

Bourdin, Sebastien

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## Local Convergences And Divergences In The European Union: An Analysis Of The Process Of Integration

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## **LOCAL CONVERGENCES AND DIVERGENCES IN THE EUROPEAN UNION: AN ANALYSIS OF THE PROCESS OF INTEGRATION**

**Abstract** - The measure of the regional disparities in the European Union was widely approached on the literature. Recent years have seen a spate of studies taking into account the spatial aspect of data in the analysis of convergence from an empirical viewpoint, or integrating spatial interdependencies from a theoretical viewpoint. In this scientific context, this paper aims to understand the spatial discontinuities at the origin of an uneven process of integration and convergence in the EU with the two last enlargements. The study shows that there are local phenomena of both marked convergence, or conversely divergence, underlying a process of uneven integration.

**Key-words** - LOCAL CONVERGENCE – REGIONAL DISPARITIES – INTEGRATION – DISCONTINUITIES – EUROPEAN UNION

**Classification JEL** - R11, R15, C31, C51

## **1. Introduction**

The two last enlargements of the European Union eastwards (2004 and 2007) have both promoted growth in these new member-states and also have created a growing discrepancy at the regional level. The regions further from the “heart of Europe” are experiencing an increase in their lagging behind. Consequently, the economic recovery of the new members of the EU seems to vary as a function of the countries and the regions, and is even problematic for the regions located at the easternmost reaches of the EU, which find it very difficult to speed up growth and improve competitiveness.

Even though on the EU ladder a clear spatial discontinuity can be discerned, which separates the economic level of the countries of Eastern and Central Europe from that of the ex-EU15, the phenomena of ruptures and discontinuities also exist at the local level. Local effects of convergence or divergence can, then, be given prominence and should be taken into account in conceiving European public policies for regional development (Bosker, 2009). These spatial discontinuities have their origin in highly asymmetric levels of development, which can either trigger a positive dynamic of local convergence and cooperation, or, conversely, instate a long-standing continental dynamic of territorial competitiveness characterized by pockets of local divergence.

The first part of this study will synthesize the theoretical and methodological framework for measuring convergence, highlighting the value of taking into account spatial effects. The second part of the article consists of a proposal for an original method of measuring convergence at the local level. Finally, there is a presentation of the results of this approach, which aims to understand the spatial discontinuities at the origin of an uneven process of integration and convergence.

## 2. Taking into account spatial effects in the measurement of convergence

Over the past decade, there has been a significant rise in the number of empirical studies on convergence<sup>1</sup> and they often produce contradictory results (Durlauf and Quah, 1999; Islam, 2003; Bode and Rey, Janikas and Rey and Janikas, 2005). The reason for the sensitivity of these results can be sought in the different concepts of convergence and therefore in methodologies inherent in each of these approaches. Recent years have seen a spate of studies taking into account the spatial aspect of data in the analysis of convergence from an empirical viewpoint (Fingleton and López-Bazo, 2006; Ertur and Koch, 2006; Dall’Erba and Le Gallo, 2008; Geppert *et al.*, 2008 ; Sardadvar, 2012), or integrating spatial interdependencies from a theoretical viewpoint (Arbia and Paelinck, 2003 ; Abreu *et al.*, 2005; Rey and Le Gallo, 2009). They detect both local spatial autocorrelation and spatial heterogeneity often taking the form of two spatial regimes (the center of Europe and its periphery). While geographical space is taken into account in the analysis of convergence and spatial aggregation phenomena seem to be present, this approach can be adopted on an even finer scale to detect “pockets of convergence” at a more local level. The approach of this article is part of very recent studies on local convergence. This concept refers to a situation where the rates of convergence are similar to observations made at points located close to one another in space.

