

Spatial effects of regional income disparities and growth in the EU countries and regions

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Abstract

The paper aims to offer empirical insights in the regional income disparities and growth giving emphasis on exploring spatial effects of income growth and convergence in the EU countries and their NUTS3 level regions. Spatial econometric methods are applied in order to identify existing spatial interaction and control effects of spatial autocorrelation. We have based our analysis on the assumption that there are two types of spatial effects and therefore regional convergence equations are specified taking into account that first, observations from adjacent regions can be correlated (Spatial Lag Models – SLM) and second, a functional relationship can vary across regions, there can be measurement errors (Spatial Error Models – SER). The estimators based on the EU countries' and their NUTS 3 level data of per capita GDP (PPP) confirmed that both spatial lag and spatial error dependence matter between observations. However, in the conditional convergence models, the effects of spatial spillovers are captured by country dummies reflecting country-specific effects, i.e. national policies, legislation, tax systems etc. The results of the empirical study demonstrate that national macroeconomic factors exert a greater influence on regional growth than spatial interactions. Spatial growth spillovers seem to stop at national borders, which indicate that border impediments still matter for the intensity of economic cross-border integration in the EU.

Keywords: regional disparities, income convergence, spatial econometrics

1. Introduction

The issues of regional income disparities, growth and convergence have been the subject of a large body of empirical research since the beginning of the 1990s ((e.g. Barro and Sala-i-Martin 1995, Armstrong 1995, Tondl 2001, Cuadrado Roura 2001, Baumont et al. 2003, Arbia and Piras 2005, Meliciani and Peracchi 2006, Anagnostou *et al* 2008). Despite the great interest in this matter, information on regional income disparities, growth and convergence in the enlarged EU is still relatively scarce. Owing to data restrictions, previous empirical research on regional convergence in Europe is mainly focused on EU-15 regions. Empirical analysis on regional convergence in the enlarged EU is able to show recent developments, but it cannot identify long-term trends.

This paper aims at providing more distinct information on regional income disparities and convergence processes in the enlarged EU during the period between 1995 and 2003. Although the explanatory capacity for long-run developments is limited, we believe that analysing the period after 1995 may yield important insights into recent tendencies in the development of income disparities in the enlarged EU. Attention is paid to differences in regional income growth between the EU-15 and the new member states (NMS) and to the role

of spatial effects in income convergence processes. Regional income disparities and convergence is analysed at a comparatively low level of regional aggregation comprising mainly NUTS3¹ level regions of the EU-25 (see also Paas and Schlitte, 2008). A convergence analysis is conducted by applying the well-known concept of β -convergence implementing spatial econometric techniques in order to control for spatial effects.

The paper consists of five main sections. In the next section we introduce data and set out methodological considerations which are relevant to our analysis. Section 3 describes the recent developments of regional income disparities and growth in the EU. Section 4 presents the empirical results of β -convergence analysis taking into account possible spatial dependence of the EU countries and regions. Finally the conclusions are presented in section 5.

2. Methodology and Data

The methodology used to estimate regional income convergence is, in most cases, based on the work of Barro and Sala-i-Martin (1992), which allows distinguishing concepts of absolute and conditional convergence.

Absolute convergence is generally tested by regressing the growth in per capita GDP on its initial level for a given set of cross-section data. This approach assumes that all economies are structurally identical. Absolute β -convergence among countries or/and regions is observed when a negative and statistically significant relation is found between the growth rate of income per capita and the initial level of income. The existence of absolute β -convergence implies that less advanced economies tend to catch up with more advanced ones while the existence of conditional β -convergence implies that each economy converges to each own steady state. A method frequently applied to test conditional convergence is based on the concept of club convergence, in which steady states are allowed to differ across groups of relatively homogenous economies (e.g. Quah 1996). The crucial role played by national characteristics, such as differences in national policies, legislation, tax systems, etc. has been stressed by several previous studies on regional growth and convergence (e.g. Armstrong 1995, Cuadrado Roura 2001).

