economic efficiency at the national and European level seem to be two contradictory goals. In addition, the local decision-makers are looking for a short term positive impact via demand and a long term positive impact via supply. The first effect too strongly influences the debate on regional policies, whereas the long term infrastructure investment choices, which aim to impact the European economical geography, should be more seriously taken into account.

This suggests the urgent necessity of redefining the regional policy goals and tools in the context of the enlarged European Union.

2.2 The statistical effect of the enlargement process

The strong regional inequalities in the European Union do not seem to be significantly reduced by the European cohesion policy. Furthermore, the situation gets even more complicated because of the enlargement process as the social and economic cohesion challenge becomes more obvious and moves to the Eastern Europe.

Following the Second Progress Report on Cohesion (2003), the European cohesion policy faces a “statistical effect”, i.e. the 13% fall in average per capita GDP in the Community as a result of the accession of ten new Member States and 18% fall for the enlargement to 27 countries, affecting the eligibility under Objective 1 of the Structural Funds. In 2000, 48 regions from current Member States, accounting for 18% of EU15 population, had income below 75% of the EU15 average per capita (in PPS) – the current eligibility threshold for objective 1 support. In an enlarged Union of 25, a total of 67 regions will fall below the 75% threshold, representing 26% of total

population. From current Member States only 30 regions will have income below the 75% threshold when compared to the average income for the EU25 (which is 13% lower), accounting for 12% of the current EU15 population. In an enlarged EU27 (where average income is 18% lower than for the EU15), only 18 regions from the current Member States would qualify, representing 6% of EU15 population.

2.3. The future of regional and cohesion policies

The debate on the future of European regional and cohesion policies goes beyond the design of new financial mechanisms and impacts the foundations of the European project. This is the reason why the European Commission initiated a large debate, which is still intense.

The conclusions and recommendations of the Second Report on Economic and Social Cohesion (2001) state that cohesion policy in relation to lagging regions could take one of the following four forms:

- The application of the present threshold of 75% irrespective of the number of countries joining the Union. This option on its own would eliminate a large number of regions in EU 15. Their future eligibility for EU support would depend on the priorities and criteria for support outside the least developed regions.
- The same approach, but where all regions above this threshold but currently eligible under Objective 1 should receive temporary support (phasing-out), the level being higher the closer their GDP to the eligibility threshold. Two levels of temporary support could be envisaged, one for regions which, because of the extent of their convergence at the end of the 2000-2006 period, would no longer be regarded as having lagging development in an EU 15, the other, set at a higher level, for those which would have been below the 75% threshold without enlargement.
- The setting of a GDP per head threshold higher than 75% of the average, at a level which would reduce or even eliminate the automatic effect of excluding those regions in the EU

15 simply because of the reduction in the average EU GDP per head after enlargement. It should also, however, be set at a level which excludes those regions which would no longer qualify at the end of the current programming period in an EU 15 without enlargement.

- The fixing of two thresholds of eligibility, one for the regions in EU 15 and one for the candidate countries, and leading de facto to two categories of lagging region. This could have a similar result to the previous solution in financial terms in a situation where the aid intensity per head from Union funds is related to regional prosperity.

The enlargement process is thus seriously complicating the implementation of regional policies. The European Union is facing an unprecedented increase in the disparities and there is a broad consensus on the long-term nature of the efforts that will be needed to reduce them as well as around the need to continue to concentrate resources on the less developed regions, and especially on those in the new Member States. On how to define the less developed regions, the contributions to the debate have not seriously put into question continued use of the present eligibility criteria based on the NUTS2¹ geographical level and per capita GDP – which has the merit of being simple and transparent - even if some contributions have called for other criteria to be added.

It must be stressed that all this debate is based on the implicit hypothesis of absence of spillover effects and spatial externalities between regions, in other terms absence of spatial correlation. Our opinion is that this implicit hypothesis should at least be tested. Therefore, our contribution to this debate is to advocate the use of spatial criteria along with economic criteria and to study the spatial distribution of regional disparities in the enlarged European Union using Exploratory Spatial Data Analysis (ESDA). Our aim in this paper is then to show that the spatial distribution of wealth is indeed spatially autocorrelated. The geographic localization and the spatial environment of each region relative to their neighbors must be taken into account in the design and implementation of regional and cohesion policies in the enlarged European Union.

¹ French acronym for Nomenclature for Territorial Statistical Units used by Eurostat.

3. Data and spatial weight matrix

We use regional per capita GDP measured in Purchasing Power Standards (PPS) over the period 1995-2000 extracted from the Eurostat-Regio database (see appendix A for more details).² In order to highlight the impact of the enlargement process of the European Union to Eastern and Central European countries on the spatial distribution of income we compare the ESDA results obtained on a sample of 203 NUTS2 European regions belonging to EU15 with those obtained on a sample of 258 European regions belonging to EU27 as predicted by the enlargement process.

In order to model spatial interactions, we need to specify the spatial connectivity between each region in our sample. The spatial weight matrix is the fundamental tool used to represent the spatial connectivity between regions. More precisely, each region is connected to a set of neighboring regions by means of a *purely spatial pattern* introduced *exogenously* in this spatial weight matrix \mathbf{W} . This matrix is a square matrix with as many rows and columns as there are regions in the sample (the number of regions is denoted by N). The elements w_{ii} on the diagonal are set to zero whereas the elements w_{ij} indicate the way the region i is spatially connected to the region j . These elements are *non-stochastic*, non-negative and finite. In order to normalize the outside influence upon each region, the weight matrix is standardized such that the elements of a row sum up to one. The spatial weight matrix \mathbf{W} we use in this study is based on the k -nearest neighbors computed from the great circle distance between region centroids as in Le Gallo and Ertur (2003). The general form of the k -nearest neighbors weight matrix $\mathbf{W}(k)$ is defined as follows:

$$\begin{cases} w_{ij}^*(k) = 0 \text{ if } i = j \\ w_{ij}^*(k) = 1 \text{ if } d_{ij} \leq d_i(k) \text{ and } w_{ij}(k) = w_{ij}^*(k) / \sum_j w_{ij}^*(k) \\ w_{ij}^*(k) = 0 \text{ if } d_{ij} > d_i(k) \end{cases} \quad (1)$$

where $d_i(k)$ is a critical cut-off distance defined for each region i . More precisely, $d_i(k)$ is the k^{th} order smallest distance between regions i and j such that each region i has exactly k neighbors. We use in this paper the 10 nearest neighbors spatial weight matrix and we check for robustness.

²All computations have been realized by means of SpaceStat 1.90 (Anselin 1999) and GeoDa 1.93 (Anselin, 2003). Maps and figures have been realized using Arcview 3.2 (ESRI).

4. Statistical results for regional per capita GDP

4.1 Global Spatial Autocorrelation

The measurement of global spatial autocorrelation is usually based on Moran's I statistic (Cliff and Ord 1981; Upton and Fingleton 1985). For each year of the period 1995-2000, this statistic is written in the following matrix form:

$$I_t = \frac{n}{S_0} \cdot \frac{\mathbf{z}_t' \mathbf{W} \mathbf{z}_t}{\mathbf{z}_t' \mathbf{z}_t} \quad t = 1, \dots, 6 \quad (2)$$

where \mathbf{z}_t is the vector of the n observations for year t in deviation from the mean. \mathbf{W} is the spatial weight matrix. S_0 is a scaling factor equal to the sum of all the elements of \mathbf{W} . For row-standardized spatial weights $S_0 = n$ and expression (2) consequently simplifies.

Moran's I statistic gives a formal indication of the degree of linear association between the vector \mathbf{z}_t of observed values and the vector $\mathbf{W} \mathbf{z}_t$ of spatially weighted averages of neighboring values, called the spatially lagged vector. Values of I larger (smaller) than the expected value $E(I) = -1/(n-1)$ indicate positive (negative) spatial autocorrelation. Statistical inference is based on the permutation approach with 10000 permutations (Anselin 1995).

Table 1a and 1b displays the values of the Moran's I statistic, using 10 nearest neighbors spatial weight matrix, for log per capita regional GDP for the initial period 1995 and the final period 2000 and for the EU15 sample of 203 regions and the extended EU27 sample of 258 regions.

| Year | Moran's I | Mean | Std. Dev. | Standardized values | p-values |
|------|-----------|--------|-----------|---------------------|----------|
| 2000 | 0,3909286 | -0,005 | 0,028345 | 13,968 | 0,0001 |
| 1995 | 0,4487649 | -0,005 | 0,028381 | 15,988 | 0,0001 |

Table 1a: Moran's I statistic for log per capita GDP (PPS) in 1995 and 2000 for EU15

| Year | Moran's I | Mean | Std. Dev. | Standardized values | p-values |
|------|-----------|--------|-----------|---------------------|----------|
| 2000 | 0,7008471 | -0,004 | 0,025473 | 27,670 | 0,0001 |
| 1995 | 0,7092094 | -0,004 | 0,025436 | 28,039 | 0,0001 |

Table 1b: Moran's I statistic for log per capita GDP (PPS) in 1995 and 2000 for EU27

It appears that per capita regional GDPs are positively spatially autocorrelated since the statistics are significant with $p = 0.0001$ for each year and each sample. This result suggests that

the distribution of per capita regional GDP is by nature clustered over the whole period. In other words, the regions with relatively high per capita GDP (low) are localized close to other regions with relatively high per capita GDP (low). Considering the evolution of Moran's I statistic over time shows that the standardized values of the statistic remain approximately the same throughout the period whatever the sample considered. It thus indicates a globally significant tendency toward geographical clustering of similar regions in terms of log per capita GDP. These results are robust with regard to the choice of the spatial weight matrix.³

Moran's I statistic is a global statistic and does not allow to assess the local structure of spatial autocorrelation. However, it may be asked whether there are local spatial clusters of high or low values, which regions contribute more to the global spatial autocorrelation, and to what extent the global evaluation of spatial autocorrelation masks atypical localizations or "pockets of local nonstationarity". In this respect, local spatial autocorrelation is analyzed with three tools: the $G_i(d)$ statistics (Getis and Ord 1992; Ord and Getis 1995), the Moran scatterplot (Anselin 1996), and Local Indicators of Spatial Association "LISA" (Anselin 1995).

4.2 Getis-Ord statistics and local clustering

Since Moran's I yields a single result for the entire data set, it cannot discriminate between a spatial clustering of high values and a spatial clustering of low values in the case of a global positive spatial autocorrelation. Getis and Ord (1992, 1995) suggest the use of the $G_i(d)$ statistic to detect local "pockets" of dependence that may not show up when using global statistics. This statistic for each region i and year t can then be written as following (Getis and Ord 1992):

$$G_{i,t}(d) = \frac{\sum_{j \neq i} w_{ij}(d)x_{j,t}}{\sum_{j \neq i} x_{j,t}} \quad (3)$$

where $w_{ij}(d)$ are the elements of a symmetric binary spatial weight matrix equal to one for all links within distance d of a given region i and equal to zero for all other links including the link of

³ Complete results for $k = 15, 20, 25$ nearest neighbors are available from the authors upon request.

region i to itself. The variable x has a natural origin and is positive. Once standardized, a positive value of $G_i(d)$ indicates a spatial cluster of *high* values, whereas a negative value indicates clustering of *low* values around region i . This statistic has been extended to variables that do not have a natural origin and to non binary standardized weight matrices (Ord and Getis 1995) and has the following expression:

$$G_{i,t}(d) = \frac{\sum_{j \neq i} w_{ij}(d)x_{j,t} - W_i \mu_t}{\sigma_t \left\{ \left[(n-1)S_{i,t} - W_i^2 \right] / (n-2) \right\}^{1/2}}, \quad j \neq i \quad (3)$$

where $W_i = \sum_j w_{ij}$ and $S_{i,t} = \sum_j w_{ij}^2$ for $j \neq i$. μ_t and σ_t are the usual sample mean and standard deviation for the sample of size $n-1$ excluding region i for year t . The sign of this statistic is interpreted in the same way as the preceding one.

These statistics are based on spatial accumulations and can thus help to deepen the analysis for detecting spatial clusters around each region i without being affected by the value taken by the variable in that region i .⁴ Moreover, they may help reveal problems with the spatial scale of the observational units by incrementing d .

Statistical inference is based on the normal asymptotic approximation as suggested by Ord and Getis (1995) even though they concede there might be a problem in the presence of global spatial autocorrelation (Ord and Getis, 1995, p.298-299). Inference is further complicated by the fact that these local statistics will be correlated when the neighborhood sets of two regions contain common elements (Ord and Getis 1995; Anselin 1995). This is actually a problem of multiple statistical comparisons.⁵ When the *overall* significance associated with the multiple comparisons (correlated tests) is set to α , and there are m comparisons, then the individual significance α_i should be set to α/m (Bonferroni) or $1 - (1 - \alpha)^{1/m}$ (Sidák). The second procedure requires the variables to be multivariate normal, which is asymptotically the case for $G_i(k)$. With $m = n$, these

⁴ Note that statistics which include the value taken by the variable in region i have also been suggested by Getis and Ord (1992, 1995).

⁵ More about this problem can be found in Savin (1984).

procedures can be overly conservative in evaluating the significance of the $G_i(k)$ statistics (Anselin 1995; Ord and Getis 1995). However using k -nearest neighbors spatial weight matrices, we note that the number of comparisons cannot exceed k because two given regions cannot have more than k common neighbors. In this respect, we suggest using $m = k$ and we present the results obtained with both the usual 5% significance level, which may be too liberal, and the 5% Sidák pseudo-significance level, which is indeed less conservative than using $m = n$.

The results for the extended Ord and Getis (1995) statistic for 10 nearest neighbors are summarized in Table 2a and 2b and displayed on figures 1a and 1b.⁶ The problem of multiple statistical comparisons is taken into account using Sidák’s pseudo-significance level with $m = 10$.

| Years | % of significant statistics at 5% significance level | % of positively significant statistics at 5% significance level | % of negatively significant statistics at 5% significance level | % of significant statistics at Sidák’s pseudo significance level | % of positively significant statistics at Sidák’s pseudo significance level | % of negatively significant statistics at Sidák’s pseudo significance level |
|-------|--|---|---|--|---|---|
| 2000 | 34,98% | 20,20% | 14,78% | 16,75% | 5,42% | 11,33% |
| 1995 | 37,93% | 22,17% | 15,76% | 15,76% | 4,93% | 10,84% |

Table 2a: Getis-Ord G_i statistics for log per capita GDP (PPS) in 1995 and 2000 for EU15

| Years | % of significant statistics at 5% significance level | % of positively significant statistics at 5% significance level | % of negatively significant statistics at 5% significance level | % of significant statistics at Sidák’s pseudo significance level | % of positively significant statistics at Sidák’s pseudo significance level | % of negatively significant statistics at Sidák’s pseudo significance level |
|-------|--|---|---|--|---|---|
| 2000 | 47,67% | 29,84% | 17,83% | 18,99% | 3,88% | 15,12% |
| 1995 | 49,61% | 31,40% | 18,22% | 20,93% | 5,81% | 15,12% |

Table 2b: Getis-Ord G_i statistics for log per capita GDP (PPS) in 1995 and 2000 for EU27

First, we note that for the sample restricted to EU15, more than one third (34.98 %) of the Getis-Ord statistics are significant at the 5% level in 2000 (20.20 % are positive and 14.78 % negative). With the enlargement, almost half of them (47.67 %) becomes significant (29.84 % are positive and 17.83 % are negative). Many European regions are therefore surrounded by rich regions and benefit from a favorable economic environment. Second, it is also possible to note a relative stability of the ratio 2/3 versus 1/3 in favor of significantly positive statistics for the two samples, which shows the persistence of the relative distribution of regional per capita GDP.

⁶ The complete results are presented in Appendix B for the restricted sample of 203 regions and in Appendix D for the sample of 258 regions extended to candidate countries.

However, considering the Sidàk pseudo-significance level, this ratio becomes favorable to significantly negative statistics. Clustering of poor regions seems therefore more significant than clustering of rich regions.

The European Union before the enlargement (EU15) is characterized by a North/South polarization pattern (if we exclude the cluster of eastern poor German regions) as it has been found in numerous previous studies (Armstrong, 1995; López-Bazo et al., 1999; Le Gallo and Ertur, 2003). Furthermore this polarization pattern is persistent through the period (Figures 1a and 1b). In contrast, considering the extended EU27 sample taking into account the enlargement process (Figures 2a and 2b) this North-South polarization pattern is replaced by a new North-West/East polarization pattern with a cluster of rich regions in the North-West and a cluster of poor regions in the East.

