Spatial Economic Analysis

ISSN: 1742-1772 (Print) 1742-1780 (Online) Journal homepage: www.tandfonline.com/journals/rsea20

Regional Growth and National Development: Transition in Central and Eastern Europe and the Regional Kuznets Curve in the East and the West

Vassilis Monastiriotis

To cite this article: Vassilis Monastiriotis (2014) Regional Growth and National Development: Transition in Central and Eastern Europe and the Regional Kuznets Curve in the East and the West, Spatial Economic Analysis, 9:2, 142-161, DOI: 10.1080/17421772.2014.891156

To link to this article: https://doi.org/10.1080/17421772.2014.891156

Spatial Economic Analysis, 2014
Vol. 9, No. 2, 142–161, http://dx.doi.org/10.1080/17421772.2014.891156

Regional Growth and National Development: Transition in Central and Eastern Europe and the Regional Kuznets Curve in the East and the West

VASSILIS MONASTIRIOTIS

(*Received March 2012; accepted January 2014*)

ABSTRACT *Regional disparities in Central and Eastern Europe rose substantially since 1990. Still, prima facie evidence of beta-convergence is often found in the CEE data. To reconcile this seeming paradox, we sketch out and test empirically a hybrid model of regional growth that draws on the regional Kuznets curve and incorporates aspects of cumulative causation and neoclassical convergence. In both CEE and the 'old' EU15, regional convergence is strongly linked to the level of national development, non-linearly. But while in the EU15 convergence speeds-up at intermediate/high levels of development, in CEE we find divergence at intermediate levels of national development and no significant return to convergence thereafter. Although this may show that overall development levels are not sufficient yet to mobilise regional convergence, it is also possible that non-convergence is attributable to centripetal forces instigated by the process of transition.*

Expansion régionale et développement national: transition en Europe centrale et orientale et la courbe régionale de Kuznets à l'est et à l'ouest

RÉSUMÉ *Les disparités régionales en Europe centrale et orientale ont augmenté de façon substantielle après 1990. Néanmoins, on trouve souvent, dans les informations de la CEE, des éléments montrant à première vue la présence d'une béta-convergence. Afin de réconcilier ce paradoxe apparent, nous traçons et nous testons de façon empirique un modèle hybride d'expansion régionale s'inspirant de la courbe de Kuznets régionale, et incorporant des aspects de « causalité cumulative » et d'une convergence néoclassique. Dans la CEE, ainsi que dans l'ancienne UE15, la convergence régionale est intimement liée au niveau de développement national, et ceci de façon non linéaire. Toutefois, alors que la convergence de l'UE15 s'accélère à des niveaux de développement intermédiaires / élevés, nous relevons, dans la CEE, une divergence à des niveaux intermédiaires de développement national, et aucun retour significatif à la convergence au-delà. Bien que ceci pourrait démontrer que les niveaux généraux de développement ne sont pas encore suffisants pour mobiliser une convergence régionale, il est également possible que la non-convergence soit attribuable à des forces centripètes découlant du processus de transition.*

Vassilis Monastiriotis (to whom correspondence should be sent), European Institute, LSE, Houghton Street, WC2A 2AE London, UK. Email: v.monastiriotis@lse.ac.uk. I wish to thank the organisers of the 2011 "Workshop on Inequality and Regional Growth and Cohesion" as well as the editor and two anonymous referees of this journal for their insightful comments and suggestions. A special acknowledgement goes to Alejandra Castrodad-Rodriguez, for the many discussions that helped shape the research reported in this paper.