In order to test for regional β -convergence, we first of all used the common cross-sectional OLS approach with per capita income growth as the dependent variable and the initial income level as the explanatory variable. In a second estimation dummy variables for countries were applied in order to account for country-specific effects. We tested for absolute and conditional convergence.

$$\ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha_0 + \alpha_1 \ln(y_{i0}) + \sum_{j=1}^N \alpha_{2j} c_{ji} + \varepsilon_i \quad (1)$$

where

y_{i0} – initial GDP *per capita* in region i ,

T – number of years in observation period,

$c_{ij} = 1$ if region i belongs to country j , otherwise $c_{ij} = 0$,

α_0, α_1 and α_{2j} – parameters to be estimated,

ε_i – normally and independently distributed error term.

When the estimated coefficient α_1 is negative, poor economies tend to grow faster than rich ones. The annual rate of convergence β can be obtained from the equation $\beta = -\ln(1 - \alpha_1)/T$, where T denotes the number of years between the initial and the final year of observation. Another common indicator used to characterise the speed of convergence is the so-called half-life τ , which can be obtained from the expression: $\tau = \ln(2)/\beta$. The half-life shows the time necessary for half of the initial income inequalities to vanish. Since

¹ NUTS (Nomenclature of Statistical Territorial Units) are spatial units used by EUROSTAT. While spatial units in NUTS-0 are countries, the level of spatial aggregation decreases with the levels 1, 2 and 3.

convergence patterns are supposed to differ between the EU-15 and the NMS, separate models for both country groups are estimated in the paper.

Although the economic development of a region is likely to be influenced by neighbouring regions, most convergence studies of the 1990s assumed growth rates to be independent across regions. Since the end of the 1990s, various convergence studies have found evidence of serious model misspecifications if spatial interdependencies of regional growth are ignored (see Abreu et al. 2005). Therefore, the convergence estimation in this paper will take account of spatial autocorrelation by applying the Spatial Error Model (SEM) and the Spatial Lag Model (SLM) suggested by Anselin (1988).

Spatial dependence can be taken into account by applying a spatial weight matrix W , which is supposed to capture spatial structure and the intensity of spatial dependence. However, there are various ways to specify a spatial weight matrix. Because there is usually no a priori information about the exact nature of spatial dependence, the choice of the design of the spatial weight is somewhat arbitrary (see Niebuhr 2001, Ertur and Le Gallo 2003). A commonly used approach is based on the concept of binary contiguity, where the elements of the matrix $w_{ij}=1$ if region i and region j share a common border or are within a certain distance range to each other, and $w_{ij}=0$ otherwise (e.g. Rey and Montouri 1999). We used a distance-based weight matrix W where distance is the squared inverse of the great-circle distance between the geographic centres of the regions. We implemented a critical distance cut-off above which spatial interaction is assumed to be zero. The functional form of the squared inverse of distances can be interpreted as reflecting a gravity function (see Le Gallo et al. 2003). Furthermore, the distance matrix is row-standardized, so that it is relative and not absolute distance that matters.

$$W = \begin{cases} w_{ij} = 0 & \text{if } i = j \\ w_{ij} = 1/d_{ij}^2 & \text{if } d_{ij} \leq D \\ w_{ij} = 0 & \text{if } d_{ij} > D \end{cases} \quad (2)$$

where

$w_{i,j}$ - spatial weight for interaction between regions i and j ;
 d – distance between geographical centres of regions i and j ;
 D – critical distance cut-off.

According to Anselin (2001), spatial autocorrelation² can be defined as a spatial clustering of similar parameter values. If similar parameter values – high or low – are spatially clustered there is a positive spatial autocorrelation present in the data. Conversely, a spatial proximity of dissimilar values indicates a negative spatial autocorrelation. As a measure of the spatial clustering of income levels and growth in the EU, we used Moran's I -statistic:

$$I_t = \frac{N \sum_{i=1}^N \sum_{j=1}^N x_{i,t} x_{j,t} w_{i,j}}{N_b \sum_{i=1}^N x_{i,t}^2} \quad (3),$$

where

$x_{i,t}$ - variable in question in region i and in year t (in deviations from the mean);
 N - number of regions;

N_b - sum of all weights (since we use row-standardised weights N_b is equal to N).