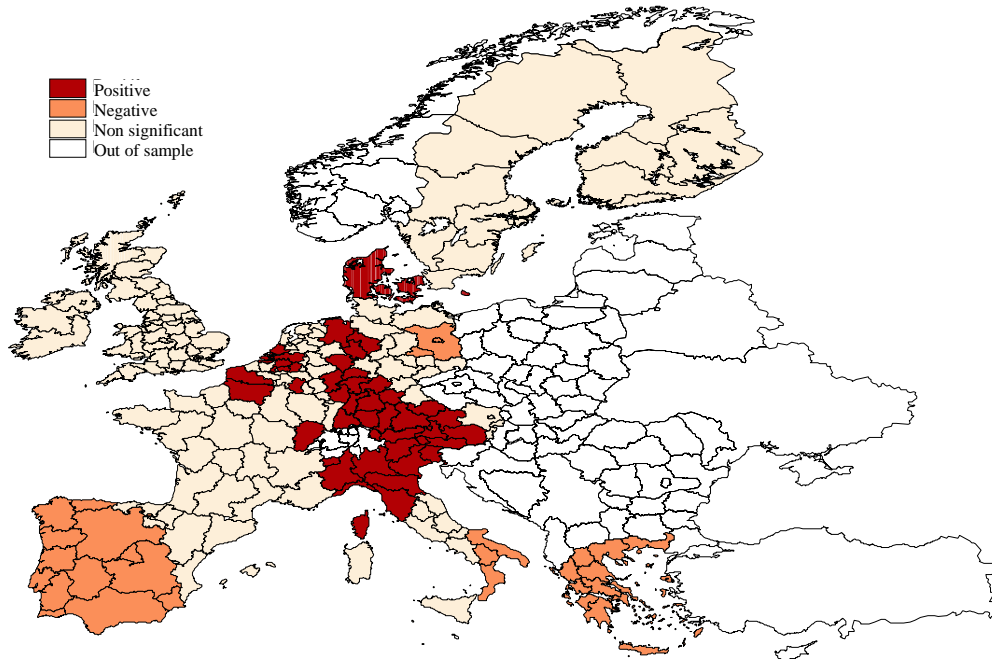


Figure 1a: Getis-Ord significance map for per capita GDP in logarithms (PPS) for 1995 and EU15 (5 % significance level)

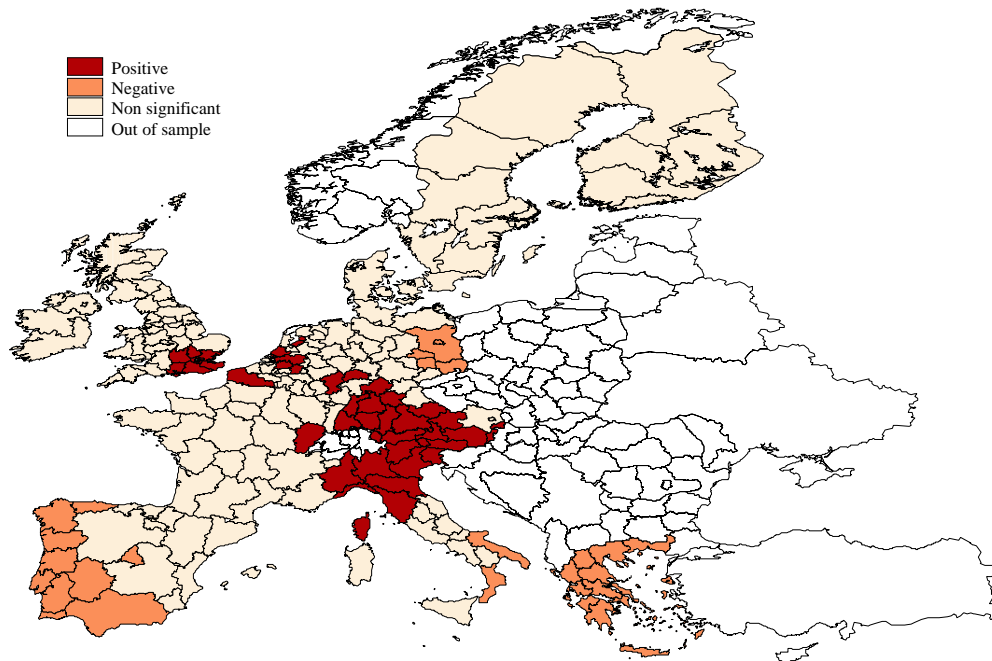


Figure 1b: Getis-Ord significance map for per capita GDP in logarithms (PPS) for 2000 and EU15 (5 % significance level)

The cluster of rich regions in 1995 as well as in 2000 and for both samples consists mainly of western German regions, north of Italy, Austria, south of United-Kingdom, some French, Belgian and Dutch regions. The number of such regions increases with the enlargement of the European Union to eastern countries since the relative wealth of north-western regions increases mechanically as poorer regions are added in the sample (Figures 2a and 2b). The clusters of poor regions for EU15 consists of four areas: first, the lagging behind Greek regions with significantly negative statistics even with the Sidak pseudo-significance level both in 1995 and 2000; second, southern Italy (Puglia, Calabria and Basilicata in 1995); third, central and southern Spanish regions and all the Portuguese regions; finally, eastern German regions.

The global picture is quite different when we take into account the enlargement process with the extended EU27 sample. There is now only one big cluster of poor regions which mainly contains regions from the eastern countries: all the Polish, Romanian and Bulgarian regions, Cyprus, Lithuania and Latvia as well as eastern regions from Hungary, Slovakia and the Czech Republic. Finally, we can note that only Greece has regions which remain significantly negative

amongst the EU15 regions, the other EU15 regions in Spain, Portugal and Italy that were significantly negative at the 5% level are no more significant in the extended EU27 sample.

Using the Getis-Ord statistics, we therefore find evidence in favor of a new polarization pattern of European regions which appears with the enlargement process of the European Union to eastern new acceding and candidate countries. The existing North/South polarization pattern is replaced by a North-West/East polarization pattern.

Another way to detect local spatial clusters but also to analyze local instability in the form of atypical localizations, spatial outliers, and spatial regimes is to use Moran scatterplots in conjunction with LISA as suggested by Anselin (1995). In the presence of global positive autocorrelation, Moran's *I* statistic may indeed mask regions that deviate from this global pattern.

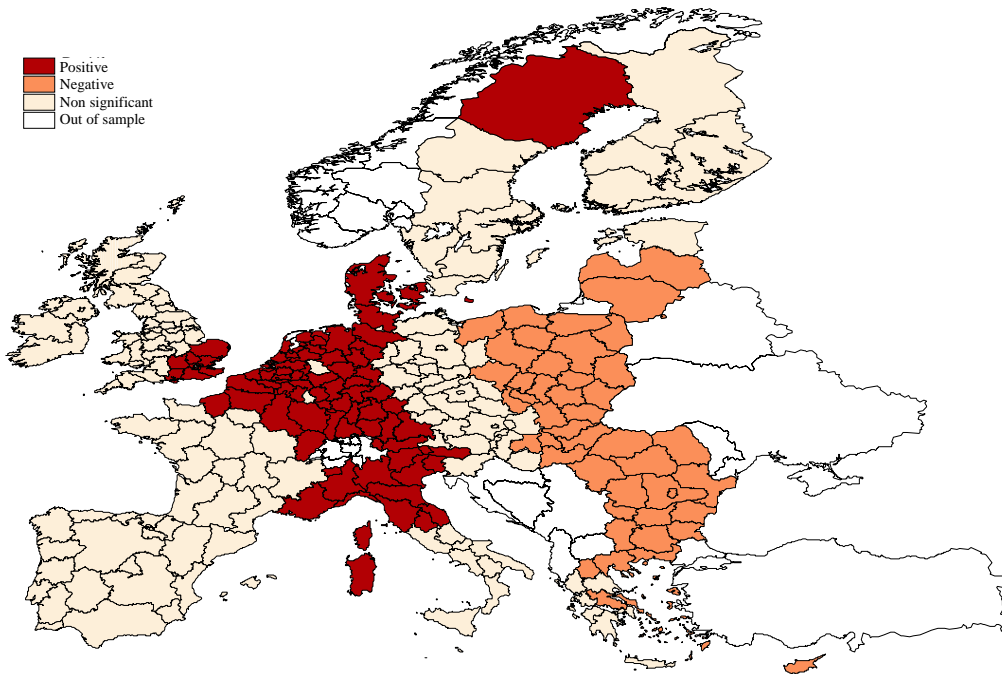


Figure 2a: Significant Getis-Ord statistics for per capita GDP in logarithms (PPS) for 1995 and EU27 (5 % significance level)

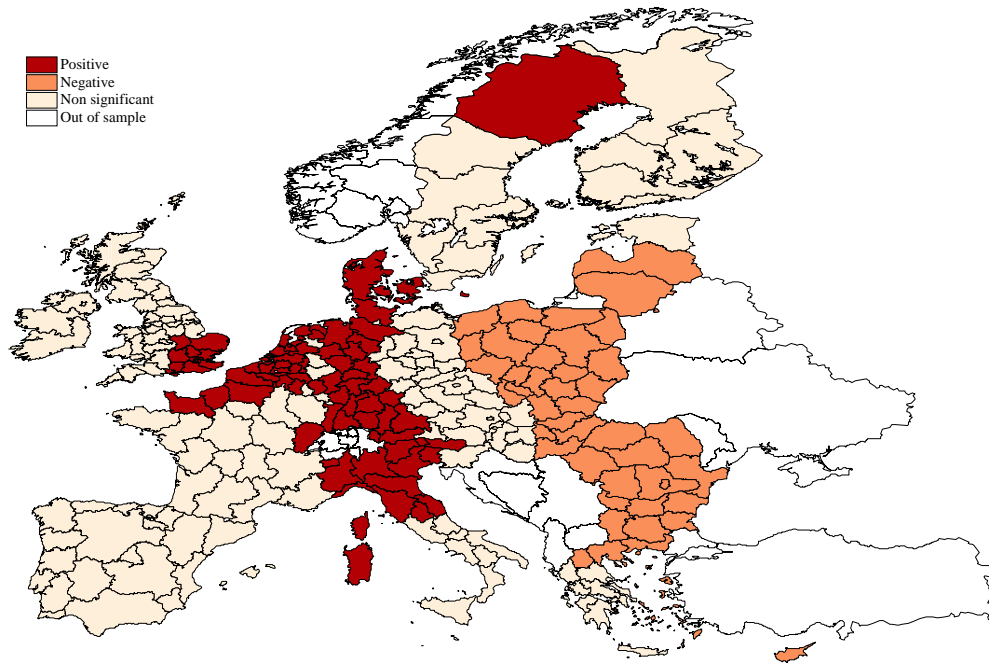


Figure 2b: Getis-Ord significance map for per capita GDP in logarithms (PPS) for 2000 and EU27 (5 % significance level)

4.3 Moran's scatterplot

Local spatial instability is studied by means of the Moran scatterplot (Anselin 1996), which plots the spatial lag \mathbf{Wz}_t against the original values \mathbf{z}_t . The four different quadrants of the scatterplot correspond to the four types of local spatial association between a region and its neighbors: HH a region with a high⁷ value surrounded by regions with high values, LH a region with a low value surrounded by regions with high values, etc. Quadrants HH and LL (LH and HL) refer to positive (negative) spatial autocorrelation indicating spatial clustering of *similar* (*dissimilar*) values. The Moran scatterplot may thus be used to visualize atypical localizations, i.e. regions in quadrant LH or HL. Moreover, the use of standardized variables makes the Moran scatterplots comparable across time.

The global spatial autocorrelation may also be visualized on this graph since, from (1) Moran's I is formally equivalent to the slope coefficient of the linear regression of \mathbf{Wz}_t on \mathbf{z}_t using a row-standardized weight matrix.

⁷ High (low) means above (below) the mean.

Tables 3a and 3b display the types of spatial association prevailing across European regions for each of our samples.

| Year | Quadrant HH | Quadrant LL | Quadrant LH | Quadrant HL |
|------|-------------|-------------|-------------|-------------|
| 2000 | 41,87% | 33,00% | 16,75% | 8,37% |
| 1995 | 43,35% | 31,53% | 16,26% | 8,87% |

Table 3a: Spatial Association for European regions in the Moran scatterplots for 1995 and 2000 and the sample of 203 regions (EU15)

| Year | Quadrant HH | Quadrant LL | Quadrant LH | Quadrant HL |
|------|-------------|-------------|-------------|-------------|
| 2000 | 56,59% | 29,46% | 8,14% | 5,81% |
| 1995 | 55,04% | 30,23% | 8,14% | 6,59% |

Tableau 3b : Spatial Association for European regions in the Moran scatterplots for 1995 and 2000 and the sample of 258 regions (EU27)

It can be noted that most European regions are characterized by positive spatial association. More specifically in 2000, almost 75% of EU15 regions exhibited association of similar values (41.87% in quadrant HH and 33% in quadrant LL). This positive spatial association increases significantly with the enlargement process since in 2000, 86.05% of EU27 regions exhibited association of similar values (56.59% in quadrant HH and 29.46% in quadrant LL).

Moran scatterplots also allow detecting atypical regions, i.e. regions that deviate from the global spatial association pattern, belonging to the quadrant LH or HL. In 2000, 25.12% of EU15 regions deviate from the global spatial association pattern (16.75% in quadrant LH and 8.37% in quadrant HL). The share of these regions moves to 13.95% (almost two times lesser) when we consider EU27 (8.14 in quadrant LH and 5.81 in quadrant HL). We finally note that these two schemes are persistent in time since the figures are almost identical at the initial and final periods.

Figures 3a, 3b, 4a and 4b display the Moran scatterplots for the logarithm of per capita GDP measured in PPS (initial and final years) of our two samples of respectively 203 and 258 regions using the 10 nearest neighbors spatial weight matrix.

Considering EU15, we observe in quadrant HH numerous regions from north-western Europe (from Belgium, western Germany, northern Italy, Netherlands, Austria, southern UK, Denmark and some French, Finnish and Swedish regions).

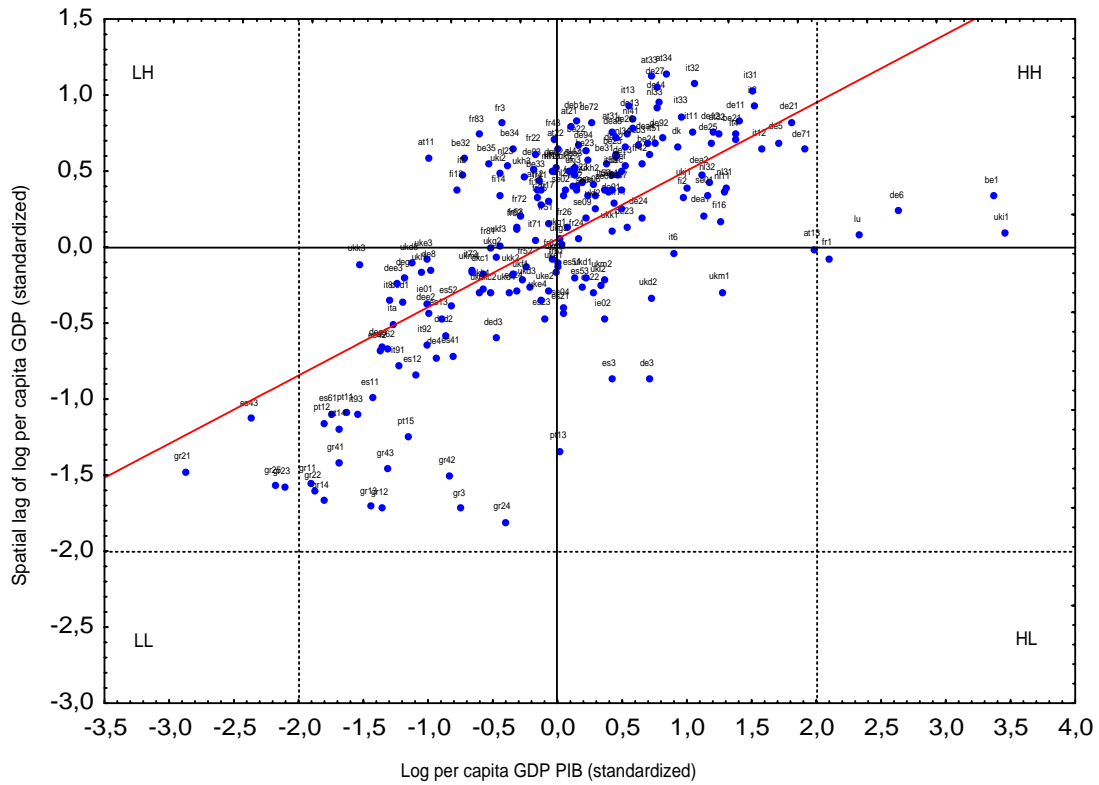


Figure 3a: Moran scatterplot for log per capita GDP measured in PPS in 1995 for the sample of 203 regions EU15