Crecimiento regional y desarrollo nacional: transición en Europa Central y Oriental y la curva de Kuznets regional en el este y el oeste

Las desigualdades regionales en Europa Central y Oriental aumentaron de manera considerable después de 1990. Sin embargo, se suele encontrar en los datos de la CEE evidencia de refuerzo de la convergencia Beta. Para concertar esta paradoja aparente, elaboramos un boceto y probamos de manera empírica un modelo híbrido de crecimiento regional que se basa en la curva de Kuznets regional e incorpora los aspectos de la causalidad acumulativa y la convergencia neoclásica. En la CEE y la 'anterior' UE15, la convergencia regional está estrechamente relacionada con el grado de desarrollo de las naciones, no de forma linear. No obstante, aunque la convergencia de la UE15 aumenta rápidamente en los niveles de desarrollo medio/alto, en la CEE encontramos una divergencia en los niveles medios de desarrollo nacional y ningún retorno importante a la convergencia posteriormente. Aunque esto puede demostrar que los niveles de desarrollo general aún no son suficientes para movilizar la convergencia regional, también es posible que la no convergencia sea atribuible a las fuerzas centrífugas instigadas por el proceso de transición.

区域增长和国家发展：中东欧的转变以及东西部的区域库兹涅茨曲线

摘要：中东欧的区域差异在 1990 年之后迅速增大。尽管如此，在欧洲经济共同体 (CEE) 数据中仍经常发现 Beta 趋同的初步证据。为了调和这一明显的矛盾，我们草拟并实验测试了一个区域增长的混合模型，该模型利用区域库兹涅茨曲线并融入了累积因果和新古典收敛的多个方面。在 CEE 和"旧的"欧盟 15 国 (EU15) 中，区域收敛与国家发展水平非线性地紧密关联。但是，在 EU15 中收敛于中/高发展水平上加速，而在 CEE 中，我们在国家发展的中等水平上发现分歧并且之后无朝向收敛的重大回归。虽然这可能表示整体发展水平尚不足以推动区域收敛，但也可能是非收敛归因于转变过程中的向心力。

KEYWORDS: *Regional growth; convergence; regional Kuznets curve; Central and Eastern Europe*

JEL CLASSIFICATION: O11; O18; R11; R15

1. Introduction

Regional disparities in the countries of Central and Eastern Europe (CEE) have risen sharply over the last two decades. With them, strong patterns of polarisation emerged, as increasing openness and economic–political integration, stimulated by the process of transition, have not been equally beneficial across space. Besides their policy relevance, these developments are particularly important for academic inquiry, as they challenge simple concepts of convergence and instantaneous equilibration (Monastiriotis & Petrakos, 2010), bringing to the fore some fundamental theoretical questions. Is the process of development inherently uneven? Is, inversely, convergence an automatic process driven by the properties of the production technology (diminishing returns)? Or is growth an endogenously-driven cumulative process, whereby leading economies, boosted by their past performance, are able to maintain and enhance their advantages over less

developed ones? And are processes of convergence and divergence conditioned on the level of national development and the national political-economic context?

In recent decades, the study of these questions has been dominated by the so-called 'convergence hypothesis'. Based on the Solow one-sector growth model under the assumptions of a common technology, diminishing returns and no systematic external shocks (Barro & Sala-i-Martin, 1991), the convergence hypothesis asserts that economies starting from higher development levels experience slower growth rates, so that less developed economies eventually catch-up. Although more recent contributions have sought to move beyond the simplicity of this hypothesis (e.g., by examining distributional dynamics, club-formation and spatial dependence—Rey & Janikas, 2005; Dall'erba et al., 2008—or by looking at the role of local-specific variables such as entrepreneurship and cultural diversity—Audretsch & Keilbach, 2005; Bellini et al., 2009), the macroeconomic analysis of regional growth, with few exceptions, is still very much rooted in the convergence hypothesis.

Following, much of the empirical analysis of regional disparities in CEE has also been within this framework, typically finding evidence of neoclassical convergence either in absolute terms or in parallel with the formation of convergence clubs (Dall'erba et al., 2008; Artelaris et al., 2010; Smetkowski & Wójcik, 2012). Curiously, studies adopting alternative analytical frameworks, such as the Kaldor–Verdoorn model of cumulative causation under the presence of increasing returns (Kaldor, 1970; McCombie & de Ridder, 1984), find evidence pointing to the opposite direction, towards cumulative divergence.