Two approaches in particular take into account the spatial dimension of the convergence process: the GWR (*Geographically Weighted Regression*) method and the SALE (*Spatial Autoregressive Local Estimation*) method. Both methods estimate the  $\beta$ -convergence at the local level and we want review each of them in order to position methodologically the index of local convergence that we have developed and which will be presented below. Firstly, the GWR is a method that produces a set of localized estimates either of the model parameters, or

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<sup>1</sup> A bibliometric study (Rey and Anselin, 2000) shows that the terms "Convergence", "Regional Growth" and "agglomeration" have the highest occurrence index of all the terms published in the last decade.

of the quality of regression<sup>2</sup> for each region. With this method, Roger Bivand and Rolf Brunstad (2003 and 2005) have apprehended the spatial non-stationarity of data by exploring the interactions between EU agricultural policy and regional growth. They consider a model of conditional convergence taking into account the spatial gap and the temporal dimension for NUTS2 European regions over the period 1989-1999. They highlight the role European funds for agriculture play in variations of growth. Their results enable them to map the spatial variation of the speed of convergence. Regions in the Iberian Peninsula, West and South-West of France and Southern Italy appear to converge at a faster rate than the other regions of the sample. However, there are some areas that deviate from this result (Sicily, the Valencian Community, Murcia, the Balearic Islands and the Algarve). On the same principle, Hans-Friedrich Eckey *et al.* (2006) study the convergence of regional labor markets in Germany. Based on the Solow model, they assess the local coefficients of the regression equations enabling them to assess their rate of convergence between 1995 and 2002 over a sample of 180 regions. All local convergence parameters are negative, which leads the authors to conclude that convergence is general in the regions studied. The study shows that Baden-Württemberg, Saarland and the South of Bavaria take twice as long as the North of Germany for their level of labor productivity to converge towards a steady state. For their part, Jülide Yildirim *et al.* (2009) also use GWR to study regional disparities in GDP per capita and the dynamics of convergence in Turkey between 1987 and 2001. They find that there is a very considerable spatial variation between provinces in the speed of convergence, something that cannot be captured through an analysis of the classical  $\beta$ -convergence. Thus, the GWR made shows that the degree of convergence appears to be higher in the less developed regions of Turkey, that is to say, in the provinces of east and south-east. The authors explain this phenomenon by the fact that these are the very regions to have received the most public

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<sup>2</sup> Coefficient of determination

investment in order to attract new investments and increase their production. Finally, although the work of Dan-Yu Lin (2006) does not specifically address convergence, it is mentioned here because it tries to understand the mechanisms of regional development in China – especially in Greater Beijing – in order to demonstrate spatial non-stationarity using GWR. It takes into account several variables<sup>3</sup> of regional development in the regression for the year 1995. The study shows that Chinese regional development has strong local characteristics and highlights regional development trajectories.

Secondly, the SALE method, like all GWR, can provide additional information about the nature of the convergence of growth rates and its spatial variation. It allows both the spatial heterogeneity and the spatial autocorrelation<sup>4</sup> of the coefficient of  $\beta$ -convergence to be taken into account. Cem Ertur, Julie Le Gallo and James LeSage<sup>5</sup> (2007) showed that geographical circumstances constitute a significant factor in explaining the growth trajectories of European regions. Compared to a-spatial analyses, the results obtained highlight the importance of geographical conditioning. For example, a scenario of divergence between regions has primarily a spatial explanation, because the regions lagging behind are negatively influenced by being surrounded by other lagging regions. Similarly, a catch-up scenario would find one explanation in the fact that neighboring rich regions tend to “prevent” adjacent regions sliding down the hierarchy of European regions. From the perspective of geographical theories of growth, geographic conditions, such as economic conditions, strongly influence the development potential of regional economies and therefore the convergence process. The authors use a Bayesian spatial approach on a sample of 138 European regions over the period from 1980 to 1995. With this method, which they call *BSALE*, they assess for each region the  $\hat{\alpha}$  parameter and conclude that convergence in the EU15 is differentiated. Indeed, while they

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<sup>3</sup> It takes into account FDI, public investment and the rate of urbanization (in order to differentiate between rural and urban areas).

<sup>4</sup> According to Julie le Gallo (2004 b), spatial autocorrelation refers to the lack of independence between geographic observations while spatial heterogeneity is related to the differentiation in space of variables and behavior.