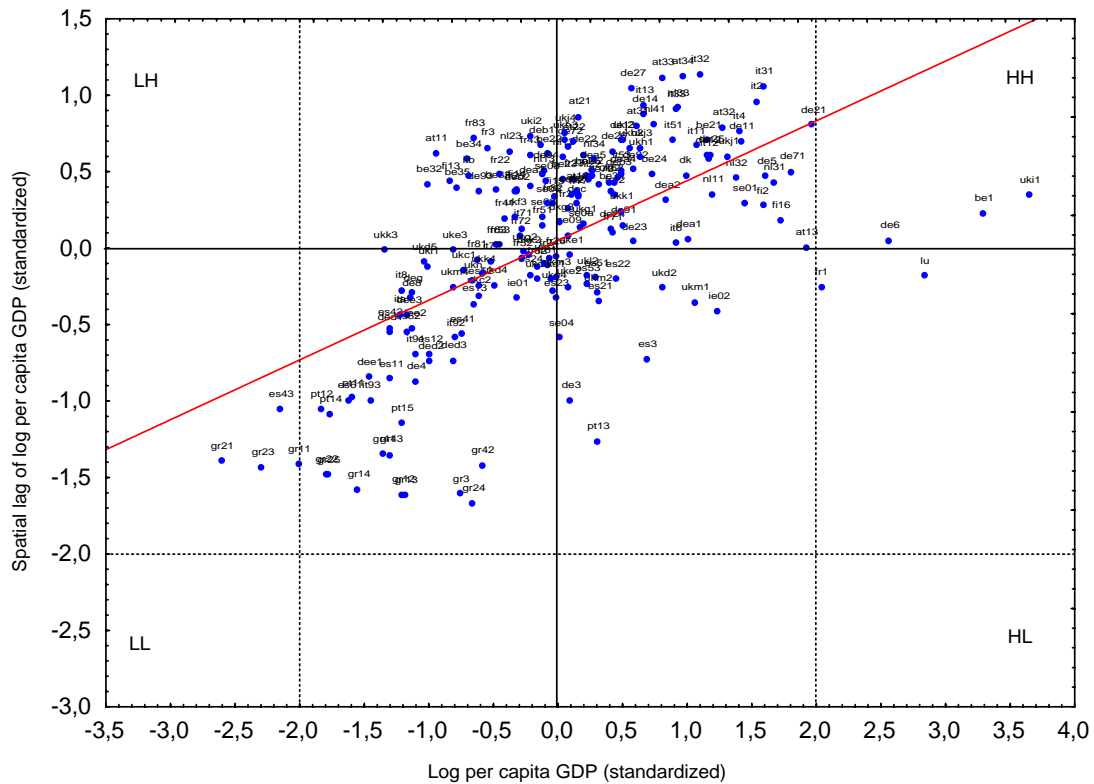


Figure 3b: Moran scatterplot for log per capita GDP measured in PPS in 2000 for the sample of 203 regions EU15

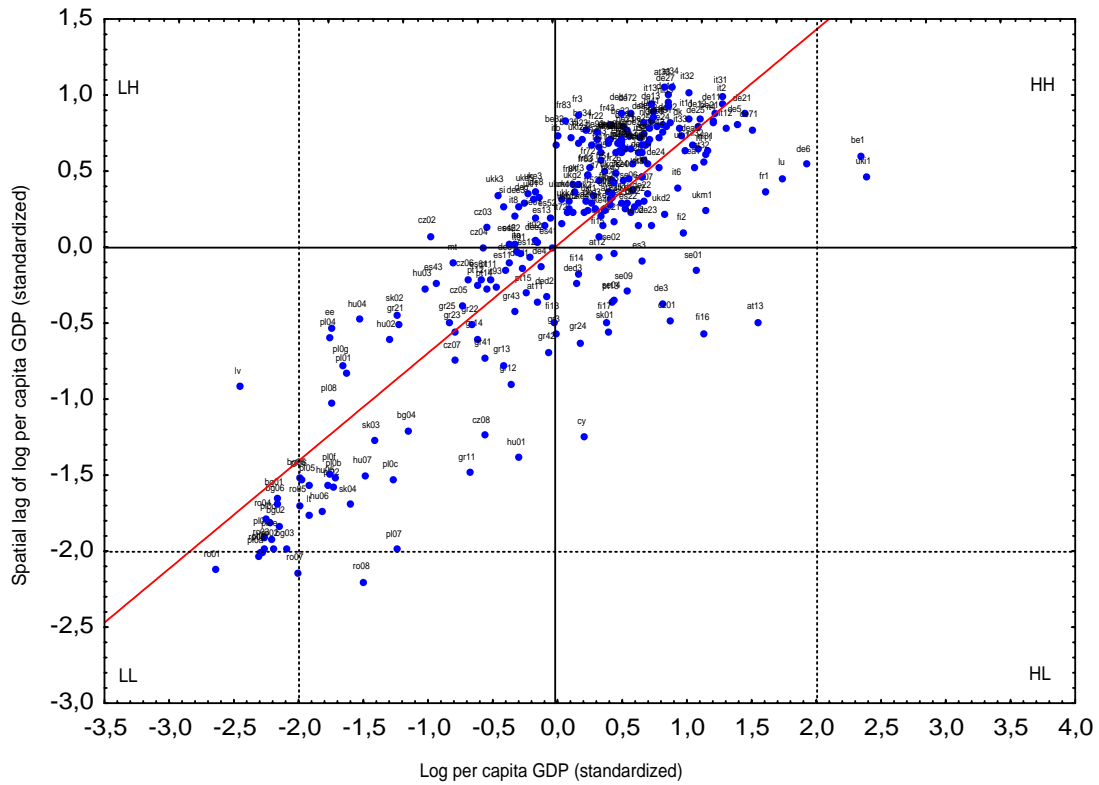


Figure 4a: Moran scatterplot for log per capita GDP measured in PPS in 1995 for the sample of 258 regions EU27

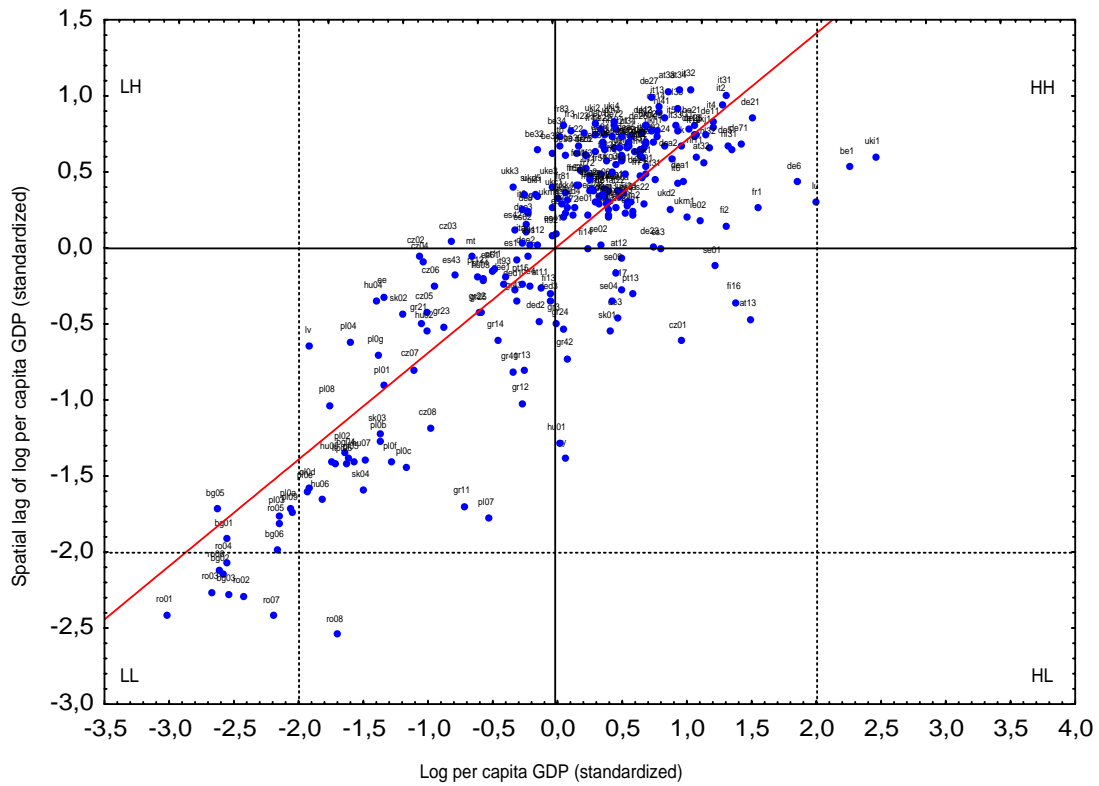


Figure 4b: Moran scatterplot for log per capita GDP measured in PPS in 2000 for the sample of 258 regions EU27

Considering the enlargement process in EU27, more north-western European regions belong to quadrant HH, which, do not include any regions from new acceding or candidate countries.

In quadrant LL consisting of poor regions surrounded by poor regions, we observe all the Greek regions, 4 Portuguese regions, southern Spanish and Italian regions, as well as eastern German regions, Northern UK when considering EU15. All these regions were eligible under Objective 1 of the Structural Funds throughout the period 1994-1999. The composition of quadrant LL changes significantly with the enlargement process to 27 European countries. We observe that almost all of the regions from new acceding or candidate countries belong to that quadrant as well as southern regions previously noted. However, two phenomena distinguish the quadrant LL in the case of EU27 compared to the case of EU15. First, we note that regions from EU15 are relatively near from the origin and therefore from the mean while regions from new acceding and candidate countries are very far from the origin. Second, quadrant LL in the case of EU15 is relatively stable in time while it is possible to note a variation in the case of EU27. Actually, numerous regions from new acceding and candidate countries seem to move away from the origin (therefore from the mean) which could mean that these regions are becoming poorer and poorer. It is the case of mainly Romanian and Bulgarian regions.

In quadrant HL consisting of regions relatively richer than surrounding regions (diamonds in the rough), we can observe capital regions as Madrid, Lisboa, Berlin, Ile de France as well as Luxembourg and northern Spanish regions when considering EU15. In the sample of 258 regions for EU27, we observe also numerous capital regions in quadrant HL (Madrid, Lisboa, Berlin, Vienna, Stockholm, Uusimaa which includes Helsinki, Prague, Bratislava, Közép-Magyarország which includes Budapest) but we also observe regions from EU15 near the border with new acceding countries as southern Swedish and Finnish regions.

In quadrant LH consisting of regions relatively poorer than surrounding regions (doughnuts), we observe regions from EU15 traditionally having structural problems as Walloon regions in Belgium, Burgenland in Austria, but also many French regions (11 among 22 regions),

Finnish, Swedish and Dutch regions. Considering EU27 in the enlargement perspective, we observe in this quadrant Spanish regions, eastern German regions, two Belgian regions (Hainaut and Namur), but also some regions from new acceding countries as Slovenia or two Czech regions. We note that in the extended EU27 sample, all the French and Dutch regions belong to quadrant HH.

It is also possible to note that for the EU15 sample, in 1995 and 2000, highly urbanized areas in western Europe as Hamburg, Brussels, London, Ile de France and Luxembourg are spatial outliers with respect to the X axis. For the EU27 sample, only Brussels and London remain as spatial outliers both in 1995 and 2000. There is no spatial outlier with respect to the Y axis for the EU15 sample whatever the time period considered. In contrast, for the EU27 sample, some Romanian regions appear as spatial outliers in 1995 and in 2000 they are many more Romanian regions and even a few Bulgarian regions appearing as such.

Therefore the analysis of Moran scatterplots confirms the polarization result obtained previously with the Getis-Ord statistics. It seems that the North/South polarization pattern observed for EU15 is replaced by a North-West/East polarization pattern when considering the enlargement process without questioning the presence of lagging behind regions in southern Europe.

Concerning spatial heterogeneity among European regions, we then can hardly conclude in favor of a stratification scheme for the enlarged European Union with many distinct regimes since positive spatial associations are prevailing in the extended sample of 258 regions for EU27 (almost 86% of the regions belong to quadrants HH or LL). In contrast, this seems to be less obvious for the restricted sample of 203 regions for EU15 since almost 25% of the regions belong to quadrants HL or LH.

However, despite the information given by the Moran scatterplots, we do not have any indication about the statistical significance of spatial associations. We must therefore compute the Local Indicators or Spatial Association (LISA) proposed by Anselin (1995).

4.4 Significance of local clusters: LISA

Anselin (1995) defines a Local Indicator of Spatial Association (LISA) as any statistics satisfying two criteria: first, the LISA for each observation gives an indication of significant spatial clustering of similar values around that observation; second, the sum of the LISA for all observations is proportional to a global indicator of spatial association.

The local version of Moran's I statistic for each region i and year t is written as:

$$I_{i,t} = \frac{(x_{i,t} - \mu_t)}{m_0} \sum_j w_{ij} (x_{j,t} - \mu_t) \quad \text{with } m_0 = \sum_i (x_{i,t} - \mu_t)^2 / n \quad (4)$$

where $x_{i,t}$ is the observation in region i and year t , μ_t is the mean of the observations across regions in year t and where the summation over j is such that only neighboring values of j are included. A positive value for $I_{i,t}$ indicates spatial clustering of *similar* values (high or low) whereas a negative value indicates spatial clustering of *dissimilar* values between a region and its neighbors. Note that this statistic is based on spatial covariances rather than spatial accumulation and measures a different concept of local spatial association from Getis and Ord (1992, 1995) statistics. It is therefore interesting to consider them in conjunction with $G_i(d)$ statistics.⁸

In presence of global spatial autocorrelation, inference must be based on the conditional permutation approach. This approach is conditional in the sense that the value x_i at location i is held fixed, while the remaining values are randomly permuted over all locations.⁹ 10000 permutations were used here to compute the empirical distribution function which provides the basis for statistical inference. The p -values obtained for the local Moran's statistics are then pseudo-significance levels (Anselin, 1995, p. 96 and p. 99-100). In addition, as normality is unlikely to be the case with LISA, we use the Bonferroni 5% pseudo-significance level with $m = 10$ instead of the Sidák 5% pseudo-significance level to deal with the multiple comparison problems.

⁸ Following Anselin (1995, p.101), the $G_i(d)$ statistic cannot be considered as a LISA "since its individual components are not related to a global statistic of spatial association".

⁹ Note that only the quantity $\sum_j w_{ij} (x_i - \mu)$ needs to be computed for each permutation since the term $(x_i - \mu)/m_0$ remains constant for a given location i .

Anselin (1995) gives two interpretations of LISA. They can be used first as indicators of significant local spatial clusters (“hot spots”) in the same way as the $G_i(d)$ statistics and second as diagnostics for local instability (atypical localizations or “pockets of nonstationarity”), significant outliers, and spatial regimes. This second interpretation is similar to the use of a Moran scatterplot to identify outliers and leverage points for Moran’s I : since there is a link between the local indicators and the global statistic, LISA outliers will be associated with the regions which exert the most influence on Moran’s I . Finally, combining the information in a Moran scatterplot and the significance of LISA yields the so called “Moran significance map”, showing the regions with significant LISA and indicating by a color code the quadrants in the Moran scatterplot to which these regions belong (Anselin and Bao 1997). Table 4a and 4b display the global results for each of our samples.¹⁰

| Years | % of significant statistics at the 5% pseudo-significance level | % of significant HH statistics at the 5% pseudo-significance level | % of significant LL statistics at the 5% pseudo-significance level | % of significant LH statistics at the 5% pseudo-significance level | % of significant HL statistics at the 5% pseudo-significance level |
|-------|---|--|--|--|--|
| 2000 | 43,35% | 20,20% | 16,26% | 4,93% | 1,97% |
| 1995 | 47,29% | 23,15% | 15,76% | 6,90% | 1,48% |

Table 4a: Significant LISA for log per capita GDP measured in PPS for 1995 and 2000 in the sample of 203 regions for EU15

| Years | % of significant statistics at the 5% pseudo-significance level | % of significant HH statistics at the 5% pseudo-significance level | % of significant LL statistics at the 5% pseudo-significance level | % of significant LH statistics at the 5% pseudo-significance level | % of significant HL statistics at the 5% pseudo-significance level |
|-------|---|--|--|--|--|
| 2000 | 55,43% | 35,27% | 17,44% | 0,78% | 1,94% |
| 1995 | 57,36% | 35,66% | 19,38% | 0,78% | 1,55% |

Table 4b: Significant LISA for log per capita GDP measured in PPS for 1995 and 2000 in the sample of 258 regions for EU27

First, we note that in 2000, 43.35 % of LISA statistics are significant at the 5% pseudo-significance level for the restricted sample of 203 regions for EU15 while the figure moves to 55.43% for the extended sample of 258 regions for EU27. Among these statistics 36.46 % exhibit significant positive spatial association: 20.20% of them belong to quadrant HH and 16.26% belong to quadrant LL. This represents almost 2/3 of significant statistics at the 5% pseudo-significance

¹⁰ Results using the Bonferroni 5% pseudo-significance level are presented in appendix E. The complete results are presented in Appendix C for the restricted sample of 203 regions and in Appendix D for the sample of 258 regions extended to candidate countries.

level. In the extended sample of 258 regions for EU27, 55.43% exhibit significant positive spatial association: 35.27 of them belong to quadrant HH and 17.44% belong to quadrant LL. This represents 95.09% of significant statistics at the 5% pseudo-significance level. This result implies that the local positive spatial association pattern is more predominant when we consider the enlarged European Union (EU27) than EU15. Therefore the enlargement process of the European Union is strengthening the positive spatial association pattern detected in the present European Union.

These results allow assessing the relative importance of regional clusters but they do not give any information about their localization and the localization of atypical regions. We therefore visualize the LISA statistics on Moran significance maps at the 5% pseudo-significance level. Maps 5a and 5b display the results for 1995 and 2000 using the restricted sample of 203 regions for EU15.