When Moran's I is positive and significant, there is a tendency towards a spatial clustering of similar parameter values in the sample. Spatial autocorrelation can appear in two different forms: the substantive form and the nuisance form (see Anselin 1988). The nuisance form of

² The terms 'spatial autocorrelation' and 'spatial dependence' are used as synonyms, although we acknowledge that the terms are not exactly identical in meaning.

spatial dependence is restricted to the error term. It stems from measurement errors, such as a wrongly specified regional system which does not adequately reflect the spatial structure of economic activities. Ignoring nuisance dependence may lead to inefficient estimates. Anselin (1988) suggests two different model specifications in order to deal with the respective forms of spatial dependence. Both models are estimated with the maximum likelihood (ML-) method. In the spatial error model (SEM), spatial dependence is restricted to the error term. Hence, on average, per capita income growth is explained adequately by the convergence hypothesis. Therefore, the SEM is an appropriate model specification for the nuisance form of spatial dependence:

$$\ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha_0 + \alpha_1 \ln(y_{i0}) + \sum_{j=1}^N \alpha_{2j} c_{ji} + \varepsilon_i \quad \varepsilon_i = \lambda [W \cdot \varepsilon]_i + u_i \quad (4)$$

where

- λ - spatial autocorrelation coefficient,
- $[W \cdot \varepsilon]_i$ - the i -th element of the vector of the weighted errors of other regions,
- $c_{ij} = 1$ if region i belongs to country j , otherwise $c_{ij} = 0$,
- ε_i and u_i - normally and independently distributed error terms.

The spatial lag model (SLM) is suitable when spatial dependence is of the substantive form, where regional growth is directly affected by the growth rates in surrounding regions. Growth spillovers from neighbouring regions are incorporated through the inclusion of a spatially lagged dependent variable on the right-hand side of the equation:

$$\ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha_0 + \rho \left[W \cdot \ln\left(\frac{y_{0+T}}{y_0}\right) \right]_i + \alpha_1 \ln(y_{i0}) + \sum_{j=1}^N \alpha_{2j} c_{ji} + \varepsilon_i \quad (5),$$

where ρ - the spatial autocorrelation coefficient, $\left[W \cdot \ln\left(\frac{y_{0+T}}{y_0}\right) \right]_i$ - the i -th element of the vector of weighted growth rates of other regions.

We are aware that when conducting regional convergence analysis, it should be borne in mind that the level of regional aggregation chosen may affect the outcome. Applying the same analysis on different spatial scales may yield different results (Arbia 2006). Except for very few studies employing relatively low levels of spatial aggregation (e.g. Niebuhr 2001, Arbia et al. 2005, Petrakos and Artelaris 2006), regional disparities and convergence processes in Europe have to date been analysed at the NUTS-2 level or higher levels of regional aggregation. On the one hand, using large spatial units of observation hides spatial heterogeneity and spatial interaction, which may be present within the regions observed. On the other hand, a very low level of regional aggregation increases the danger of slicing functional regions into parts. In the latter case, economic activities within a homogenous, functional region may be wrongly detected as spatial autocorrelation (see also Ertur and Le Gallo 2003).

In this paper, the analysis is conducted at a relatively low level of regional aggregation for two reasons. Firstly, there may be economic spillover effects which cannot be observed in a sample of NUTS-2 regions owing to their short range (see also Bräuninger and Niebuhr (2005). Secondly, many of the NUTS-2 regions are relatively large and comprise very heterogeneous areas, such as highly agglomerated and very rural regions. The Baltic States, where the NUTS-2 level equals the county-level, are good examples of diverse regional structures within NUTS-2 regions. Our cross-section consists basically of NUTS-3 level regions of the EU-25. Only in the case of Germany do we use 97 so-called planning regions

(“*Raumordnungsregionen-ROR*”) which comprise several NUTS-3 regions.³ Overall, we analyse 861 regions, of which 739 belong to the EU-15 and 122 to the NMS. Regional disparities between the regions of the EU countries are high, particularly in the case of EU-15 countries (table 1).