<sup>5</sup> With a Bayesian spatial econometric approach

observe clusters of regions characterized by convergence to their steady-state (the whole Iberian Peninsula, the west and south-west of France, the south-west of England), they conclude that the other regions are not in a state of convergence. Julie Le Gallo, Sandy Dall'erba and Rachel Guillain (2011) also used a BSALE Bayesian approach on 145 European regions to differentiate and measure the direct and indirect impacts of several variables (including structural funds) causing regional growth. This shows that regions in the countries of Mediterranean Europe and the UK benefit positively from European structural funds while French, Dutch, German, Danish and Belgian regions do not benefit. Finally, we should emphasize the contribution of Steven Durlauf *et al.* (2001) in highlighting a local Solow growth model. In other words, they propose to apply the Solow model in each country in order to observe the variations of the model parameters for all countries.

While GWR and the BSALE method allow an analysis of the convergence of regions through a model of localized beta-convergence, our index of local convergence is based on a localized version of sigma-convergence<sup>6</sup>. In other words, the two methods presented above offer a study of regions' catching-up or of their convergence to a steady state, while our local convergence index provides an analysis of the reduction in development disparities between a region vis-à-vis its neighbors. The different approaches thus seem to be complementary in measuring the various phenomena of convergence.

### **3. Spatialization of $\sigma$ -convergence**

The spatial dimension of the data is not taken into account in the measurement of  $\sigma$ -convergence on a global scale. We hypothesize that convergence should be calculated not only at the global level (beta and sigma convergence) but also at the local level. Thus, local measurements obtained will provide additional information on the nature of the convergence

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<sup>6</sup> As works of Rey and Dev (2006) or Egger and Pfaffermayr on the spatial effects of sigma-convergence

and on the forms of regional growth. They may also illustrate the potential importance of location factors in patterns of convergence. Local convergence is an indicator measuring the reduction (or increase) in economic disparities within a group of adjacent regions. In other words, there is local convergence when GDP per capita of regions included in the delimited area tend to the average level of GDP per capita of the zone concerned.

We have formalized this index of local convergence as follows:

$$C_i = \sum_{j \in V(i)} \frac{\frac{\sigma_n^j}{m_n^j} - \frac{\sigma_0^j}{m_0^j}}{n} \quad (1)$$

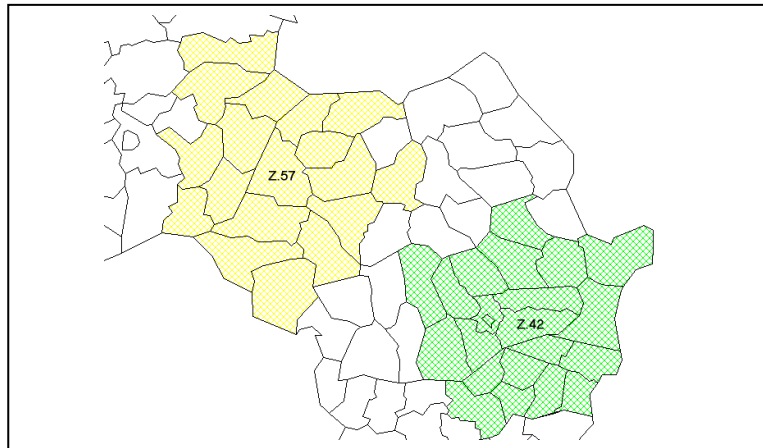
$C_i$  measures change in the dispersion of GDP per capita over  $n$  years for a region  $i$  and its neighbors  $j$ . We calculate the annual difference in the coefficient of variation between two periods  $t_0$  and  $t_n$  for  $V(i)$ .

$m_n^j$  is the average GDP per capita for the year  $n$  of  $V(i)$  and  $\sigma_n^j$  its standard deviation.

$V(i)$  consists of the region  $i$  and all regions within a radius of  $\delta$  from the region  $i$  (See fig.1)

$\delta$  is the maximum distance (in km) defining the perimeter  $V(i)$  between a region  $i$  and its neighbors  $j$ .