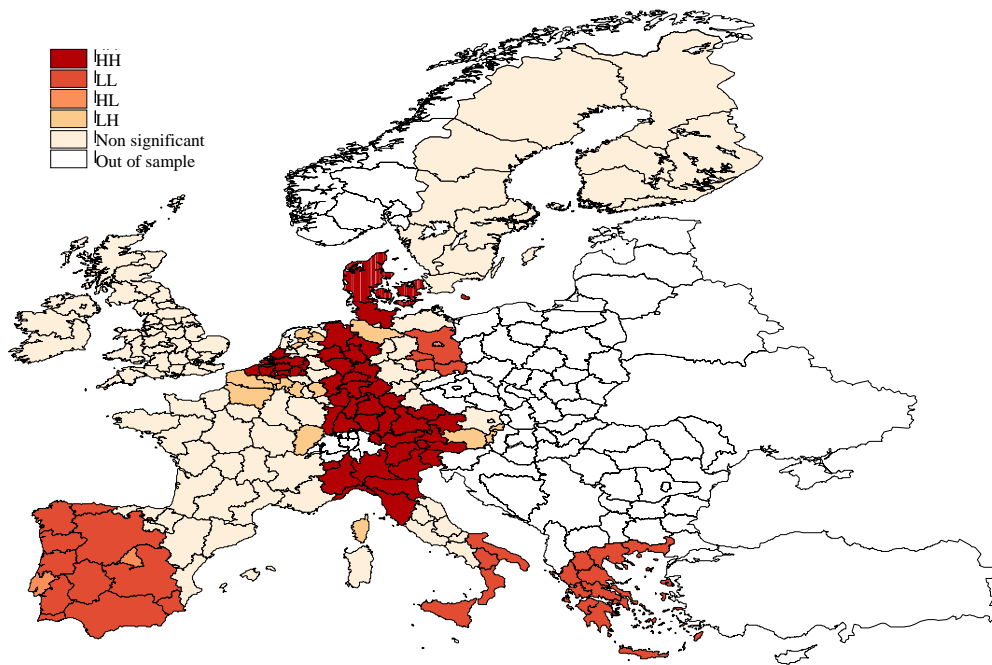


Figure 5a: Moran significance map for log per capita GDP measured in PPS for 1995 in the sample of 203 regions for EU15 (5% pseudo-significance level)

Regions characterized by a spatial association of the HH type are mainly localized in three areas. The biggest cluster includes regions from northern Italy, western Austria and south-western

Germany (this area included Denmark in 1995), the second cluster, smaller in 2000 than in 1995, is the one localized in the north of Belgium and in the south of Netherlands and finally the third cluster, appearing only in 2000, includes regions surrounding London in the south-east of United-Kingdom. Regions belonging to quadrant LL are localized mainly in four areas, all the Greek regions with significant LISA at the 5% Bonferroni pseudo-significance level in 1995 and 2000, regions from southern Italy (Puglia, Basilicata, Calabria in 2000), eastern German regions (Brandenburg, Chemnitz, Dresden, Leipzig, Dessau, Halle), Portuguese regions (except Lisboa) and finally southern and central Spanish regions (except Madrid). This type of spatial association is more persistent through the period under study than spatial association of the HH type.

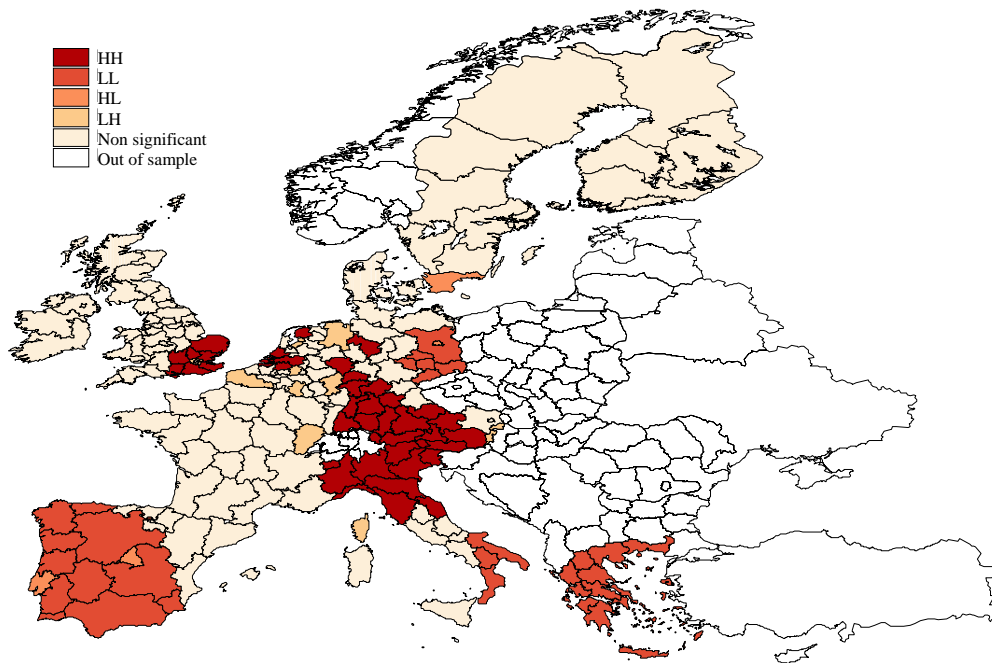


Figure 5b: Moran significance map for log per capita GDP measured in PPS for 2000 in the sample of 203 regions for EU15 (5% pseudo-significance level)

There are four significant HL regions: three capital regions localized in the core of the LL clusters (Madrid, Lisboa and Berlin) and the southern Swedish region of Sydsverige (in 2000). In contrast, there are much more significant LH regions: these are structurally lagging behind regions belonging to the richest European countries as northern French regions (Nord-Pas-de-Calais significant at the 5% Bonferroni pseudo-significance level in 1995, Picardie in 1995 and Franche-

Comté in 1995 and 2000) and southern Belgian regions (Limburg, Hainaut, Belgian region of Luxembourg, Namur), as well as Corse, the Austrian region of Burgenland and Outer London in the United-Kingdom. We also observe some regions from northern and western Germany (Lüneburg, Weser-Ems, Koblenz, Trier) and from northern Netherlands (Friesland, Drenthe, Flevoland).

Maps 6a and 6b displays the results for 1995 and 2000 using the extended sample of 258 regions for EU27. The enlargement of the European Union clearly modifies the structure of significant spatial clusters. Regions belonging to quadrant HH are localized mainly in the north-west of the enlarged European Union (EU27) in a cluster which spreads out from north of Italy and south of France to Denmark, northern Germany and southern United-Kingdom.

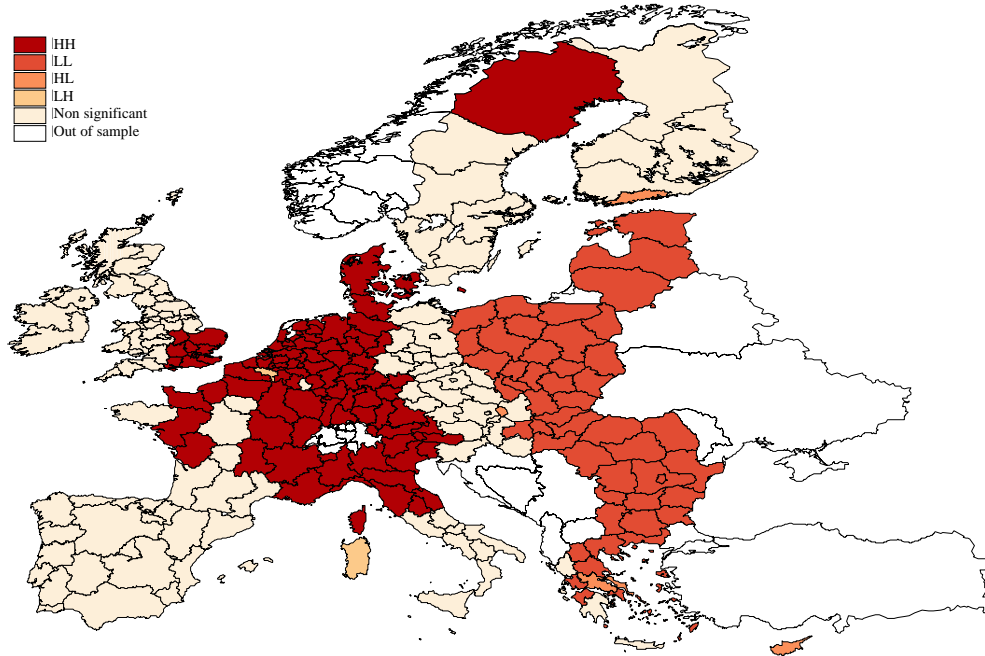


Figure 6a: Moran significance map for log per capita GDP measured in PPS for 1995 in the sample of 258 regions for EU27 (5% pseudo-significance level)

We can note that many regions belonging to that cluster are significant at the 5% Bonferroni pseudo-significance level. This HH cluster is much bigger and persistent through the period under study than the corresponding cluster for the restricted sample of 203 regions for EU15. We can also note that many regions that belonged to quadrant LH in the restricted sample belong now to quadrant HH. Finally, we can note that the Swedish region of Övre Norrland is the only significant

HH Scandinavian region at the 5% pseudo-significance level. This can be explained by its neighborhood structure, which does not include any regions from new acceding countries in contrast to other Swedish and Finnish regions.

The spatial association pattern of the LL type is deeply modified with the enlargement process. LL regions mostly are localized at the East of the enlarged European Union. This area extends from Baltic States to the North of Greece. It is made up of all Romanian, Bulgarian and Polish regions, Baltic States, most eastern Hungarian regions, Slovakia and Czech Republic.¹¹ Only northern regions of Greece remain significant among EU15 regions, other regions from southern Italy, Spain and Portugal are no more significant. The “diamonds in the rough” significant at the 5% level are mainly capital regions of acceding countries like Prague, Bratislava and Közép-Magyarország (Budapest) as well as a few regions in Greece and Cyprus. Only the Belgian regions of Hainault and Namur remain significantly of the “doughnuts” type.

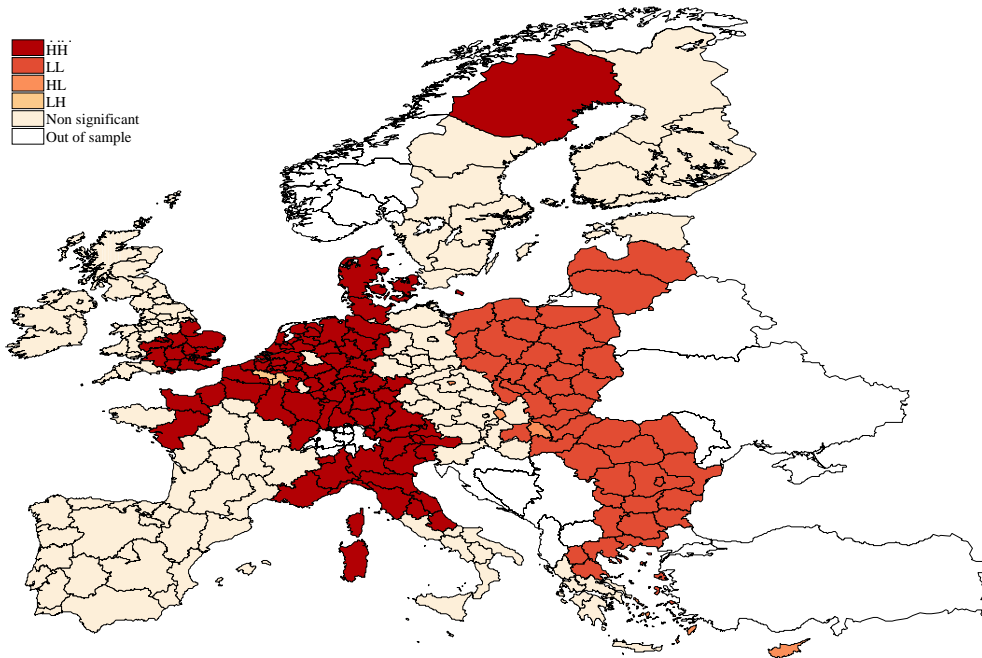


Figure 6b: Moran significance map for log per capita GDP measured in PPS for 2000 in the sample of 258 regions for EU27 (5% pseudo-significance level)

¹¹ We note that almost all of these statistics are significant using the Bonferroni pseudo-significance level.

It is worth stressing the following interesting result: we note the presence of a fringe between the cluster of rich regions in the North-West and the cluster of poor regions in the East of the enlarged European Union. This fringe is mainly made up of central European regions characterized by a low level of per capita GDP and benefit from a more favorable environment than more Eastern European regions also characterized by even a lower level of per capita GDP. It mainly consists of eastern Germany regions, western Czech regions and Slovenia which are characterized by a LH spatial association pattern and which have positive Getis-Ord statistics (see appendix B and D), that is to say that they benefit from a more favorable environment for their future economic development than more eastern regions. This result is important for the implementation of the regional and cohesion policy in the enlarged European Union since these regions will probably benefit more from spillover effects coming from the richer western regions in contrast to eastern regions which will probably less or not benefit from these spillovers.

5. Exploratory Spatial Data Analysis for average annual growth rates

The preceding results show evidence in favor of the persistence of strong spatial disparities for levels of per capita GDP throughout the period 1995-2000, according to a North-South pattern for EU15 and to a North-West/East for EU27. We will now apply ESDA to assess the spatial characteristics of the distribution of the average annual growth rates of per capita GDP.¹² We will first evaluate global spatial autocorrelation. Second, we will determine local clusters of high or low average annual growth rates using the Getis-Ord statistics. Finally, we will analyze the structure and the significance of local spatial associations by means of the Moran scatterplot and LISA.

¹² We use the approximation of average annual growth rates throughout the period 1995-2000, i.e for a region i of the sample, we have $g_i = [\ln y_{i,2000} - \ln y_{i,1995}] / 5$ where $y_{i,2000}$ and $y_{i,1995}$ stand for per capita GDP of region i measured in PPS respectively in 2000 and 1995. Indeed, this variable is the dependant variable in empirical growth regressions.

5.1 Global spatial autocorrelation

The results presented in Table 5 show a strongly significant positive global spatial autocorrelation ($p = 0.0001$) for both samples.

| | Moran's I | Mean | Std. Dev. | Standardized values | p-values |
|------|-----------|--------|-----------|---------------------|----------|
| EU15 | 0,2933744 | -0,005 | 0,028303 | 10,542 | 0,0001 |
| EU27 | 0,4075095 | -0,004 | 0,025456 | 16,166 | 0,0001 |

Table 5: Moran's I statistic for average annual growth rates of per capita GDP (PPS) for the 1995-2000 period for EU15 and EU27

We note that the standardized values are far below those computed for the levels of log per capita GDP for both samples. Nevertheless, these results indicate that regions presenting relatively high (low) average annual growth rates are localized near other regions with relatively high (low) average annual growth rates.

5.2 Getis-Ord statistics and local clustering

The results for the extended Ord and Getis (1995) statistic for the average annual growth rates of per capita GDP measured in PPS using 10-nearest neighbors are summarized in Table 6 for both samples and displayed on figures 7a and 7b.¹³ The problem of multiple statistical comparisons is taken into account using Sidák's pseudo-significance level with $m = 10$. As before, statistical inference is based on the normal asymptotic approximation.

| | % of significant statistics at 5% significance level | % of positively significant statistics at 5% significance level | % of negatively significant statistics at 5% significance level | % of significant statistics at Sidák's pseudo significance level | % of positively significant statistics at Sidák's pseudo significance level | % of negatively significant statistics at Sidák's pseudo significance level |
|------|--|---|---|--|---|---|
| EU15 | 33,50% | 12,81% | 20,69% | 10,84% | 4,93% | 5,91% |
| EU27 | 23,64% | 11,24% | 12,40% | 10,86% | 5,43% | 5,43% |

Table 6: Getis-Ord G_i statistics for average annual growth rates of per capita GDP (PPS) for the 1995-2000 period for EU15 and EU27.

For the EU15 sample, we note that 33.50% of the Getis-Ord statistics are significant at the 5% level, whereas only 23.64% remain significant for the EU27 sample. In addition, the shares of significantly positive and negative statistics varies between the samples: for the EU27 sample, 11.24% of the Getis-Ord statistics are significantly positive and 12.40% are significantly negative,

¹³ The complete results are presented in Appendix B for the restricted sample of 203 regions and in Appendix D for the sample of 258 regions extended to new acceding and candidate countries.

while for the EU15 sample 12.81% are significantly positive and 20.69% are significantly negative. However, it is possible to note that there is almost no difference between the two samples when considering the Sidak pseudo-significance level.

For EU15, local clusters of high average annual growth rates are localized in three areas: first, regions around Madrid in Spain, second regions around London at the south-east of United Kingdom and finally central and eastern regions in Greece. For the enlarged European Union, we note two main clusters at each side of Europe. As for the preceding sample, regions around London are characterized by high average annual growth rates. The other cluster is localized near the Baltic Sea in the North-Eastern Europe: Finnish regions excluding Åland Islands (four of them are significant at the Sidak pseudo-significance level), Småland med öarna in Sweden is also significant at the 5% level. The three Baltic States are significant at the Sidak pseudo-significance level and nine Polish regions are as well significant (seven of them are significant at the Sidak pseudo-significance level). Finally, two Hungarian regions (Dél-Dunántúl et Észak-Magyarország) are also significant at the 5% level.