Table 1. The highest and the lowest income levels in the EU at NUTS-3 level, 2003 (EU-25=100)

	Average	Minimum	Maximum	Differences (times)
EU-25	100.0	21.1 (Latgale, Latvia)	477.0 (Inner London West, UK)	22.6
EU-15	109.1	36.7 (Tamega, Portugal)	477.0 (Inner London West, UK)	13.0
NMS	52.9	21.1 (Latgale, Latvia)	139.3 (Warsaw, Poland)	6.6

Source: Eurostat; see also Paas and Schlitte, 2006

To measure income, we use GDP per capita data adjusted for purchasing power standards (PPS), taken from the Eurostat database.⁴ Data in PPS are adjusted for differences in national price levels, but not for differing price levels within countries. Although there are considerable regional within-country differences in price levels, we believe that data in PPS provide a better approximation of regional wealth than do data in euros. Furthermore, GDP in PPS is used to determine the eligibility of regions for support from the EU structural funds in the range of Objective 1. GDP data are collected in the place of residence. When small regional units are used, the commuting of workers between their place of residence and place of work may pose a problem for the analysis. However, convergence analyses are typically conducted with GDP data. For example, using GDP per employee data may attenuate the commuting problem, but it creates another one: productivity can be detached from actual regional growth. During structural changes in particular, decreasing employment may lead to increasing GDP per employee. The weight matrix is compiled based on the data of the inverse of travel time of freight vehicles between the centers of regions.⁵

3. Regional income disparities and growth

Figure 1 confirms the viewpoint that there are significant income disparities between the EU countries; at the same time growth of GDP (PPP) per capita has been faster in the poorer economies. The spatial distribution of regional income levels in the EU-25 shows a centre-periphery structure (see figures 2 and 3).

Most of the relatively rich regions were situated along the so-called “blue banana”, which ranges from Southern England to Northern Italy. In the EU-15, regions with income levels below 75% of the EU-25 average can be found mainly in the southern periphery. Most noticeable, however, is an east-west gradient. In 1995, slightly more than two thirds of all regions in the NMS had income levels below 50% of the EU-25 average. Only the five capital regions – Prague (126%), Bratislava (95%), Ljubljana (94%), Budapest (89%) and Warsaw (89%), as well as Cyprus (82%) – had income levels above 75%.

³ German NUTS-3 regions are relatively small and very numerous compared to other European NUTS-3 regions. The inclusion of 439 German NUTS-3 regions would have significantly increased the influence of German regions in the analysis.

⁴ It should be noted that Eurostat warns against using PPS-adjusted GDP values to calculate growth rates. However, we do not analyse the dynamics of single countries or regions, but the relative development of income levels between countries and regions.

⁵ We are thankful to Carsten Schürmann (Dortmund) for this information.

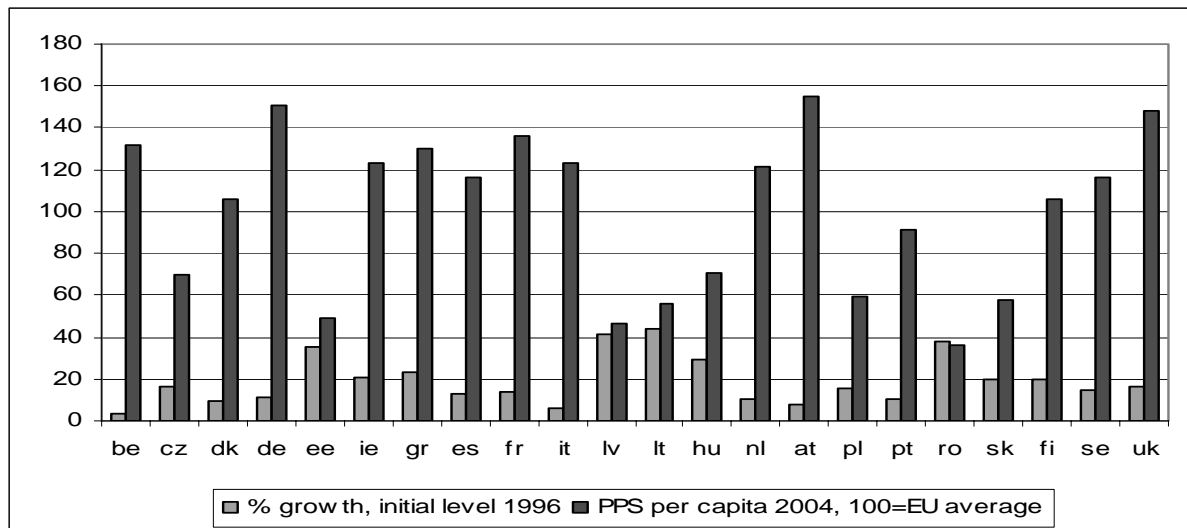


Figure 1. Regional income disparities and growth, EU-25
Source: Eurostat data, authors' calculations