It is of course very difficult to subscribe simultaneously to both analytical processes. Neoclassical convergence implies the presence of constant returns to scale, resulting in catching-up by lagging regions as the growth rates of more advanced regions slow down. In turn, the cumulative causation thesis contents that more advanced regions maintain higher rates of growth as they capitalise on their productivity advantages and increasing returns to scale. Simple inspection of the evolution of regional incomes and productivities in the CEE countries confirms the presence of such divergence tendencies. It is thus puzzling that the 'convergence hypothesis' is still empirically validated by the data.

Against this background, this paper sets out to examine in a comparative way the process of regional growth in CEE linking it to the process of national development in a fashion more akin to the so-called 'regional Kuznets curve', developed by Williamson (1965). Our aim is not to provide a causal explanation of regional growth but rather a description of the regional growth process that moves beyond the polarity of the convergence–divergence debate and frames it within the context of national development.

Our empirical analysis supports this analytical departure. Consistent with previous findings, we find evidence of both convergence and cumulative causation, in both the east (CEE) and the west (EU15). We show that convergence–divergence tendencies exist in parallel with a process of polarisation, especially in the CEE, whereby 'convergence at the bottom' (amongst low-to-medium productivity regions) takes place in conjunction with a 'separation from the top' (for the more advanced regions). We subsequently examine the interaction between regional growth and national development, through an adapted formulation of the regional Kuznets curve, and find the process of convergence to follow a non-linear path along levels of national development in both samples, but to be weaker and qualitatively different in the CEE, where levels of development are

generally lower and where the national context is influenced uniquely by the process of post-communist transition and European integration.

The reminder of the paper is structured as follows. In the next section we offer a brief review of the literature on regional convergence and the evolution of regional disparities in CEE and in Europe more broadly. Section 3 examines the evidence concerning the patterns of regional growth in CEE (and, comparatively in the EU15) through both a descriptive and an exploratory regression analysis, with emphasis on processes of convergence, divergence and polarisation. Drawing on the notion of the regional Kuznets curve and linking it to the process of transition, in section 4 we move on to propose an alternative theoretical description of the growth process and investigate it empirically. We discuss the implications of our results in the concluding section.

2. Regional Growth in CEE and the Wider National-Development Context

Descriptive studies examining the extent and evolution of regional disparities in the CEE countries have found consistently that these have grown significantly over the last two decades. The rise in inequalities has been evident from the early stages of transition (Petrakos, 1996; Römisch, 2003), but it continued throughout the period and in some cases intensified (Ezcurra et al., 2007; Kallioras & Petrakos, 2010). There is broad consensus in the literature, largely attributing these developments to the significant geographical and sectoral reallocation that has taken place in CEE over the last two decades. On the one hand, there is a notable shift of industrial activity towards metropolitan regions and regions bordering the EU (Petrakos & Economou, 2002; Iara & Traistaru, 2003), stimulated partly by the self-selected inflow of foreign investments in these areas (Altomonte & Resmini, 2002; Tondl & Vuksic, 2003). Trade integration also played a role in this, by favouring regions with significant specialisations and agglomeration economies, relative concentration of skilled labour and vibrant product demand (Traistaru et al., 2003; Resmini, 2007). On the other hand, the literature identifies a process of structural change across sectoral lines, both in terms of internal structures (sectoral compositions) and external competitiveness (trade specialisations) (Resmini, 2003; Niebuhr & Schlitte, 2009; Kallioras & Petrakos, 2010). Analyses along these lines confirm the inherent link between spatial and structural restructuring, finding that regions which have successfully restructured and thus benefited most from integration are those located closer to the EU borders and to metropolitan areas or large agglomerations.