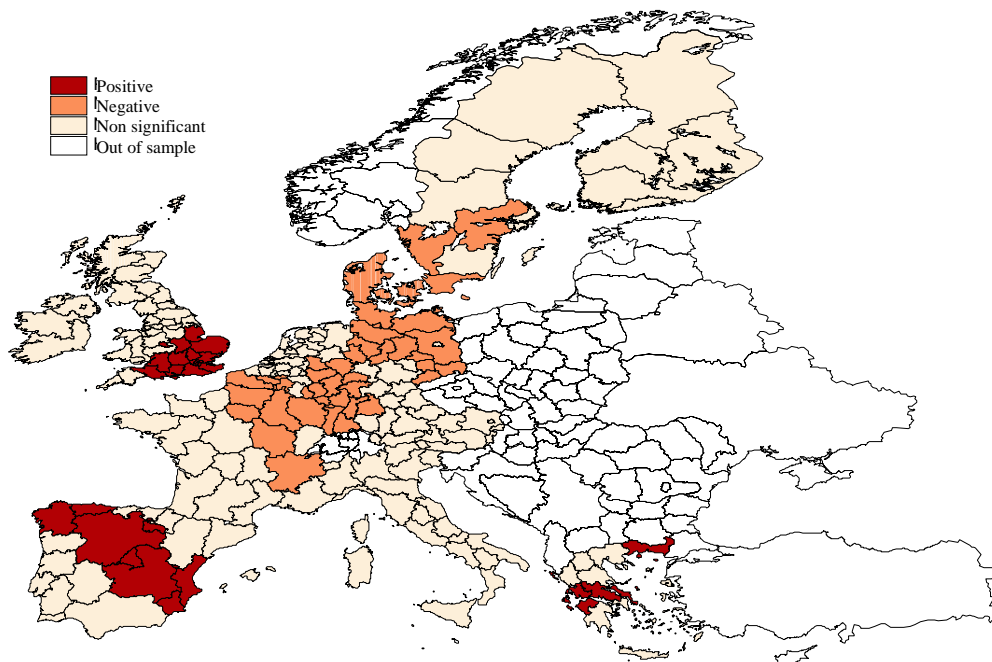


Figure 7a: Getis-Ord significance map for average annual growth rates of per capita GDP (PPS) for EU15 and the 1995-2000 period (5% significance level)

For EU15, local clusters of low average annual growth rates are mainly localized in an area extending from the south of Sweden to the centre of France. More precisely, it is made up of three Swedish regions (one of them significant at the Sidak level), Denmark, northern, eastern and western German regions (26 regions, nine of them significant at the Sidak level), Luxembourg (significant at the Sidak level), three Belgian regions and 8 French regions (Alsace is significant at the Sidak level). With the enlargement process, this type of clusters is localized in two areas. First, all of the Romanian and Bulgarian regions, which are significant at the Sidak level (except Vest and Nord-Vest in Romania which are significant at the 5% level). Two northern Greek regions (one of them significant at the Sidak level) are also part of this area as well as Cyprus. The second cluster of low average annual growth rates is composed of some of the regions which were found before in the EU15 sample as characterized by a neighborhood with low average annual growth rates: central and eastern German regions, Luxembourg, Alsace, Prague and Strední Cechy in the Czech Republic.

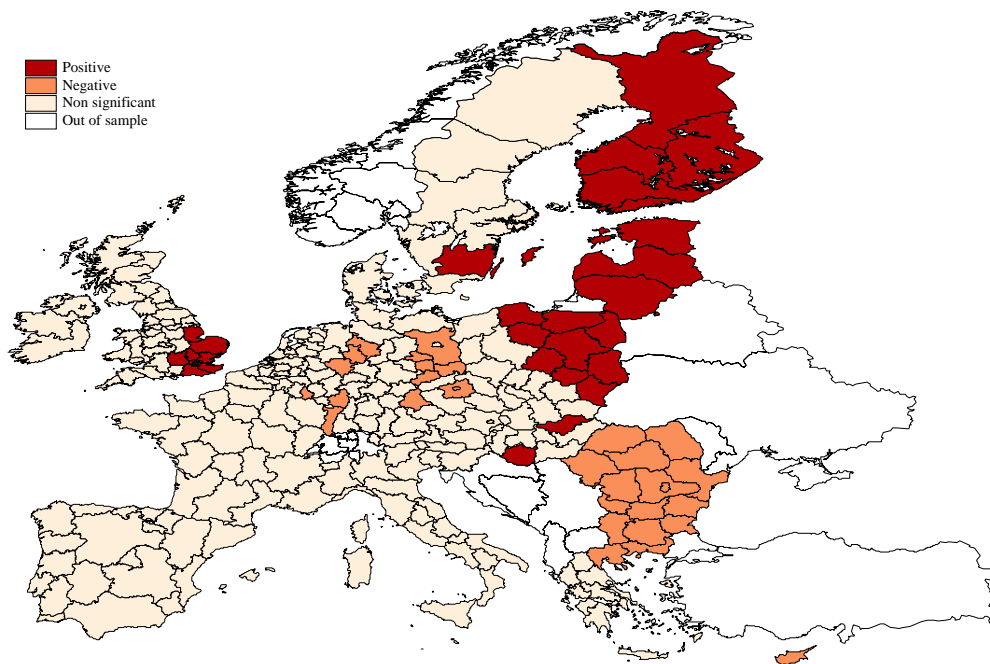


Figure 7b: Getis-Ord significance map for average annual growth rates of per capita GDP (PPS) for EU27 and the 1995-2000 period (5% significance level)

5.3 Moran's scatterplot

Table 7 presents the results for Moran's scatterplots:

| | Quadrant HH | Quadrant LL | Quadrant LH | Quadrant HL |
|-------|-------------|-------------|-------------|-------------|
| EU 15 | 41,87% | 37,93% | 10,84% | 9,36% |
| EU 27 | 41,47% | 36,82% | 11,24% | 10,47% |

Table 7: Spatial associations of European regions in the Moran scatterplots for the average annual growth rates for EU15 and EU27 and the 1995-2000 period

We note that 79.8% (78.29%) of EU15 regions (EU27 regions) present a positive spatial association. Figures 8 and 9 display the results. EU15 regions from Spain, Ireland, United-Kingdom, Finland and Italy belong to the quadrant HH for both of the samples. Baltic States, Slovenia, most of the Polish, Hungarian and Slovak regions belong as well to this quadrant. We can note that none of the French, German and Belgian regions belong to this quadrant for both samples. Most of Belgian, French and German regions belong to quadrant LL as well as Scottish regions for both samples. All of the Bulgarian, Romanian regions and most of the Czech regions also belong to quadrant LL.

In quadrant HL which contains more dynamic regions than their neighbors, we can find two Belgian regions, Denmark, Luxembourg, some German, Italian, Austrian and Dutch regions for both samples. We note that Prague, Bratislava and two Polish regions are also characterized by this type of spatial association. Finally, due to the enlargement process and to the modification of their neighborhood structure, some Greek regions are moving from quadrant HH to quadrant HL, Finnish or Swedish regions are moving from quadrant LL to quadrant LH.

Figure 9 confirms the previous findings concerning the time pattern of Moran scatterplots between 1995 and 2000 for the levels of per capita GDP for the EU27 sample (Figures 4a and 4b). We noted that some of the regions belonging to quadrant LL in 1995 tend to move away in 2000 from the origin, therefore from the sample mean of the enlarged European Union. Romanian and Bulgarian regions were mostly concerned; these two candidate countries will probably not accede to the European Union before 2007. Here we see that all these regions belong to quadrant LL when their average annual growth rates are considered, hence this area characterized by relative low levels also exhibits a very low relative dynamism.

More generally, the Moran scatterplot for levels of per capita GDP in 1995 compared to the Moran scatterplot for average annual growth rates can be interpreted in terms of actual catching-up with respect to the European sample mean. Clusters exhibiting low per capita GDP levels at the beginning of the period (LL and LH quadrants in Figures 3a and 4a) and high average annual growth rates between 1995 and 2000 (HH and HL quadrants in Figures 8 and 9) can be interpreted as actually catching-up the European sample mean. These clusters are mainly localized in Spain for the EU15 sample and in Poland, Hungary and Baltic States for the enlarged EU27 sample. Clusters which benefit from the same initial conditions (LL and LH quadrants in Figures 3a and 4a) but which are characterized by low average annual growth rates (LL and LH quadrants in Figures 8 and 9) are not actually catching-up. These clusters are mainly localized in eastern Germany and Belgian Walloon for the EU15 sample and in Romania and Bulgaria for the enlarged EU27 sample.

As in the preceding section, we still need to compute the LISA to assess the statistical significance of the spatial associations detected.

5.4 Significance of local clusters: LISA statistics

Tables 8a and 8b display the results of LISA applied to average annual growth rates.¹⁴

| Years | % of significant statistics at the 5% pseudo-significance level | % of significant HH statistics at the 5% pseudo-significance level | % of significant LL statistics at the 5% pseudo-significance level | % of significant LH statistics at the 5% pseudo-significance level | % of significant HL statistics at the 5% pseudo-significance level |
|-------|---|--|--|--|--|
| EU15 | 46,31% | 14,78% | 23,65% | 4,43% | 3,45% |
| EU27 | 31,01% | 12,79% | 13,57% | 1,55% | 3,10% |

Table 8a: Significant LISA at the 5% pseudo-significance for the average annual growth rates of per capita GDP (PPS) for UE15 and EU27 and the 1995-2000 period

| Years | % of significant statistics at the 5% Bonferroni pseudo-significance level | % of significant HH statistics at the 5% Bonferroni pseudo-significance level | % of significant LL statistics at the 5% Bonferroni pseudo-significance level | % of significant LH statistics at the 5% Bonferroni pseudo-significance level | % of significant HL statistics at the 5% Bonferroni pseudo-significance level |
|-------|--|---|---|---|---|
| EU15 | 14,78% | 4,93% | 7,88% | 0,00% | 1,97% |
| EU27 | 12,02% | 5,43% | 6,20% | 0,39% | 0,00% |

Table 8b: Significant LISA at the 5% Bonferroni pseudo-significance level for average annual growth rates of per capita GDP (PPS) for UE15 and EU27 and the 1995-2000 period

¹⁴ The complete results are presented in Appendix C for the restricted sample of 203 regions and in Appendix D for the sample of 258 regions extended to new acceding and candidate countries.

Almost half of the LISA (46.31%) are significant at 5% in the EU15 sample and 31.01% of them are significant in the EU27 sample (14.78% and 12.02% at the 5% Bonferroni pseudo-significance level). First, 38.43% of the significant statistics are presenting a positive spatial association pattern (14.78% belong to quadrant HH and 23.65% to quadrant LL). This figure moves to 26.36% in the extended sample of EU27 (12.79% belong to quadrant HH and 13.57% to quadrant LL). Only 7.88% of significant LISA are presenting a negative spatial association pattern (4.43% belong to quadrant LH and 3.45% to the quadrant HL) in the EU15 sample. In the extended sample of EU27, this figure is even lower as 4.65% (1.55% belong to quadrant LH and 3.10% to the quadrant HL).

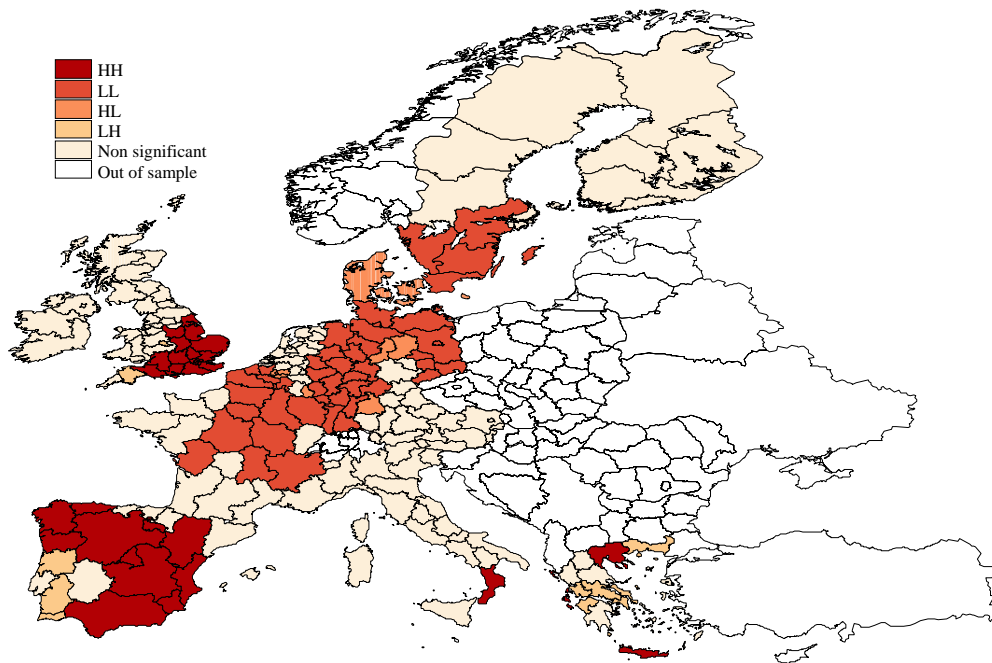


Figure 10: Moran significance map for average annual growth rates of per capita GDP for EU15 and the 1995-2000 period (5 % pseudo-significance level)

In the EU15 sample, we observe two main areas containing regions characterized by a spatial association pattern of the HH type. The first one is located in Spain and in northern Portugal and the second one is located in south-eastern United-Kingdom. Four more regions are characterized by this pattern: three in Greece (Kentriki Makedonia, Ionia and Crete) and Calabria in southern Italy. Spatial association of the LL type is observed in an area which spreads from centre

of France to southern Sweden. We can note that seven regions, located in the preceding area, are more dynamic than their neighbors (HL): Denmark, Luxembourg (both at the Bonferroni pseudo-significance level), two central Belgian regions (Vlaams Brabant, Brabant Wallon), and three German regions (Stuttgart, Braunschweig and Magdeburg). There are nine regions less dynamic than their neighbors (LH): three Portuguese regions (Centro, Alentejo, Algarve), four Greek regions (Anatoliki Makedonia, Dytiki Ellada, Sterea Ellada, Attiki including Athens) and two more regions in the United-Kingdom (West Midlands, Devon).

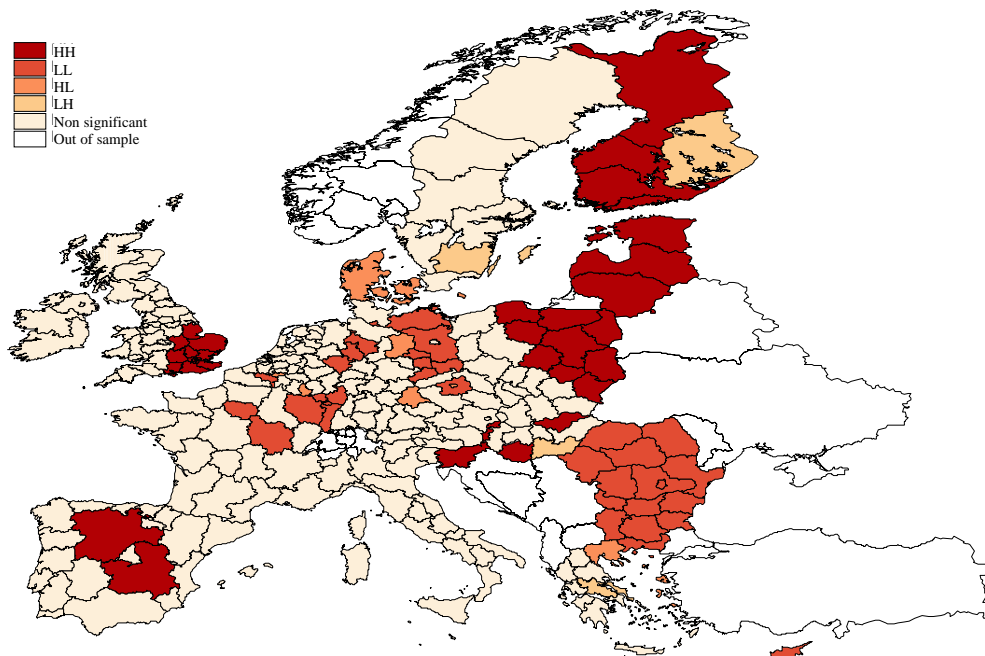


Figure 11: Moran significance map for average annual growth rates of per capita GDP for EU27 and the 1995-2000 period (5 % pseudo-significance level)

The enlargement process modifies this overall picture. First, we can observe three main regional clusters characterized by a HH spatial association pattern. The first one is located near Baltic Sea in north-eastern Europe and is made up of four Finnish regions, Baltic States and nine northern Polish regions (most of them are significant at the Bonferroni pseudo-significance level). The other two clusters are located in south-eastern United-Kingdom and around Madrid in Spain. Four more central European regions are characterized by this spatial association pattern: two Hungarian regions (Észak-Magyarország et Dél-Dunántúl), Slovenia, and the poorest eastern

Austrian region (Burgenland). We can also observe several LL clusters. The most important cluster is located in the south-east of the European Union: it is made up of all of the Romanian and Bulgarian regions (all are significant at the Bonferroni pseudo-significance level except Nord-Vest), Anatoliki Makedonia in northern Greece (also significant at the Bonferroni pseudo-significance level). Several regions which belonged to the previous area in the EU15 sample are still characterized by the same spatial association pattern when considering the enlargement process. These regions are located in Germany (13 regions including eastern regions), in north-eastern France (Bourgogne, Île de France, Alsace, Lorraine) and in Belgium (Hainault). The Czech region surrounding Prague (Střední Čechy) is also exhibiting a spatial association of the LL type. Eight regions belong significantly to the HL quadrant at the 5% level. These are “diamonds in the rough” characterized by high growth rates surrounded by regions with low growth rates as Brabant Wallon in Belgium, Denmark, Oberpfalz and Magdeburg in Germany, Luxembourg, Kentriki Makedonia and Voreio Aigaio in Greece, Prague in the Czech Republic. In contrast, four regions belong significantly to the LH quadrant. These are “doughnuts” or regions with low growth rates surrounded by regions with high growth rates: Sterea Ellada in Greece, Itä-Suomi in Finland (significant at the Bonferroni pseudo-level), Småland med öarna in Sweden and Dél-Alföld in Hungary.