**Figure 1: Neighboring regions selected within a radius of 100 km for the county of Bihor (Z 57) and Călărași (Z 42)**



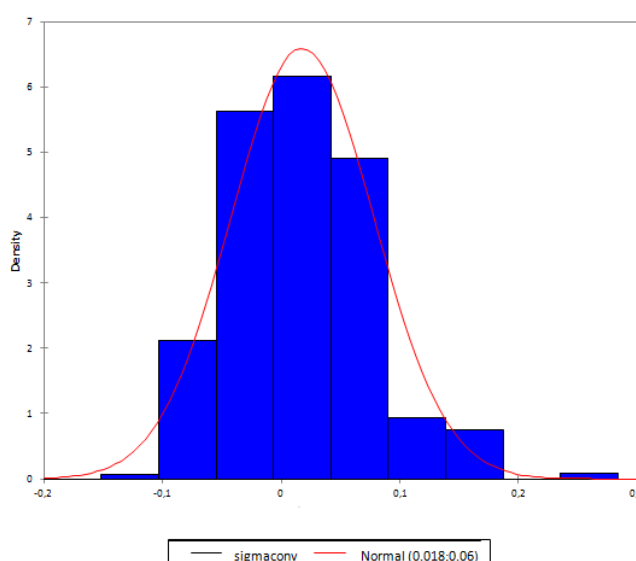


In order to automate the calculations for the 285 regions at NUTS2 level and the 683 regions at NUTS 2/3 that constitute our sample, we have developed a computer program<sup>7</sup> to run these calculations. The calculations were carried out at NUTS 2/3 as it allows for territorial units of similar size and thus overcome, at least in part, the Modifiable Area Unit Problem.<sup>8</sup>

To assess the significance level of the local convergence index, it seemed necessary to conduct statistical inference on the results obtained in testing the null hypothesis. The inference is based on the non-parametric Kolmogorov-Smirnov test (Table 1) which enables us to test the null hypothesis  $H_0$  that the local convergence index values are generated by a theoretical probability distribution considered as a suitable model.

**Table 1: Test for the null hypothesis - Kolmogorov-Smirnov method**

Kolmogorov-Smirnov Test	
D	0.052
p-value	0.047
alpha	0.05



It appears that the values for each region of the local convergence index ( $C_i$ ) are significant with a critical value of  $p = 0.05$ . The risk of rejecting the null hypothesis  $H_0$  when

<sup>7</sup> The program Caquot4 was developed by Pierre Dolez (all rights reserved). The user inserts the base map desired with the data associated with it. The program then automatically calculates the local convergence based on the parameters selected in advance.

<sup>8</sup> This issue was raised by Openshaw and Taylor (1979) and later studied by Wong and Amrhein (1996) and Reynolds (1998) among others. In the case of the EU, the variability of networks is an obstacle to comparability of unequally divided territories. This method therefore uses an intermediate network between the levels NUTS 2 and NUTS 3: NUTS 2/3.

it is true is less than 4.72%. The data for each region follow a normal distribution. Thus, it is possible to reject the null hypothesis of no local convergence or divergence in favor of the alternative hypothesis. The latter assumes that the distribution of the index presumes that regions tend either to converge with their neighbors, or to diverge with their neighbors, more often than if the distribution was purely random.

An analysis of the results obtained for an matrix of proximity with a range of 250 km shows that the index measurements of local convergence are significant with a critical probability of  $p = 0.0001$ . In mapping the results of our calculations of the local convergence index (Map 2), we have given discrete values  $C_i$  based on the z-score<sup>9</sup> of each region. In this way, the significance of the results is mapped. However, it is highly likely that the values of the local convergence index are correlated as they are likely to have neighboring regions in common. The number of multiple comparisons cannot exceed the number of regions included in the neighborhood  $V(i)$ . It is therefore necessary to adjust the nominal risk of the first kind by using for example a Bonferroni correction ( $\alpha/m$ <sup>10</sup>).

#### **4. Local convergence and integration processes: an analysis of spatial discontinuities in regional catching-up**

Discontinuities can be defined as lines of marked dissimilarities between contiguous territorial units, which can be considered as local exceptions in a global context (Grasland, 1997). The European Economic Area is fragmented and consists of ruptures, thresholds, limits