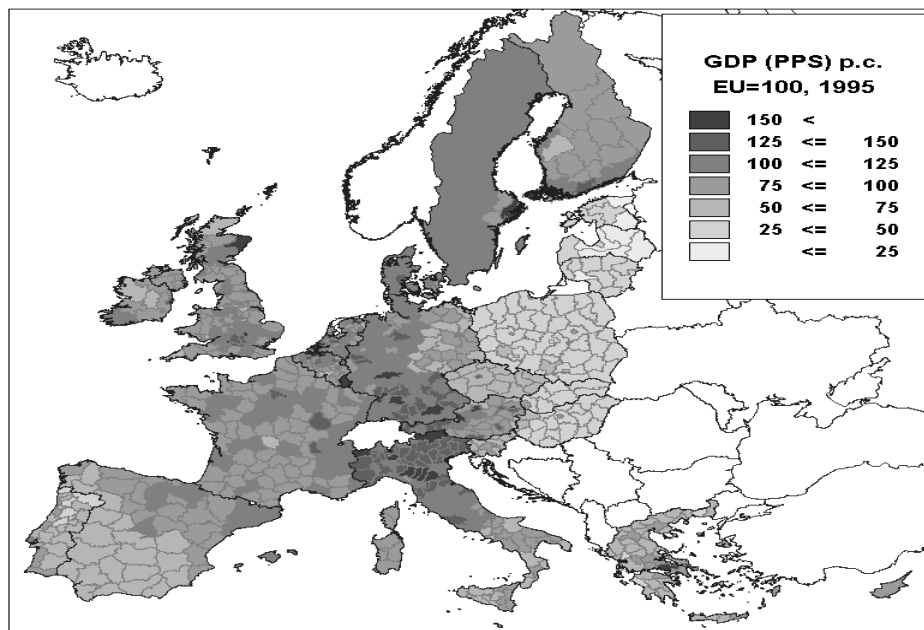


Figure 2. Regional Income Levels Relative to the EU-25 average.
Source: Eurostat 2007, authors' calculations.

However, the spatial pattern of per capita growth between 1995 and 2003 is more dynamic in the periphery, indicating a general catching-up process (see figure 3). Most regions in Spain, Greece, Ireland, Finland and in the NMS experienced growth rates above the average EU-25 growth rate. Relatively few regions within the “blue banana”, mainly in the London area and in the Netherlands, displayed above average per capita growth. Strikingly, a closer look at regional growth rates in the NMS reveals particularly strong dynamics in the relatively rich agglomerations – mainly the capital regions and their peripheries. The capital cities – Warsaw (139%), Prague (138%), Budapest (122%), Bratislava (116%) and Ljubljana (109%) – clearly achieved above average income levels in 2003. This suggests that the general catching-up of the NMS may have been accompanied by increasing regional within-country disparities in the NMS