6. Conclusion

The aim of this paper was to analyze European regional income disparities in the context of the enlargement process using Exploratory Spatial Data Analysis (ESDA). The spatial distribution of regional per capita GDP in logarithms is therefore studied throughout the 1995-2000 period using two different samples: the first one is based on 203 regions from EU15 and second one is based on 258 regions including regions from new Central and Eastern European member States, which joined the European Union on May 1st, 2004 and Romania and Bulgaria which are still candidate countries (EU27). We found strong evidence of global and local spatial autocorrelation in both samples

highlighting the fact that the per capita GDP level for a given region is not independent of neighboring regions per capita GDP levels. This result has important implications on the way regional and cohesion policies have to be designed since the criteria used by the European Commission for the eligibility under different objectives of the Structural Funds has traditionally neglected this spatial dimension. Therefore the expected effects of such policies on a given region could be over or under-estimated depending on the spatial interaction pattern characterizing it. Indeed, spillovers and spatial externalities underlying the spatial autocorrelation detected in both samples are likely to affect regional development processes and therefore should be seriously taken into account.

In addition, using the Moran scatterplot and the Local Indicators of Spatial Association (LISA), we highlighted the new North-West/East polarization pattern which appears with the enlargement process to Central and Eastern European countries and which replaces the previous North-South polarization pattern often underlined in the literature for EU15. However, this new picture should not completely mask clusters of “previously” poor European regions in the implementation of future regional and cohesion policies. We also found evidence of a fringe made up of relatively poor regions belonging to Central and Eastern European countries, which have better come through the economic transition to market structures and democracy. In our opinion, this fringe, which pulls apart the two poles that we found, plays an important role for the European economic policy. Regional and cohesion policies could lean on the proximity of this fringe to the core of north-western rich regions as well as to the periphery of eastern poor regions, which lacks driving forces to benefit from spillovers. We can also put the stress on highly urbanized areas belonging to this fringe which could also promote regional development policies.

The analysis of average annual growth rates of per capita GDP also showed strong evidence in favor of spatial autocorrelation: the economic dynamism of a given region is highly correlated to the economic dynamism of neighboring regions.

All these results highlight the fact that specific regional policies could be implemented in different regional clusters. First, we noted that the economic dynamism of the regions belonging to the fringe tailed off during the period under study, maybe because the cluster of regions characterized by low growth rates located in an area extending from the south of Sweden to the centre of France exhibited low growth rates spreading out to neighboring regions belonging to this fringe. This area that is experiencing less difficulty than more eastern regions should therefore receive particular attention from the European Commission since it seems very dependant of the dynamism of core regions and since it may play an important role for the development of more eastern regions.

Second, European policy should maintain the dynamism of Spanish regions and of regions near the Baltic Sea in order to provide them with the conditions of an actual catching-up for coming years. This is especially true for poor regions from eastern new member States, which are lagging behind and would not benefit from external effects from regions belonging to the core, except via regions belonging to the fringe.

In contrast, traditionally lagging behind regions in EU15 which do not seem to experience an actual catching-up should be treated according to their geographic localization. Thus lagging behind regions belonging to the core of Europe (for instance Belgian Walloon and eastern regions in Germany) should speed up their restructuring and modernization in order to benefit from spillovers from nearby rich regions. Lagging behind regions belonging to the periphery (Greece, south of Italy and Portugal), which would not benefit from spillovers because they are farther away should receive a different treatment.

Finally, regional and cohesion policies should not forget the cluster of Romanian and Bulgarian regions characterized by low levels of per capita GDP and low growth rates even if they should not accede to the European Union before 2007. No regions in these countries significantly differ from their neighbors, not even capital regions in contrast to other central and eastern new member countries. In addition, their geographic location does not favor them since their

neighborhood is only made up of lagging behind regions and since they are isolated compared to other European regions as they are surrounded by ex-Yugoslavia at the west and ex-USSR at the east.

The measure and the treatment of regional inequalities in the future enlarged European Union seem much more complex than what is suggested by the “statistical effect”, i.e. fall in average per capita GDP in the Community as a result of the recent accession of ten new Member States, often discussed by the European Commission. The European regional and cohesion policy also should take into account spatial interactions between regions.

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Appendix A

Eurostat-Regio Database

The data are extracted from the Eurostat-Regio database. Eurostat is the Statistical Office of the European Communities. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. These statistics are used by the European Commission and other European Institutions so that they can define, implement, and analyze Community policies. The Regio database is the official source of harmonized annual data at the regional level throughout the 1980-1995 period for the European Union and per capita GDP is likely to be one of the most reliable series in this database.

We use the Eurostat 1995 nomenclature of statistical territorial units, which is referred to as NUTS (Nomenclature of Territorial Units for Statistics). The aim is to provide a single uniform breakdown of territorial units for the production of regional statistics for the European Union. In this nomenclature NUTS1 means European Community Regions while NUTS2 means Basic Administrative Units. For practical reasons to do with data availability and the implementation of regional policies, this nomenclature is based primarily on the institutional divisions currently in force in the Member States following “normative criteria”. Eurostat defines these criteria as follows: “normative regions are the expression of political will; their limits are fixed according to the tasks allocated to the territorial communities, according to the size of population necessary to carry out these tasks efficiently and economically, and according to historical and cultural factors” (Regio database, user’s guide, Methods and Nomenclatures, Eurostat, 1999, p.7). It excludes territorial units specific to certain fields of activity or functional units in favor of regional units of a general nature. The regional breakdown adopted by Eurostat appears therefore as one of the major shortcomings of the Regio database, which can have some impact on our spatial weight matrix and estimation results (scale problems).

We use the series E2GDP95 for EU15 and XE_GDP for new acceding and candidate countries based on ESA95 measured in purchasing power parity (PPS) per inhabitant over the 1995-2000 period. We use per capita GDP expressed in purchasing power standards (PPS) since it takes into account price levels variations between countries not reflected by prevailing exchange rates and because it is widely used as a key indicator for assessing levels of economic development in regions and disparities between them in cross-region international comparisons. In addition, the eligibility condition under Objective 1 of Structural Funds is also

expressed in PPS and not in Euro. Using PPS allows a better understanding of the consequences of the enlargement process on the eligibility criteria.

The first sample contains 203 NUTS2 regions for EU15 and the second contains 258 NUTS2 regions for EU27: Belgium (11), Denmark (1), Germany (40), Greece (13), Spain (16), France (22), Ireland (2), Italy (20), Luxembourg (1), Netherlands (12), Austria (9), Portugal (5), Finland (6), Sweden (8), United-Kingdom (37) for EU15 and Czech Republic (8), Estonia (1), Hungary (7), Lithuania (1), Latvia (1), Poland (16), Slovenia (1), Slovakia (4), Malta (1), Cyprus (1), for the new acceding countries and Romania (8), Bulgaria (6) for candidate countries for EU27.

We exclude some geographically isolated regions in both of our samples: the Canary Islands and Ceuta y Mellila for Spain, the Azores and Madeira for Portugal, Guadeloupe, Martinique, French Guyana and Réunion for France.

The choice of the NUTS2 level as our spatial scale of analysis may appear to be quite arbitrary and may have some impact on our inference results. Regions in NUTS2 level may be too large in respect to the variable of interest and the unobserved heterogeneity may create an ecological fallacy, so that it might have been more relevant to use NUTS3 level. Conversely, they may be too small so that the spatial autocorrelation detected could be an artifact that comes out from slicing homogenous zones in respect to the variable considered, so that it might have been more relevant to use NUTS1 level. Even if, ideally, the choice of the spatial scale should be based on theoretical considerations, we are constrained in empirical studies by data availability. Moreover, our preference for the NUTS2 level rather than the NUTS1 level, when data are available, is based on European regional development policy considerations: indeed it is the level at which eligibility under Objective 1 of Structural Funds is determined since their reform in 1989. Our empirical results are indeed conditioned by this choice and could be affected by different levels of aggregation and even by missing regions. Therefore, they must be interpreted with caution.

Appendix B

Getis-Ord statistics for log per capita GDP measured in PPS and average annual growth rates, 1995 and 2000 for EU15 and EU27

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|----------------|--------------------------------------|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| Belgium | | | | | | | |
| be1 | Région Bruxelles-capitale | + | +* | + | + | - | - |
| be21 | Antwerpen | +* | +* | +* | +* | - | - |
| be22 | Limburg (B) | +* | +* | +* | +* | - | - |
| be23 | Oost-Vlaanderen | + | +* | + | +* | - | - |
| be24 | Vlaams Brabant | +* | +* | + | +* | - | - |
| be25 | West-Vlaanderen | + | +* | + | +* | - | - |
| be31 | Brabant Wallon | + | +* | + | +* | .* | - |
| be32 | Hainaut (Objective 1) | + | +* | + | +* | .* | - |
| be33 | Liège | + | +* | + | +* | - | - |
| be34 | Luxembourg (B) | +* | +* | + | +* | - | - |
| be35 | Namur | + | +* | + | +* | .* | - |
| Denmark | | | | | | | |
| dk | Denmark | +* | +* | + | +* | .* | - |
| Germany | | | | | | | |
| de11 | Stuttgart | +* | +** | +* | +* | .* | - |
| de12 | Karlsruhe | +* | +* | +* | +* | .* | - |
| de13 | Freiburg | +* | +** | +* | +* | .* | - |
| de14 | Tübingen | +** | +** | +** | +** | - | - |
| de21 | Oberbayern | +* | +** | +* | +** | - | - |
| de22 | Niederbayern | +* | + | +* | + | - | - |
| de23 | Oberpfalz | + | + | + | + | - | .* |
| de24 | Oberfranken | + | + | + | + | - | - |
| de25 | Mittelfranken | +* | +* | +* | +* | - | - |
| de26 | Unterfranken | +* | +* | +* | +* | - | - |
| de27 | Schwaben | +** | +** | +** | +** | - | - |
| de3 | Berlin (Objective 1, East Berlin) | .* | - | .** | - | - | - |
| de4 | Brandenburg (Objective 1) | .* | - | .** | - | .* | .* |
| de5 | Bremen | +* | +* | + | +* | .** | .* |
| de6 | Hamburg | + | + | + | + | .** | - |
| de71 | Darmstadt | +* | +* | + | +* | .* | - |
| de72 | Gießen | +* | +** | +* | +* | .* | - |
| de73 | Kassel | + | +* | + | +* | - | - |
| de8 | Mecklenburg-Vorpommern (Objective 1) | - | + | - | + | .* | - |
| de91 | Braunschweig | + | + | + | + | .* | - |
| de92 | Hannover | +* | +* | + | +* | .** | .* |
| de93 | Lüneburg | + | +* | + | +* | .* | - |
| de94 | Weser-Ems | +* | +* | + | +* | - | - |
| dea1 | Düsseldorf | + | + | + | + | .* | - |
| dea2 | Köln | + | +* | + | + | .* | - |
| dea3 | Münster | + | +* | + | +* | - | - |
| dea4 | Detmold | +* | +* | + | +* | .** | .* |
| dea5 | Arnsberg | +* | +* | + | +* | .** | .* |
| deb1 | Koblenz | +* | +** | +* | +* | .* | - |
| deb2 | Trier | + | +* | + | +* | .* | - |
| deb3 | Rheinhessen-Pfalz | +* | +* | + | +* | .** | .* |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|---------------|---|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| dec | Saarland | + | + | + | + | -** | - |
| ded1 | Chemnitz (Objective 1) | - | - | - | - | -** | .* |
| ded2 | Dresden (Objective 1) | - | - | .* | - | .* | -** |
| ded3 | Leipzig (Objective 1) | - | - | .* | - | .* | .* |
| dee1 | Dessau (Objective 1) | .* | - | .* | - | .* | .* |
| dee2 | Halle (Objective 1) | - | + | - | - | - | - |
| dee3 | Magdeburg (Objective 1) | - | + | - | + | -** | - |
| def | Schleswig-Holstein | + | + | + | + | .* | - |
| deg | Thüringen (Objective 1) | - | + | - | + | - | - |
| Greece | | | | | | | |
| gr11 | Anatoliki Makedonia, Thraki (Objective 1) | -** | -** | -** | -** | .* | -** |
| gr12 | Kentriki Makedonia (Objective 1) | -** | -** | -** | -** | + | .* |
| gr13 | Dytiki Makedonia (Objective 1) | -** | .* | -** | .* | + | - |
| gr14 | Thessalia (Objective 1) | -** | - | -** | - | + | - |
| gr21 | Ipeiros (Objective 1) | -** | - | -** | - | + | + |
| gr22 | Ionia Nisia (Objective 1) | -** | - | -** | - | .* | + |
| gr23 | Dytiki Ellada (Objective 1) | -** | - | -** | - | .* | + |
| gr24 | Sterea Ellada (Objective 1) | -** | .* | -** | - | .* | + |
| gr25 | Peloponnisos (Objective 1) | -** | - | -** | - | + | + |
| gr3 | Attiki (Objective 1) | -** | - | -** | - | + | + |
| gr41 | Voreio Aigaio (Objective 1) | -** | .* | -** | .* | + | - |
| gr42 | Notio Aigaio (Objective 1) | -** | .* | -** | .* | + | - |
| gr43 | Kriti (Objective 1) | -** | - | -** | - | + | + |
| Spain | | | | | | | |
| es11 | Galicia (Objective 1) | -** | - | .* | - | .* | + |
| es12 | Principado de Asturias (Objective 1) | .* | - | .* | + | .* | + |
| es13 | Cantabria (Objective 1) | - | + | - | + | + | + |
| es21 | Pais Vasco | - | + | - | + | + | + |
| es22 | Comunidad Foral de Navarra | - | + | - | + | + | + |
| es23 | La Rioja | - | + | - | + | .* | + |
| es24 | Aragón | - | + | - | + | + | + |
| es3 | Comunidad de Madrid | .* | - | .* | + | .* | + |
| es41 | Castilla y León (Objective 1) | .* | + | - | + | .* | + |
| es42 | Castilla-la Mancha (Objective 1) | .* | + | - | + | .* | + |
| es43 | Extremadura (Objective 1) | -** | - | -** | - | + | + |
| es51 | Cataluña | - | + | - | + | + | + |
| es52 | Comunidad Valenciana (Objective 1) | - | + | - | + | .* | + |
| es53 | Illes Balears | - | + | - | + | + | + |
| es61 | Andalucia (Objective 1) | -** | - | -** | - | + | + |
| es62 | Murcia (Objective 1) | .* | + | - | + | .* | + |
| France | | | | | | | |
| fr1 | Île de France | - | + | - | + | .* | - |
| fr21 | Champagne-Ardenne | + | .* | + | + | .* | - |
| fr22 | Picardie | .* | .* | + | .* | .* | - |
| fr23 | Haute-Normandie | + | .* | + | .* | + | + |
| fr24 | Centre | + | + | - | + | - | - |
| fr25 | Basse-Normandie | + | + | + | .* | + | + |
| fr26 | Bourgogne | + | + | - | + | .* | - |
| fr3 | Nord - Pas-de-Calais | .* | *** | .* | .* | .* | - |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|-------------------|--|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| fr41 | Lorraine | + | + | + | + | -* | - |
| fr42 | Alsace | + | + | + | + | -** | -* |
| fr43 | Franche-Comté | + | + | + | + | - | - |
| fr51 | Pays de la Loire | + | + | + | + | - | - |
| fr52 | Bretagne | - | + | - | + | + | + |
| fr53 | Poitou-Charentes | + | + | + | + | - | - |
| fr61 | Aquitaine | - | + | - | + | + | + |
| fr62 | Midi-Pyrénées | - | + | - | + | - | - |
| fr63 | Limousin | + | + | + | + | - | - |
| fr71 | Rhône-Alpes | + | + | + | + | -* | - |
| fr72 | Auvergne | + | + | + | + | - | - |
| fr81 | Languedoc-Roussillon | + | + | - | + | - | - |
| fr82 | Provence-Alpes-Côte d'Azur | + | + | + | + | - | - |
| fr83 | Corse (Objective 1) | + | + | + | + | - | - |
| Ireland | | | | | | | |
| ie01 | Border, Midlands and Western (Objective 1) | - | + | - | + | + | + |
| ie02 | Southern and Eastern (Objective 1) | - | + | - | + | + | + |
| Italy | | | | | | | |
| it11 | Piemonte | + | + | + | + | - | - |
| it12 | Valle d'Aosta | + | + | + | + | - | - |
| it13 | Liguria | + | + | + | + | + | + |
| it2 | Lombardia | + | + | + | + | + | + |
| it31 | Trentino-Alto Adige | + | + | + | + | + | + |
| it32 | Veneto | + | + | + | + | + | + |
| it33 | Friuli-Venezia Giulia | + | + | + | + | + | + |
| it4 | Emilia-Romagna | + | + | + | + | + | + |
| it51 | Toscana | + | + | + | + | + | + |
| it52 | Umbria | + | + | + | + | + | + |
| it53 | Marche | + | + | + | + | + | + |
| it6 | Lazio | - | + | + | + | + | + |
| it71 | Abruzzo (Objective 1) | + | + | + | + | + | + |
| it72 | Molise (Objective 1) | - | + | - | + | + | + |
| it8 | Campania (Objective 1) | - | + | - | + | + | + |
| it91 | Puglia (Objective 1) | -* | - | -* | + | + | + |
| it92 | Basilicata (Objective 1) | -* | + | - | + | + | + |
| it93 | Calabria (Objective 1) | -** | - | -** | - | + | + |
| ita | Sicilia (Objective 1) | - | - | - | + | + | + |
| itb | Sardegna (Objective 1) | + | + | + | + | + | + |
| Luxembourg | | | | | | | |
| lu | Luxembourg | + | + | - | + | -** | -* |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|--------------------|-------------------------------------|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| Netherlands | | | | | | | |
| nl11 | Groningen | + | + | + | + | - | - |
| nl12 | Friesland | + | + | + | + | + | + |
| nl13 | Drenthe | + | + | + | + | - | - |
| nl21 | Overijssel | + | + | + | + | - | - |
| nl22 | Gelderland | + | + | + | + | + | + |
| nl23 | Flevoland (Objective 1) | + | + | + | + | + | + |
| nl31 | Utrecht | + | + | + | + | + | + |
| nl32 | Noord-Holland | + | + | + | + | + | + |
| nl33 | Zuid-Holland | + | + | + | + | - | - |
| nl34 | Zeeland | + | + | + | + | - | - |
| nl41 | Noord-Brabant | + | + | + | + | + | + |
| nl42 | Limburg (NL) | + | + | + | + | - | - |
| Austria | | | | | | | |
| at11 | Burgenland (Objective 1) | + | - | + | - | + | + |
| at12 | Niederösterreich | + | - | + | - | - | - |
| at13 | Vienna | + | - | + | - | + | + |
| at21 | Kärnten | + | + | + | + | + | + |
| at22 | Steiermark | + | + | + | + | + | + |
| at31 | Oberösterreich | + | + | + | + | + | - |
| at32 | Salzburg | + | + | + | + | + | + |
| at33 | Tirol | + | + | + | + | - | - |
| at34 | Vorarlberg | + | + | + | + | - | - |
| Portugal | | | | | | | |
| pt11 | Norte (Objective 1) | - | - | - | - | + | + |
| pt12 | Centro (PT) (Objective 1) | - | - | - | - | + | + |
| pt13 | Lisboa e Vale do Tejo (Objective 1) | - | - | - | - | + | + |
| pt14 | Alentejo (Objective 1) | - | - | - | - | + | + |
| pt15 | Algarve (Objective 1) | - | - | - | - | + | + |
| Finland | | | | | | | |
| fi13 | Itä-Suomi | + | - | + | - | + | + |
| fi14 | Väli-Suomi | + | - | + | + | + | + |
| fi15 | Pohjois-Suomi | + | + | + | + | + | + |
| fi16 | Uusimaa (suuralue) | + | - | + | - | + | + |
| fi17 | Etelä-Suomi | + | - | + | - | + | + |
| fi2 | Åland | + | + | + | + | - | + |
| Sweden | | | | | | | |
| se01 | Stockholm | + | - | + | - | - | + |
| se02 | Östra Mellansverige | + | - | + | + | - | + |
| se04 | Sydsverige | - | - | - | - | - | - |
| se06 | Norra Mellansverige | + | + | + | + | - | + |
| se07 | Mellersta Norrland | + | + | + | + | - | + |
| se08 | Övre Norrland | + | + | + | + | + | + |
| se09 | Småland med öarna | + | - | + | - | - | + |
| se0a | Västsvrige | + | + | + | + | - | - |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|-----------------------|---|------|------|--------------|------|------|------|
| | | 2000 | 1995 | Growth rates | | | |
| United-Kingdom | | | | | | | |
| ukc1 | Tees Valley and Durham | - | + | - | + | + | + |
| ukc2 | Northumberland, Tyne and Wear | - | + | - | + | - | - |
| ukd1 | Cumbria | - | + | - | + | - | + |
| ukd2 | Cheshire | - | + | - | + | + | + |
| ukd3 | Greater Manchester | - | + | - | + | + | + |
| ukd4 | Lancashire | - | + | - | + | + | + |
| ukd5 | Merseyside (Objective 1) | - | + | - | + | + | + |
| uke1 | East Riding and North Lincolnshire | - | + | - | + | + | + |
| uke2 | North Yorkshire | - | + | - | + | + | + |
| uke3 | South Yorkshire | - | + | - | + | + | + |
| uke4 | West Yorkshire | - | + | - | + | + | + |
| ukf1 | Derbyshire and Nottinghamshire | - | + | - | + | + | + |
| ukf2 | Leicestershire, Rutland and Northants | + | + | + | + | + | + |
| ukf3 | Lincolnshire | + | + | + | + | + | + |
| ukg1 | Herefordshire, Worcestershire and Warks | + | + | + | + | + | + |
| ukg2 | Shropshire and Staffordshire | - | + | - | + | + | + |
| ukg3 | West Midlands | + | + | + | + | + | + |
| ukh1 | East Anglia | + | + | + | + | + | + |
| ukh2 | Bedfordshire, Hertfordshire | + | + | + | + | + | + |
| ukh3 | Essex | + | + | + | + | + | + |
| uki1 | Inner London | + | + | + | + | + | + |
| uki2 | Outer London | + | + | + | + | + | + |
| ukj1 | Berkshire, Bucks and Oxfordshire | + | + | + | + | + | + |
| ukj2 | Surrey, East and West Sussex | + | + | + | + | + | + |
| ukj3 | Hampshire and Isle of Wight | + | + | + | + | + | + |
| ukj4 | Kent | + | + | + | + | + | + |
| ukk1 | Gloucestershire, Wiltshire and North Somerset | + | + | + | + | + | + |
| ukk2 | Dorset and Somerset | - | + | - | + | + | + |
| ukk3 | Cornwall and Isles of Scilly | - | + | - | + | + | + |
| ukk4 | Devon | - | + | - | + | + | + |
| ukl1 | West Wales and The Valleys | - | + | - | + | + | + |
| ukl2 | East Wales | - | + | - | + | + | + |
| ukm1 | North Eastern Scotland | - | + | - | + | - | - |
| ukm2 | Eastern Scotland | - | + | - | + | - | - |
| ukm3 | South Western Scotland | - | + | - | + | - | - |
| ukm4 | Highlands and Islands (Objective 1) | - | + | - | + | - | - |
| ukn | Northern Ireland (Objective 1) | - | + | - | + | + | + |