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<sup>9</sup>

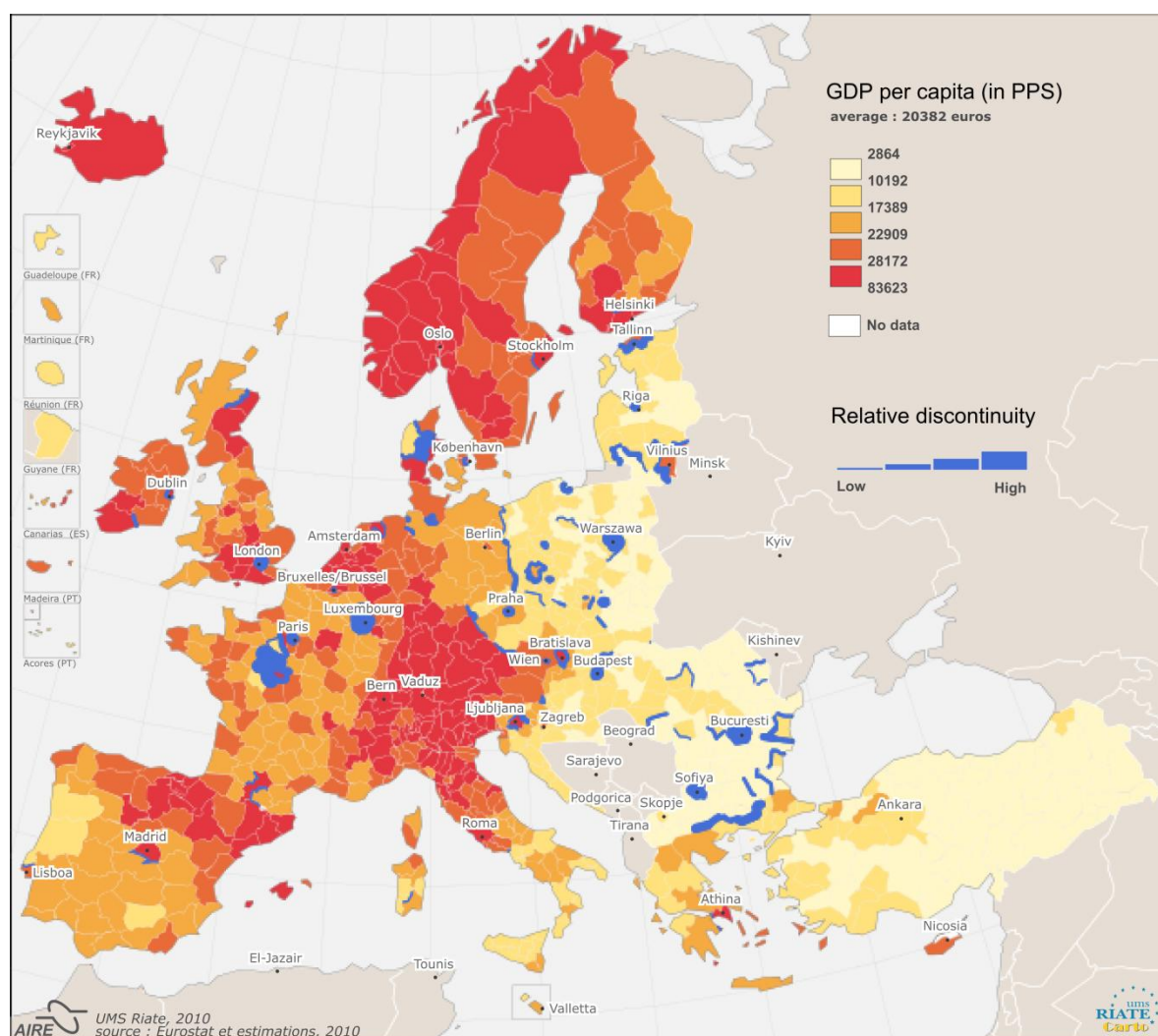
Z-score (standard deviations)	P-value (probability)	Confidence level
< -1.65 or > 1.65	< 0.10	90%
< -1.96 or > + 1.96	< 0.05	95%
< -2.58 or > +2.58	< 0.01	99%

<sup>10</sup> Where  $m$  = number of regions included in the neighborhood  $V(i)$ .

and boundaries that fracture it. These fractures occur along the boundaries of a spatial network and separate areas judged to be non-homogeneous. A spatial discontinuity results in a sharp decline in the similarity of units located on either side of the political boundary. The analysis of regional economic disparities includes the highlighting of the phenomena of gradients, fronts, thresholds and interfaces useful for understanding the configuration of these disparities. To this end, recent tools of geostatistics and mapping can highlight phenomena of economic discontinuity (Map 1).