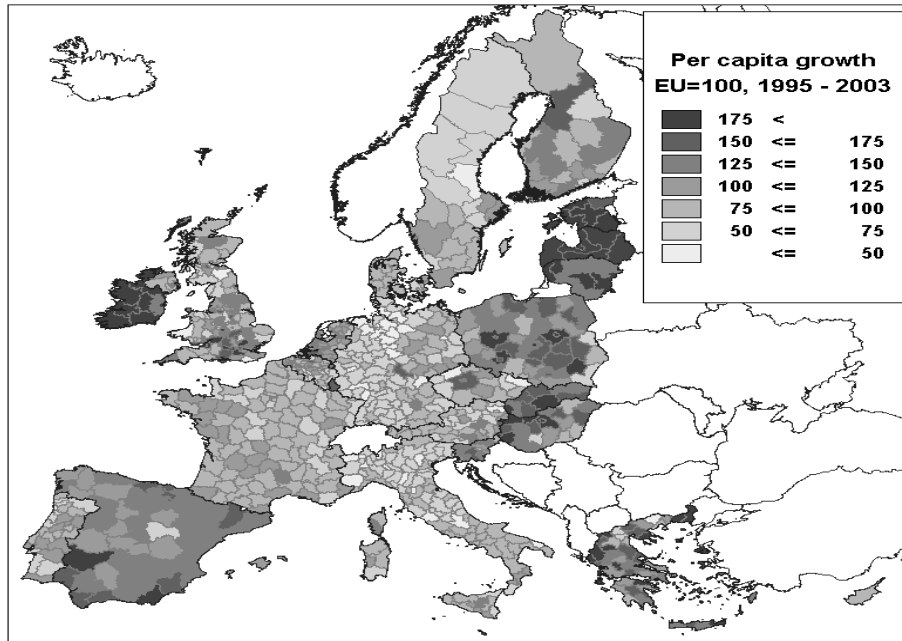


Figure 3. Regional per Capita Growth Relative to the EU-25 Average
Source: Eurostat 2007, authors' calculations

4. Convergence analysis taking into account spatial dependence of the EU countries and regions

Considering the variety of regions in Europe, including large structural differences, conditional β -convergence may be often more realistic for exploring convergence processes. Analysing regional convergence in the enlarged EU, Fischer and Stirböck (2004) identify two convergence clubs: one consisting of poorer regions in the NMS and the southern periphery of Western Europe, and the other consisting of the relatively rich Central and Northern European regions of the EU-15. Feldkircher (2006) as well as Niebuhr and Schlitte (2004) find strong evidence for country-specific effects on regional growth in the enlarged EU. The crucial role played by national characteristics, such as differences in national policies, legislation, tax systems, etc. has been stressed by several studies on regional growth and convergence (e.g. Armstrong 1995, Cuadrado Roura 2001). Therefore besides testing the absolute convergence hypothesis, we also test for conditional convergence, allowing regions to converge towards country-specific steady-state income levels. We test the regional convergence that takes place within the individual member states.

The results in table 2 show that there is strong evidence for spatial dependence among the regions in the EU. The coefficient I is highest with a cut-off distance of a hundred kilometres and decreases with increasing cut-off distances. However, the significance of the results (standardised z-values) increases up to a critical cut-off distance of 500 km and decreases thereafter. This leads to the conclusion that regional interaction over distances of more than 500 km is not relevant in terms of spatial autocorrelation. Therefore, a critical cut-off distance of 500 km is used in our analysis.

The estimation results of convergence equations are presented in Appendix: table 1A presents the results of OLS estimation ignoring spatial dependence; table 2A presents Spatial Lag Model (SLM) and table 3A Spatial Error Model (SEM) estimation results. The results of Moran's I show significant spatial autocorrelation in the residuals of all OLS estimations. Though commonly used, Moran's I is not very reliable and does not provide information about the form of spatial dependence (Anselin 1992). In order to identify the form of spatial autocorrelation, Lagrange Multiplier (LM-) tests are applied (see tables 1A and 3A in Appendix).

Table 2 - Moran's I-test for Spatial Autocorrelation (Randomization Assumption)

Critical distance cut-off (km)	Moran coefficient I (Standardised z-value)		
	$\ln\left(\frac{y_{i2003}}{y_{i1995}}\right)$	$\ln(y_{i1995})$	$\ln(y_{i2003})$
100	0.54** (21.27)	0.75** (29.77)	0.67** (26.71)
200	0.51** (29.35)	0.74** (42.43)	0.66** (37.49)
300	0.48** (31.63)	0.72** (47.34)	0.63** (41.77)
400	0.45** (32.44)	0.70** (49.72)	0.61** (43.82)
500	0.44** (32.77)	0.68** (50.80)	0.60** (44.80)
600	0.42** (32.67)	0.65** (50.74)	0.58** (44.78)
700	0.41** (32.60)	0.63** (50.55)	0.56** (44.65)
800	0.40** (32.37)	0.62** (50.12)	0.55** (44.33)
900	0.39** (32.09)	0.60** (49.64)	0.53** (43.94)
1000	0.38** (31.82)	0.59** (49.13)	0.52** (43.54)
2000	0.34** (30.27)	0.52** (46.38)	0.47** (41.33)

Note: (**) significant at the 0.01 level.