Notes: (*) significant at the 5% significance level based on normal approximation
(**) significant at the 5 % Sidak pseudo-significance level
(Objective 1) : Eligible Regions which have benefited from Objective 1 Structural Funds throughout the 1995-2000 period taking into account NUTS modifications

Annexe C

LISA for log per capita GDP measured in PPS and average annual growth rates, 1995 and 2000 for EU15 and EU27

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|----------------|--------------------------------------|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| Belgium | | | | | | | |
| be1 | Région Bruxelles-capitale | HH | HH* | HH | HH* | LL* | LL |
| be21 | Antwerpen | HH* | HH** | HH* | HH** | LL | LL |
| be22 | Limburg (B) | HH* | HH** | LH* | HH** | LL | LL |
| be23 | Oost-Vlaanderen | HH* | HH** | HH | HH* | LL* | LL |
| be24 | Vlaams Brabant | HH* | HH** | HH | HH* | HL* | HL |
| be25 | West-Vlaanderen | HH* | HH** | HH | HH* | LL* | LL |
| be31 | Brabant Wallon | HH* | HH** | HH | HH* | HL** | HL* |
| be32 | Hainaut (Objective 1) | LH* | LH** | LH | LH* | LL* | LL* |
| be33 | Liège | LH | HH* | LH | HH* | LL | LL |
| be34 | Luxembourg (B) | LH* | HH** | LH* | HH** | LL | LL |
| be35 | Namur | LH* | HH** | LH | LH* | LL* | LL |
| Denmark | | | | | | | |
| dk | Denmark | HH* | HH** | HH | HH* | HL** | HL* |
| Germany | | | | | | | |
| de11 | Stuttgart | HH** | HH** | HH* | HH** | HL* | HL |
| de12 | Karlsruhe | HH* | HH** | HH* | HH** | LL* | LL |
| de13 | Freiburg | HH** | HH** | HH* | HH** | LL* | LL |
| de14 | Tübingen | HH** | HH** | HH** | HH** | LL | LL |
| de21 | Oberbayern | HH** | HH** | HH* | HH** | HL | HL |
| de22 | Niederbayern | HH* | HH | HH* | HH | LL | LL |
| de23 | Oberpfalz | HH | HH | HH | HH | HL | HL* |
| de24 | Oberfranken | HH | HH* | HH | HH* | LL | LL |
| de25 | Mittelfranken | HH* | HH** | HH* | HH** | LL | LL |
| de26 | Unterfranken | HH* | HH** | HH* | HH** | LL* | LL |
| de27 | Schwaben | HH** | HH** | HH** | HH** | LL | LL |
| de3 | Berlin (Objective 1, East Berlin) | HL** | HL | HL** | HL | LL* | LL |
| de4 | Brandenburg (Objective 1) | LL* | LL | LL** | LL | LL* | LL* |
| de5 | Bremen | HH* | HH** | HH | HH* | LL** | LL* |
| de6 | Hamburg | HH | HH* | HH | HH | LL** | LL* |
| de71 | Darmstadt | HH* | HH** | HH* | HH* | LL* | LL |
| de72 | Gießen | HH** | HH** | HH* | HH** | LL* | LL |
| de73 | Kassel | HH* | HH* | HH | HH* | LL* | LL |
| de8 | Mecklenburg-Vorpommern (Objective 1) | LL | LH | LL | LH | LL** | LL* |
| de91 | Braunschweig | HH | HH* | HH | HH* | HL* | HL |
| de92 | Hannover | HH* | HH** | HH* | HH* | LL** | LL* |
| de93 | Lüneburg | LH* | HH* | LH | HH* | LL* | LL |
| de94 | Weser-Ems | HH* | HH** | LH* | HH* | LL* | LL |
| dea1 | Düsseldorf | HH | HH* | HH | HH | LL* | LL |
| dea2 | Köln | HH | HH* | HH | HH* | LL* | LL |
| dea3 | Münster | HH* | HH** | LH | HH* | LL* | LL |
| dea4 | Detmold | HH* | HH** | HH | HH* | LL** | LL* |
| dea5 | Arnsberg | HH* | HH** | HH* | HH** | LL** | LL* |
| deb1 | Koblenz | HH** | HH** | LH* | HH** | LL* | LL |
| deb2 | Trier | LH* | HH** | LH | HH* | LL* | LL |
| deb3 | Rheinessen-Pfalz | HH* | HH** | HH | HH* | LL** | LL* |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|---------------|---|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| | | | | | | | |
| dec | Saarland | HH | HH* | HH | HH* | LL** | LL* |
| ded1 | Chemnitz (Objective 1) | LL | LL | LL* | LL | LL** | LL* |
| ded2 | Dresden (Objective 1) | LL* | LL | LL* | LL | LL* | LL** |
| ded3 | Leipzig (Objective 1) | LL* | HL | LL* | LL | LL* | LL* |
| dee1 | Dessau (Objective 1) | LL* | LL | LL** | LL | LL** | LL* |
| dee2 | Halle (Objective 1) | LL | LH | LL* | LL | LL | LL |
| dee3 | Magdeburg (Objective 1) | LL | LH | LL | LH | HL** | HL* |
| def | Schleswig-Holstein | HH* | HH* | HH | HH* | LL* | LL |
| deg | Thüringen (Objective 1) | LL | LH | LL | LH | HL | HL |
| Greece | | | | | | | |
| gr11 | Anatoliki Makedonia, Thraki (Objective 1) | LL** | LL** | LL** | LL** | LH* | LL** |
| gr12 | Kentriki Makedonia (Objective 1) | LL** | LL** | LL** | LL** | HH* | HL* |
| gr13 | Dytiki Makedonia (Objective 1) | LL** | LL* | LL** | LL* | HH | HL |
| gr14 | Thessalia (Objective 1) | LL** | LL* | LL** | LL* | HH | HL |
| gr21 | Ipeiros (Objective 1) | LL** | LL | LL** | LL | HH | HH |
| gr22 | Ionia Nisia (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| gr23 | Dytiki Ellada (Objective 1) | LL** | LL* | LL** | LL | LH* | LH |
| gr24 | Stereia Ellada (Objective 1) | LL** | HL* | LL** | HL | LH* | LH* |
| gr25 | Peloponnisos (Objective 1) | LL** | LL | LL** | LL | HH | HH |
| gr3 | Attiki (Objective 1) | LL** | LL* | LL** | LL | LH* | LH |
| gr41 | Voreio Aigaio (Objective 1) | LL** | LL* | LL** | LL* | HH | HL* |
| gr42 | Notio Aigaio (Objective 1) | LL** | LL* | LL** | HL* | HH | HL |
| gr43 | Kriti (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| Spain | | | | | | | |
| es11 | Galicia (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| es12 | Principado de Asturias (Objective 1) | LL** | LL | LL* | LH | HH* | HH |
| es13 | Cantabria (Objective 1) | LL | LH | LL | HH | HH | HH |
| es21 | Pais Vasco | HL | HH | HL | HH | HH | HH |
| es22 | Comunidad Foral de Navarra | HL | HH | HL | HH | HH | HH |
| es23 | La Rioja | LL | HH | LL | HH | HH* | HH |
| es24 | Aragón | LL | HH | LL | HH | HH* | HH |
| es3 | Comunidad de Madrid | HL** | HL | HL* | HH | HH* | HH |
| es41 | Castilla y León (Objective 1) | LL* | LH | LL* | LH | HH* | HH* |
| es42 | Castilla-la Mancha (Objective 1) | LL* | LH | LL* | LH | HH* | HH* |
| es43 | Extremadura (Objective 1) | LL** | LL | LL** | LL | HH | HH |
| es51 | Cataluña | HL | HH | HL | HH | HH | HH |
| es52 | Comunidad Valenciana (Objective 1) | LL | LH | LL | HH | HH* | HH |
| es53 | Illes Balears | HL | HH | HL | HH | HH | HH |
| es61 | Andalucia (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| es62 | Murcia (Objective 1) | LL* | LH | LL* | LH | HH* | HH |
| France | | | | | | | |
| fr1 | île de France | HL | HH | HL | HH | LL** | LL* |
| fr21 | Champagne-Ardenne | HH | HH* | HH | HH* | LL* | LL |
| fr22 | Picardie | LH* | HH** | LH | HH* | LL* | LL |
| fr23 | Haute-Normandie | HH | HH* | HH | HH* | LH | LH |
| fr24 | Centre | HH | HH | LL | HH | LL* | LL |
| fr25 | Basse-Normandie | LH | HH* | LH | HH* | LH | LH |
| fr26 | Bourgogne | HH | HH* | LL | HH | LL** | LL* |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|-------------------|--|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| | | | | | | | |
| fr3 | Nord - Pas-de-Calais | LH** | HH** | LH* | HH** | LL* | LL |
| fr41 | Lorraine | LH | HH* | LH | HH* | LL** | LL* |
| fr42 | Alsace | HH* | HH** | HH | HH* | LL** | LL* |
| fr43 | Franche-Comté | LH* | HH** | LH* | HH** | LL | LL |
| fr51 | Pays de la Loire | LH | HH* | LH | HH* | LL | LL |
| fr52 | Bretagne | LL | HH | LL | HH | LH | LH |
| fr53 | Poitou-Charentes | LH | HH* | LH | HH | LL* | LL |
| fr61 | Aquitaine | HL | HH | LL | HH | LH | LH |
| fr62 | Midi-Pyrénées | LL | HH | LL | HH | LL | LL |
| fr63 | Limousin | LH | HH | LH | HH | LL | LL |
| fr71 | Rhône-Alpes | HH | HH* | HH | HH | LL* | LL |
| fr72 | Auvergne | LH | HH* | LH | HH | LL* | LL |
| fr81 | Languedoc-Roussillon | LH | HH | LL | HH | LL | LL |
| fr82 | Provence-Alpes-Côte d'Azur | HH | HH* | LH | HH* | LL | LL |
| fr83 | Corse (Objective 1) | LH* | HH** | LH* | HH** | LL | LL |
| Ireland | | | | | | | |
| ie01 | Border, Midlands and Western (Objective 1) | LL | LH | LL | HH | HH | HH |
| ie02 | Southern and Eastern (Objective 1) | HL | HH | HL | HH | HH | HH |
| Italy | | | | | | | |
| it11 | Piemonte | HH* | HH** | HH* | HH** | HL | HL |
| it12 | Valle d'Aosta | HH* | HH** | HH* | HH** | LL | LL |
| it13 | Liguria | HH** | HH** | HH** | HH** | HH | HH |
| it2 | Lombardia | HH** | HH** | HH** | HH** | HH | HH |
| it31 | Trentino-Alto Adige | HH** | HH** | HH** | HH** | HH | HH |
| it32 | Veneto | HH** | HH** | HH** | HH** | HH | HH |
| it33 | Friuli-Venezia Giulia | HH** | HH** | HH** | HH** | LH | LH |
| it4 | Emilia-Romagna | HH* | HH** | HH* | HH** | HH | HH |
| it51 | Toscana | HH* | HH** | HH* | HH** | HH | HH |
| it52 | Umbria | HH | HH* | HH | HH* | HH | HH |
| it53 | Marche | HH | HH* | HH* | HH* | HH | HH |
| it6 | Lazio | HL | HH | HH | HH | HH | HH |
| it71 | Abruzzo (Objective 1) | LH | HH | LH | HH* | LH | LH |
| it72 | Molise (Objective 1) | LL | HH | LL | HH | HH | HH |
| it8 | Campania (Objective 1) | LL | LH | LL | LH | HH | HH |
| it91 | Puglia (Objective 1) | LL* | LL | LL* | LH | HH | HH |
| it92 | Basilicata (Objective 1) | LL* | LH | LL* | LH | HH | HH |
| it93 | Calabria (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| ita | Sicilia (Objective 1) | LL* | LL | LL | LH | HH | HH |
| itb | Sardegna (Objective 1) | LH | LH* | LH | HH* | HH | HH |
| Luxembourg | | | | | | | |
| lu | Luxembourg | HH | HH | HL | HH | HL** | HL* |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|--------------------|-------------------------------------|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| Netherlands | | | | | | | |
| nl11 | Groningen | HH | HH* | HH | HH* | LL | LL |
| nl12 | Friesland | LH* | HH** | HH* | HH** | HH | HH |
| nl13 | Drenthe | LH* | HH* | LH | HH* | LL | LL |
| nl21 | Overijssel | HH | HH* | HH | HH* | HL | HL |
| nl22 | Gelderland | HH | HH* | HH | HH* | HH | HH |
| nl23 | Flevoland (Objective 1) | LH* | HH* | LH* | HH** | HH | HH |
| nl31 | Utrecht | HH | HH* | HH | HH* | HH | HH |
| nl32 | Noord-Holland | HH | HH* | HH | HH* | HH | HH |
| nl33 | Zuid-Holland | HH** | HH** | HH** | HH** | HL | HL |
| nl34 | Zeeland | HH* | HH** | HH* | HH** | LL | LL |
| nl41 | Noord-Brabant | HH* | HH** | HH** | HH** | HH | HH |
| nl42 | Limburg (NL) | HH* | HH** | HH | HH* | HL | HL |
| Austria | | | | | | | |
| at11 | Burgenland (Objective 1) | LH* | LL | LH* | LL | HH | HH* |
| at12 | Niederösterreich | LH | HL | HH | HL | HL | HL |
| at13 | Vienna | HL | HL | HH | HL | LH | LH |
| at21 | Kärnten | HH* | HH* | HH** | HH** | HH | HH |
| at22 | Steiermark | LH* | HH | HH* | HH | HH | HH |
| at31 | Oberösterreich | HH* | HH | HH* | HH | HH | HL |
| at32 | Salzburg | HH* | HH* | HH* | HH* | HH | HH |
| at33 | Tirol | HH** | HH** | HH** | HH** | HL | HL |
| at34 | Vorarlberg | HH** | HH** | HH** | HH** | HL | HL |
| Portugal | | | | | | | |
| pt11 | Norte (Objective 1) | LL** | LL | LL** | LL | HH* | HH |
| pt12 | Centro (PT) (Objective 1) | LL** | LL | LL** | LL | LH* | LH |
| pt13 | Lisboa e Vale do Tejo (Objective 1) | HL** | HL | HL** | HL | HH | HH |
| pt14 | Alentejo (Objective 1) | LL** | LL | LL** | LL | LH* | LH |
| pt15 | Algarve (Objective 1) | LL** | LL | LL** | LL | LH* | LH |
| Finland | | | | | | | |
| fi13 | Itä-Suomi | LH | LL | LH | LL | LH | LH** |
| fi14 | Väli-Suomi | LH | HL | LH | HH | HH | HH** |
| fi15 | Pohjois-Suomi | LH | HH | LH | HH | HH | HH* |
| fi16 | Uusimaa (suuralue) | HH | HL* | HH | HL | HH | HH** |
| fi17 | Etelä-Suomi | LH | HL | HH | HL | HH | HH** |
| fi2 | Åland | HH | HH | HH | HH | HL | HH |
| Sweden | | | | | | | |
| se01 | Stockholm | HH | HL | HH | HL | HL | HH |
| se02 | Östra Mellansverige | HH | HL | LH | HH | LL* | LH |
| se04 | Sydsverige | HL | HL | HL* | HL | LL** | LL |
| se06 | Norra Mellansverige | HH | HH | LH | HH | LL | LH |
| se07 | Mellersta Norrland | HH | HH | HH | HH | LL | LH |
| se08 | Övre Norrland | HH | HH* | LH | HH* | LH | LH |
| se09 | Småland med öarna | HH | HL | HH | HL | LL* | LH* |
| se0a | Västsverige | HH | HH | HH | HH | LL** | LL |