Thus, the mapping of the local convergence index (Map 2) coupled to the mapping of spatial discontinuities can highlight an uneven integration process. Map 1 shows the presence of marked spatial discontinuities in the countries of Central and Eastern Europe in particular between metropolitan areas and their hinterland. Now, these observed discontinuities have a significant impact on the process of regional integration. As emphasized by Philippe De Boe, Claude Grasland and Adrian Healy (1999), the discontinuities can be perceived in different ways. Firstly, they can be viewed as a potential for greater integration, in the sense that the “differential” can generate flows between regions that tend to participate in local convergence (cf. (a)). Alternatively, they may be perceived as generating difficulties in integration in the sense that differences in the economic level can reduce the opportunities for relationships and interactions (cf. (b1) et (b2)).

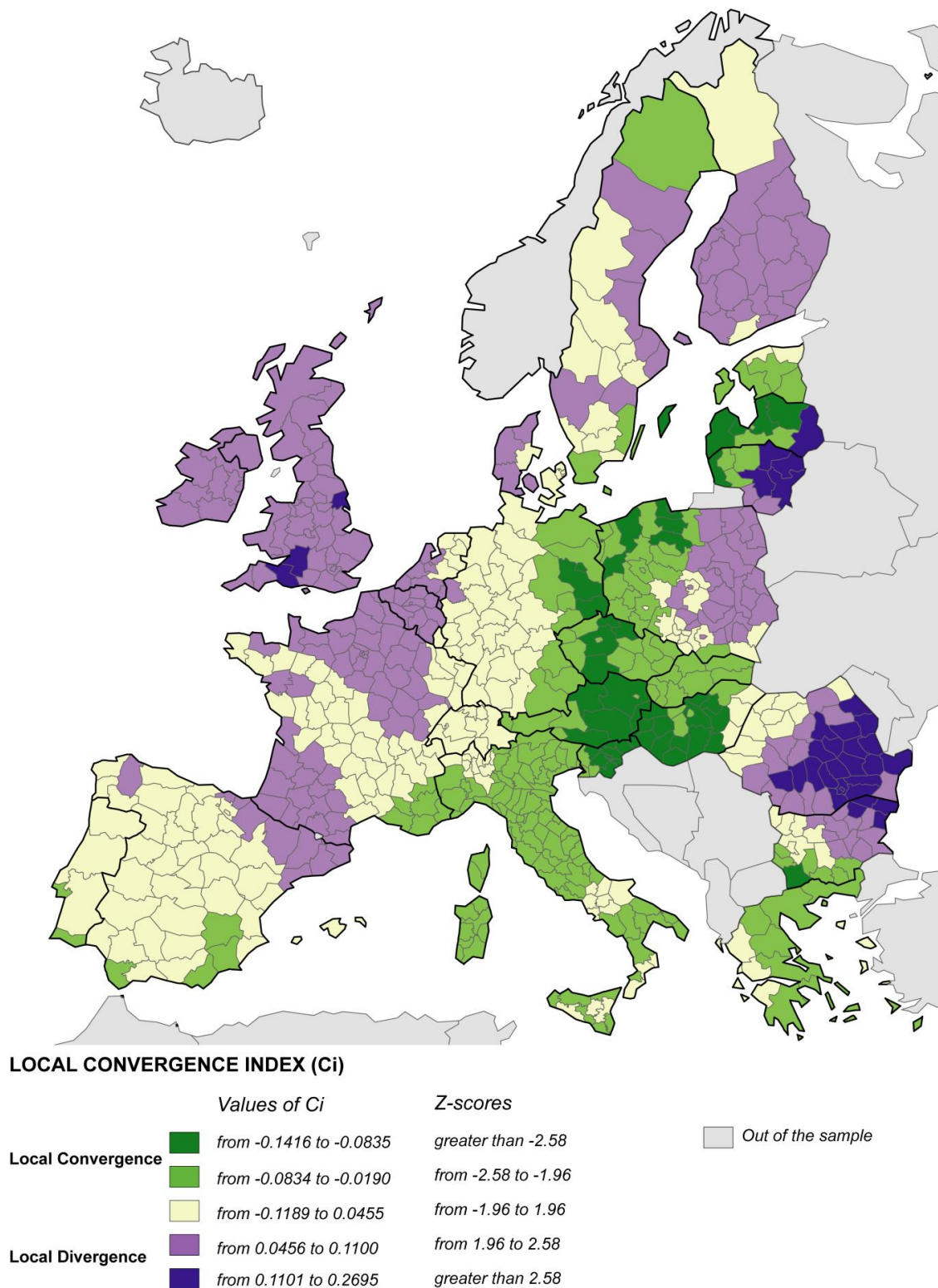
**Map 1: Spatial discontinuities in GDP per capita (PPP) in 2007**