Based on the OLS estimators (see table 1A in Appendix) it is possible to conclude that the EU-25 experienced a significant regional convergence of income levels at an average rate of 2% p.a. Such a convergence rate, which is frequently found in the literature (e.g. Barro and Sala-i-Martin 1995), implies a half-life of 35 years. Regional convergence was somewhat weaker within the EU-15 and clearly less pronounced within the NMS. The respective half-lives are 38 years in the EU-15 and 50 years in the NMS. When national effects are taken into account, the estimated convergence rates decrease substantially. There is no significant convergence process on-going within the countries of the EU-25, and the speed of within-country convergence in the EU-15 halves relative to the absolute convergence model. The rate of within-country convergence in the NMS even changes sign. Regional per capita incomes within the countries of the NMS actually diverge at a rate of 1.5% p.a. Hence, within individual NMS, richer regions tend to grow faster. Overall, the catching-up process in the EU-25 is predominantly a national phenomenon.

In the case of absolute convergence, the LM-tests show a preference for spatial lag dependence in the EU-15 and spatial error dependence in the NMS. When national effects are considered, the results clearly indicate spatial error dependence in the EU-15, while there is no clear result for the NMS. Applying SEM and SLM estimations without control for country-specific effects yielded very low convergence rates. In both spatial specifications, the estimated rate of convergence is 0.6% in the EU-25 and 0.7% in the EU-15. These rates imply half-lives of more than a hundred years. In both models, there was no significant convergence in the NMS. In the case of the NMS, LM-tests pointed to the nuisance form of spatial dependence. Considering the EU-25 and the EU-15 cases, LM-tests do not provide a clear-cut conclusion as to which of the two models is more suitable. However, compared with the convergence speed in the spatial models, OLS estimates seem to be biased. This leads to the conclusion that the substantive form of spatial autocorrelation is present in the data.⁶

When country dummies were included, the estimations yielded results very similar to those of the conditional OLS estimations. There was a very slow process of conditional convergence taking place in the EU-15, while income levels in individual NMS diverged. Also, the model fits did not vary remarkably from OLS models. This indicates that OLS estimates are not seriously biased when national effects are taken into account. As a consequence, spatial lag dependence seems to be captured sufficiently by the employment of

⁶ It should be noted that a direct comparison of β -coefficients between the SLM and OLS models is not quite correct because the estimated speed of convergence in the SLM also takes indirect and induced effects into account (see Abreu et al. 2005 or Pace and Le Sage 2006).

country dummies. Hence, national macroeconomic factors appear to be more influential on regional growth than spatial spillovers.

5. Conclusions

Examination of regional income levels of NUTS-3 regions across the enlarged EU reveals significant regional disparities in both the EU-15 and the NMS. There is a core-periphery structure with relatively high income levels in the centre of the EU and relatively low income levels in peripheral regions. Furthermore, the spatial structure of income levels in the EU is marked by an east-west gradient, with comparatively low income levels in the NMS. However, regional growth rates tend to be higher in the periphery, especially in the NMS, indicating a catching-up process. These findings have been confirmed by formal β -convergence analysis. OLS estimation results show a significant absolute convergence at an annual rate of 2% between 1995 and 2003. At the same time, catching-up processes were somewhat less pronounced in the EU-15 and the NMS. However, on taking national effects into account, the general convergence process was shown to be driven mainly by country-specific effects, i.e. national policies, legislation, tax systems etc. This is particularly the case of the NMS, where institutional changes in the course of market liberalisation have been large compared with Western Europe. When regions are allowed to converge towards country-specific steady-state levels of per capita income, the convergence rate across regions in the NMS becomes negative. Hence, in the course of general catching-up by the NMS, regional within-country disparities in the NMS have increased. Considering spatial dependence in the convergence estimations shows that regions cannot be regarded as isolated entities in absolute convergence processes. Both spatial lag dependence and spatial error dependence matter. However, in the conditional convergence models, the effects of spatial spillovers are sufficiently captured by country dummies. This demonstrates that national macroeconomic factors exert a greater influence on regional growth than spatial interaction. In other words, spatial growth spillovers seem to stop at national borders, which indicate that border impediments still matter for the intensity of economic cross-border integration in the EU.