| Code | Regions | UE15 | UE27 | UE15 | UE27 | UE15 | UE27 |
|-----------------------|---|------|------|------|------|--------------|------|
| | | 2000 | | 1995 | | Growth rates | |
| United-Kingdom | | | | | | | |
| ukc1 | Tees Valley and Durham | LL | HH | LL | LH | LH | LH |
| ukc2 | Northumberland, Tyne and Wear | LL | HH | LL | HH | LL | LL |
| ukd1 | Cumbria | HL | HH | LL | HH | LL | LH |
| ukd2 | Cheshire | HL | HH | HL | HH | HH | HH |
| ukd3 | Greater Manchester | LL | HH | LL | HH | HH | HH |
| ukd4 | Lancashire | LL | HH | LL | HH | LH | LH |
| ukd5 | Merseyside (Objective 1) | LL | LH | LL | LH | HH | HH |
| uke1 | East Riding and North Lincolnshire | LL | HH | HL | HH | HH* | HH |
| uke2 | North Yorkshire | LL | HH | HL | HH | HH | HH |
| uke3 | South Yorkshire | LL | LH | LL | LH | HH | HH |
| uke4 | West Yorkshire | LL | HH | LL | HH | HH | HH |
| ukf1 | Derbyshire and Nottinghamshire | LL | HH | LL | HH | HH* | HH |
| ukf2 | Leicestershire, Rutland and Northants | HH | HH* | HH | HH* | HH* | HH* |
| ukf3 | Lincolnshire | LH | HH | LH | HH* | HH** | HH* |
| ukg1 | Herefordshire, Worcestershire and Warks | HH | HH | HH | HH* | HH | HH |
| ukg2 | Shropshire and Staffordshire | LL | HH | LL | HH | HH | HH |
| ukg3 | West Midlands | HH | HH | HH | HH* | LH* | LH |
| ukh1 | East Anglia | HH | HH* | HH* | HH** | HH** | HH* |
| ukh2 | Bedfordshire, Hertfordshire | HH | HH* | HH* | HH** | HH** | HH* |
| ukh3 | Essex | LH | HH* | HH* | HH** | HH** | HH* |
| uki1 | Inner London | HH | HH* | HH | HH* | HH** | HH* |
| uki2 | Outer London | LH | HH* | LH* | HH** | HH** | HH* |
| ukj1 | Berkshire, Bucks and Oxfordshire | HH | HH* | HH* | HH** | HH** | HH* |
| ukj2 | Surrey, East and West Sussex | HH | HH* | HH* | HH** | HH** | HH* |
| ukj3 | Hampshire and Isle of Wight | HH | HH* | HH* | HH** | HH** | HH* |
| ukj4 | Kent | LH | HH** | HH* | HH** | HH** | HH* |
| ukk1 | Gloucestershire, Wiltshire and North Somerset | HH | HH | HH | HH* | HH* | HH |
| ukk2 | Dorset and Somerset | LL | HH | LL | HH | HH* | HH |
| ukk3 | Cornwall and Isles of Scilly | LL | LH | LL | LH | HH | HH |
| ukk4 | Devon | LL | HH | LL | HH | LH* | LH |
| ukl1 | West Wales and The Valleys | LL | LH | LL | LH | HH | HH |
| ukl2 | East Wales | HL | HH | HL | HH | LH | LH |
| ukm1 | North Eastern Scotland | HL | HH | HL | HH | LL | LL |
| ukm2 | Eastern Scotland | HL | HH | HL | HH | LL | LL |
| ukm3 | South Western Scotland | LL | HH | LL | HH | LL | LL |
| ukm4 | Highlands and Islands (Objective 1) | LL | HH | LL | LH | LL | LL |
| ukn | Northern Ireland (Objective 1) | LL | HH | LL | HH | LH | LH |

Notes: (*) significant at the 5% significance level based on normal approximation
(**) significant at the 5 % Sidak pseudo-significance level
(Objective 1) : Eligible Regions which have benefited from Objective 1 Structural Funds throughout the 1995-2000 period taking into account NUTS modifications

Annexe D

Getis-Ord statistics and LISA for log per capita GDP measured in PPS and average annual growth rates, 1995 and 2000 for new acceding and candidate countries

| Code | Regions | 2000 | | 1995 | | Growth rates | |
|------|-----------------------|------|------|------|------|--------------|------|
| | | Gi | LISA | Gi | LISA | Gi | LISA |
| | Cyprus | | | | | | |
| cy | Cyprus | -.** | HL** | -.** | HL** | -.* | LL** |
| | Czech Republic | | | | | | |
| cz01 | Praha | - | HL* | - | HL | -.* | HL* |
| cz02 | Strední Cechy | - | LL | + | LH | -.* | LL* |
| cz03 | Jihozápad | + | LH | + | LH | - | LL |
| cz04 | Severozápad | - | LL | - | LL | - | LL |
| cz05 | Severovýchod | - | LL | - | LL | - | LL |
| cz06 | Jihovýchod | - | LL | - | LL | - | LL |
| cz07 | Strední Morava | -.* | LL* | -.* | LL* | - | LL |
| cz08 | Moravskoslezsko | -.** | LL** | -.** | LL** | + | LH |
| | Estonia | | | | | | |
| ee | Estonia | - | LL | - | LL* | +** | HH** |
| | Hungary | | | | | | |
| hu01 | Közép-Magyarország | -.** | HL** | -.** | LL** | + | HH |
| hu02 | Közép-Dunántúl | - | LL* | -.* | LL* | + | HH |
| hu03 | Nyugat-Dunántúl | - | LL | - | LL | + | HH |
| hu04 | Dél-Dunántúl | - | LL | - | LL | +* | HH* |
| hu05 | Észak-Magyarország | -.** | LL** | -.** | LL** | +* | HH** |
| hu06 | Észak-Alföld | -.** | LL** | -.** | LL** | + | LH |
| hu07 | Dél-Alföld | -.** | LL** | -.** | LL** | + | LH* |
| | Lithuania | | | | | | |
| lt | Lithuania | -.** | LL** | -.** | LL** | +** | HH** |
| | Latvia | | | | | | |
| lv | Latvia | -.* | LL* | -.** | LL** | +** | HH** |
| | Malta | | | | | | |
| mt | Malta | - | LL | - | LL | + | HH |
| | Poland | | | | | | |
| pl01 | Dolnoslaskie | -.** | LL** | -.* | LL* | - | HL |
| pl02 | Kujawsko-Pomorskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl03 | Lubelskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl04 | Lubuskie | -.* | LL* | - | LL* | - | HL |
| pl05 | Lódzkie | -.** | LL** | -.** | LL** | +* | HH* |
| pl06 | Malopolskie | -.** | LL** | -.** | LL** | + | HH |
| pl07 | Mazowieckie | -.** | LL** | -.** | LL** | +** | HH** |
| pl08 | Opolskie | -.** | LL** | -.** | LL** | - | LL |
| pl09 | Podkarpackie | -.** | LL** | -.** | LL** | +* | HH* |
| pl0a | Podlaskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl0b | Pomorskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl0c | Slaskie | -.** | LL** | -.** | LL** | + | HH |
| pl0d | Swietokrzyskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl0e | Warminsko-Mazurskie | -.** | LL** | -.** | LL** | +** | HH** |
| pl0f | Wielkopolskie | -.** | LL** | -.** | LL** | + | HH |
| pl0g | Zachodniopomorskie | -.* | LL* | -.* | LL* | + | HH |

| Code | Regions | 2000 | | 1995 | | Growth rates | |
|------|--------------------|------|------|------|------|--------------|------|
| | | Gi | LISA | Gi | LISA | Gi | LISA |
| | Slovenia | | | | | | |
| si | Slovenia | + | LH | + | LH | + | HH* |
| | Slovakia | | | | | | |
| sk01 | Bratislavský | - | HL* | - | HL* | - | HL |
| sk02 | Západné Slovensko | - | LL | - | LL | + | HH |
| sk03 | Stredné Slovensko | ** | LL** | ** | LL** | + | HH |
| sk04 | Východné Slovensko | ** | LL** | ** | LL** | + | HH |
| | Bulgaria | | | | | | |
| bg01 | Severozapaden | ** | LL** | ** | LL** | ** | LL** |
| bg02 | Severen Tsentralen | ** | LL** | ** | LL** | ** | LL** |
| bg03 | Severoiztochen | ** | LL** | ** | LL** | ** | LL** |
| bg04 | Yugozapaden | ** | LL** | ** | LL** | ** | LL** |
| bg05 | Yuzhen Tsentralen | ** | LL** | ** | LL** | ** | LL** |
| bg06 | Yugoiztochen | ** | LL** | ** | LL** | ** | LL** |
| | Roumania | | | | | | |
| ro01 | Nord-Est | ** | LL** | ** | LL** | ** | LL** |
| ro02 | Sud-Est | ** | LL** | ** | LL** | ** | LL** |
| ro03 | Sud | ** | LL** | ** | LL** | ** | LL** |
| ro04 | Sud-Vest | ** | LL** | ** | LL** | ** | LL** |
| ro05 | Vest | ** | LL** | ** | LL** | * | LL** |
| ro06 | Nord-Vest | ** | LL** | ** | LL** | * | LL* |
| ro07 | Centru | ** | LL** | ** | LL** | ** | LL** |
| ro08 | Bucuresti | ** | LL** | ** | LL** | ** | LL** |

Notes: (*) significant at the 5% significance level based on the normal approximation for Getis-Ord statistics and on 10 000 permutations for LISA

(**) significant at the 5 % Sidak pseudo-significance level for Getis-Ord statistics and at the 5 % Bonferroni pseudo-significance level for LISA

Annexe E

LISA for log per capita GDP measured in PPS and average annual growth rates, 1995 and 2000 for EU15 and EU27, using Bonferroni pseudo-significance level

| Years | % of significant statistics at the 5% Bonferroni pseudo-significance level | % of significant HH statistics at the 5% Bonferroni pseudo-significance level | % of significant LL statistics at the 5% Bonferroni pseudo-significance level | % of significant LH statistics at the 5% Bonferroni pseudo-significance level | % of significant HL statistics at the 5% Bonferroni pseudo-significance level |
|-------|--|---|---|---|---|
| 2000 | 18,23% | 5,91% | 11,33% | 0,00% | 0,99% |
| 1995 | 20,20% | 7,39% | 10,84% | 0,49% | 1,48% |

Table E1: significant LISA at the Bonferroni 5% pseudo-significance level for log per capita GDP (PPS) for 1995 and 2000, EU15

| Years | % of significant statistics at the 5% Bonferroni pseudo-significance level | % of significant HH statistics at the 5% Bonferroni pseudo-significance level | % of significant LL statistics at the 5% Bonferroni pseudo-significance level | % of significant LH statistics at the 5% Bonferroni pseudo-significance level | % of significant HL statistics at the 5% Bonferroni pseudo-significance level |
|-------|--|---|---|---|---|
| 2000 | 31,40% | 16,28% | 14,34% | 0,00% | 0,78% |
| 1995 | 34,88% | 19,38% | 14,73% | 0,39% | 0,39% |

Table E2: significant LISA at the Bonferroni 5% pseudo-significance level for log per capita GDP (PPS) for 1995 and 2000, EU27