## Map 2: Local convergences and divergences in the EU

### A MULTIPOLARIZATION OF THE CONVERGENCE

*The European Regions (NUTS 2/3) between 1995 and 2008*



(a) Map 2 shows a large area of local convergence along the boundary between the EU15 and the CEEC, and even further south into the Italian boot. Nevertheless, Map 1 shows the considerable phenomena of local discontinuities. Thus, regions of Central Europe (eastern Germany, the western parts of the Czech Republic, Slovakia, Hungary and Slovenia) that make up the “local convergence club” have a low level of GDP per capita compared to the EU15 average, but a geographic environment which is more favorable than the regions further to the east in the EU. These discontinuities generate local convergence and hence regional integration. The proximity of these regions of Central and Eastern Europe to the border of the EU15 gives these regions a high development potential. They combine positive net migration, unemployment rates below the national average and high accessibility. In addition, these regions benefit greatly from the cohesion policy, in particular under Objective 1 “Convergence”, and in recent years have run major infrastructure development projects largely thanks to the Structural Funds received. Thus benefiting from both Foreign Direct Investment and European funds, coupled with a strong and liberal national economic policy, these regions are sure to register higher growth rates than their neighbors in EU15. This first observation, of the catching-up of areas located further to the west of the central-eastern zone, raises the question of the uneven integration of territories and territorial cohesion of all CEECs.

(b1) In contrast, Ireland and Great Britain is a pocket of local divergence (Map 2) with Dublin and London registering high spatial disparity with their hinterlands (Map 1). In the first case, the ‘Celtic Tiger’ of the years 1990/2000 registered spectacular growth rates (due to both a national policy of revival and the considerable Cohesion Funds received) but at the expense of increasing divergence between regions. In addition, the phenomenon of local divergence observed in Great Britain is due to the overwhelming weight of the London area (the most prosperous region of all the EU). The effect of diffusion of dynamic poles of

regional growth (in this case the Dublin area and London) on the lagging peripheral regions (the northernmost of which are even in decline) has not taken place, or at least has not been sufficient to allow a convergence between regions for the area concerned.

(b2) The case of Romania is similar to the previous two. Bucharest, the capital region, registered marked spatial discontinuity with its hinterland creating a pocket of strong local divergence. According to the Green Paper on Regional Development<sup>11</sup> the depressed areas are located in the north-east (corresponding to the historical province of Moldova) and in the south (more or less coinciding with Wallachia). In this regard, without exactly matching the boundaries of the historical regions, these divisions in terms of regional development nevertheless tend to relativize the effects of the various homogenizing policies that have been pursued for a century. The inertia of the central government, long inseparable from the Communist Party, and the actual choices made were more in favor of reforms of the economic system than of the administrative system. The authoritarian communist regime of Ceausescu was isolationist, locking the country on its “national path”. After the fall of the *Conducator* economic reform was so much more difficult that Romania exported very little. As for political reform, it suffers from the ambiguities of post-communist elites. The result is a largely unfinished regionalization for Romania with centralism still holding sway. In this way, Bucharest annihilates the regions surrounding it thus creating a long-term process of local divergence, which does not allow regional integration. Although the election of Constantinescu in 1996 led to a significant influx of FDI characterized by economic growth, FDI has not been evenly distributed over the territory. Bucharest accounts for 85% of national GDP, it holds more than 20% of national export volume and almost 40% of imports, it hoards 55% of national GDP spending on R & D and has an unemployment rate lower than half the