Given the short length of the period observed, these results cannot be taken as an indication for long-run development. It is possible, for example, that forces driving regional inequality in the individual NMS will cease in the long run. However, the analysis has shown that there may be a trade-off between convergence on the national level and regional within-country convergence in the NMS which may impede the European Commission in its pursuit of the objective of economic and social cohesion.

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Appendix

Table 1A - OLS Estimation Results

	EU-25	EU-15	EU-10	EU-25	EU-15	EU-10
Country dummies	no			yes		
No. of regions	861	739	122	861	739	122
Intercept	1.583** (17.04)	1.473** (8.84)	1.258** (3.98)	0.553** (4.34)	0.876** (6.09)	-0.646 (-1.60)
α_1	-0.130** (-13.36)	-0.119** (-6.88)	-0.092* (-2.52)	-0.020 (-1.14)	-0.058** (-3.89)	0.112** (2.58)

$R^2_{adj.}$	0.20	0.09	0.06	0.48	0.37	0.36
AIC	-1371.4	-1230.1	-151.1	-1721.3	-1483.3	-190.2
Convergence speed	2.0**	1.8**	1.4*	0.3	0.9**	-1.5**
Half-life	35	38	50	240	81	-
Jarque-Bera	389.54**	429.96**	9.50**	496.48**	540.82**	3.96
Moran's I	21.68**	21.79**	6.12**	9.32**	14.15**	4.34**
LM _{Error}	451.90**	454.81**	30.25**	51.16**	149.60**	7.21**
Robust LM _{Error}	40.45**	10.46**	6.64**	9.90**	18.06**	0.08
LM _{Lag}	440.45**	473.91**	25.95**	41.26**	131.61**	9.03**
Robust LM _{Lag}	29.01**	29.56**	2.33	0.01	0.07	1.91

Note: (**) significant at the 0.01 level. *significant at the 0.05 level.

Table 2A- SLM Estimation Results

	EU-25	EU-15	NMS	EU-25	EU-15	NMS
	<i>Country dummies</i>			<i>yes</i>		
<i>Number of regions</i>	861	739	122	861	739	122
INTERCEPT	0.485** (5.72)	0.509** (4.31)	0.346 (1.35)	0.343** (2.82)	0.548** (4.24)	-0.541** (-1.60)
α_1	-0.043** (-5.23)	-0.046** (-3.87)	-0.019 (-0.69)	-0.014 (-1.14)	-0.042** (-3.23)	0.101** (2.89)
ρ	0.780** (21.28)	0.782** (20.15)	0.604** (6.05)	0.410** (6.52)	0.535** (8.78)	0.508** (4.02)
AIC	-1640.1	-1473.2	-174.9	-1755.0	-1558.2	-197.8
Convergence speed	0.6**	0.7**	0.3	0.2	0.6**	-1.4**
Half-life	110	103	253	344	113	-
LM-test	0.00	2.08	8.99**	7.68**	0.29	1.10

Note: (**) significant at the 0.01 level. *significant at the 0.05 level.

Table 3A- SEM Estimation Results

	EU-25	EU-15	NMS	EU-25	EU-15	NMS
	<i>Country dummies</i>			<i>yes</i>		
<i>Number of regions</i>	861	739	122	861	739	122
INTERCEPT	0.781** (6.30)	0.752** (4.87)	0.268 (0.97)	0.518** (4.01)	0.766** (5.30)	-0.311 (-0.98)
α_1	-0.041** (-3.62)	-0.045** (-2.77)	0.013 (0.42)	-0.017 (-1.30)	-0.048** (-3.22)	0.076* (2.35)
λ	0.840** (26.01)	0.809** (21.21)	0.830** (12.37)	0.495** (7.75)	0.592** (9.79)	0.540** (4.17)
AIC	-1636.1	-1467.4	-185.5	-1764.8	-1568.7	-199.0
Convergence speed	0.6**	0.7**	-0.2	0.2	0.7**	-1.0*
Half-life	116	105	-	283	99	-
LM-test	0.03	1.48	0.89	0.02	5.33*	2.74

Note: (**) significant at the 0.01 level. *significant at the 0.05 level.