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<sup>11</sup> Written in 1996 by the Romanian Government and assisted by experts from the European Commission. The Green Paper was intended to reflect the implementation of the PHARE program.

national average (3.4% against 7.2% for Romania<sup>12</sup>). This pocket of local divergence marked by sharp discontinuities provides a concrete example of what Paul Krugman (1996) calls the “agglomeration shadow” effect. This case occurs when there is a significant domination by an economic center over the rest of its territory. Given centripetal forces, activities and individuals are attracted by the Romanian capital at the expense of surrounding regions, following the predictions of the gravity model. Therefore, the secondary poles can only appear at a distance sufficient to avoid the phenomenon of attraction, leaving the intermediate spaces relatively empty. A second spatial discontinuity explains this local pocket of marked divergence: the economic discontinuity between the Constanța region and surrounding areas. Constanța has taken advantage of its geographical position (the coast of the Black Sea) to develop its economy around the mass tourism and trade. In addition, Constanța is the largest port in Romania, with container and oil terminals. Many oil industry and import-export companies are located Constanța because of its port. The city ranks second in the country in terms of living standards. Spatial discontinuities in Romania are thus reinforced without the ongoing regionalization process indicating any possible reduction in regional disparities. From this point of view, the European structural policies have to confront relatively significant administrative, historical, spatial and cultural inertia.

(b3) A final example is Poland, through which run strong spatial discontinuities (Map 1) resulting in a partition of the territory between a local convergence zone and a local local divergence zone (Map 2). These structural divisions set western Poland, richer and marked by the Prussian domination, against eastern Poland, which was once with in the Russian sphere of influence. These discontinuities show the spatial character of regional development. The most populated and urbanized regions are those of Silesia and those that include the main Polish cities. The urbanization rate is over 65% in the west, while it is under 45% in the east.

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<sup>12</sup> Source: Ministry of Labour, Family and Social Protection



The pocket of local divergence is characterized by a lack of infrastructure, poor urban fabric, few industries, and fragmented agriculture which is not very competitive. It should be noted that between 1950 and 1985, 18 regions (out of 49) in the eastern part of Poland were entitled to only 0.1% of industrial investments made by the former USSR. With the integration of Poland into the EU, the regions on the western border quickly played the role of active interfaces with multiple streams, even though these boundaries had been rigid and almost impermeable barriers during the Soviet period. In addition, the price differential between Germany and Poland due to the relative low standard of living of Poles and the low tax on products benefited Polish border territories which captured German consumers. In contrast, the eastern Polish regions benefit very little from this “return to Europe”.

## **5. Conclusion**

The aim was to highlight the need to take into account the geographical environment in explaining the catching-up of regions, in order to rethink theories of convergence and the extent of regional disparities in Europe. The study shows that there are local phenomena of both marked convergence, or conversely divergence, underlying a process of uneven integration.

Local phenomena of convergence can be seen as linked with the joint roles played by national and / or European public policies (in particular the role of the Structural Funds) and economic dynamics (IDE, etc.). The development of an index of local convergence can account satisfactorily for spatial diversity (geographical heterogeneity – spatial discontinuities) in the process of convergence (or not) of the regions.

The multipolarization of the convergence, and therefore the unequal integration process of the regions, calls for differentiated policy responses. These responses should take into

account different factors behind the convergence of regions, including the Structural Funds (although in the literature there is an ambiguity regarding the impact of the Structural Funds), the effects of inheritance and the effects of context. Faced with the inability of the cohesion policy to reduce interregional disparities within each country, our study on local convergence provides points to reflect regarding how to rethink future EU regional policy after 2013 in order to make it more effective. It emphasizes the value of taking into account geographical location and the structure of the neighborhood of each of the European regions in order to develop the cohesion policy. The highlighting of a multipolar convergence and the joint presence of areas of convergence and divergence within the European area underlines the differentiated effectiveness of the Structural Funds. Thus, some regions considered as marginalized peripheries (due to their geographic location, the fact that many discontinuities run through them and their being characterized by a situation of local divergence) deserve special treatment in terms of European aid if the aim is to make the integration process less unequal.

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