Despite this general trend, econometric studies following the convergence approach often find evidence of convergence, at least in cross-country—cross-regional analyses (indicating regional convergence across the CEE space but not necessarily within each CEE country). Herz & Vogel (2003) use data for 31 regions across the CEECs and find evidence of divergence in the early transition period and of conditional convergence more recently. Using Eurostat data and examining cross-national and cross-regional convergence across the CEE, Niebuhr & Schlitte (2009; at the NUTS2 level for the period 1995–2000) and Paas et al. (2007; at the NUTS3 level for 1995–2002) find evidence of regional divergence or stability within countries but of fast cross-national convergence, resulting in an overall slow convergence of regional incomes at the supra-national level. Using the same

database in a simple neoclassical framework, Petrakos et al. (2005a) also find evidence of convergence. Similar are the results obtained by Del Bo et al. (2010), who use NUTS2-level Cambridge Econometrics data in a spatial econometrics framework and find evidence of both conditional and (marginally) unconditional convergence across the CEE regions. Evidence of convergence is also obtained in country-specific studies (e.g., Totev, 2008, for Bulgaria; Banerjee & Jarmuzek, 2010, for Slovakia).

In an analysis that departs somewhat from the neoclassical approach, Petrakos et al. (2005b) find simultaneous evidence of short-run divergence and long-run convergence, with the level of disparities moving pro-cyclically along an overall convergent trend. Kallioras (2010) shows that convergence trends are conditioned on the size of the regional economies, pointing to the possibility of club convergence. Direct evidence for this, with strong regional convergence within, and persistent divergence across clubs, has been offered recently by Artelaris et al. (2010; for within-country clubs) and earlier by Fischer & Stirböck (2006; for cross-country clubs). In a detailed study along these lines, which also examines the stability of convergence clubs across the CEE countries, Smetkowski & Wójcik (2012) find club-membership to be rather persistent and within-club convergence to exist together with spatial polarisation at wider scales.

Similar results are found more generally in the literature on regional growth in Europe. Evidence of club convergence in the 'old' EU member states has been obtained widely (see, inter alia, Canova, 2004; Corrado et al., 2005; Fischer & Stirböck, 2006; Dall'erba et al., 2008), while more recent contributions highlight the role of spatial processes (proximity, concentration), both for club-formation (spatial heterogeneity) and for the overall speed of convergence (see, for example, López-Bazo et al., 2004; Ertur et al., 2006; Arbia et al., 2008—see also the discussion in Fingleton & López-Bazo, 2006). The analysis of these processes has been also analysed in empirical studies employing the Verdoorn Law equation. Using this, Fingleton & McCombie (1998), Dall'erba et al. (2008), Angeriz et al. (2008), and others find evidence of increasing returns—and thus of a tendency for regional divergence and/or club convergence—across EU regions.

Despite the important advances made in this literature, the analysis of processes of club-formation and convergence is largely separated from the national (and supra-national) context of the regional economies. Indeed, if we are to put aside the studies that look at questions of regional restructuring within the context of transition, there is only a handful of studies that examine the issue of convergence–divergence in relation to the national-development context. In his historical study of regional convergence in Europe, Tondl (1997) found that this was speedier in the 1950s and 1960s, slowed down during the 1970s, and recovered somewhat in the 1980s—suggesting that the speed of convergence may well be pro-cyclical (in relation to national growth). In turn, Geppert & Stephan (2008) examine regional convergence in relation to the process of economic integration in Europe and find integration to be associated to cross-regional convergence across countries, albeit with increasing spatial concentration and regional disparities within countries. More specifically on the issue of development, Gennaioli et al. (2013) develop a theoretical model where the speed of convergence is an inverse function of factor mobility frictions. The authors claim that such frictions are higher in less developed economies, thus predicting higher rates of regional convergence as national economic development progresses. Employing a different methodological approach that looks at the issue of polarisation rather than disparity/convergence

per se, Ezcurra & Pascual (2007) find that the distribution of regional incomes becomes less polarised (along a non-linear path) as levels of national GDP per capita increase. A similar effect (an inverted-J path) has been found in the study of Petrakos et al. (2011), albeit for the case of regional levels of development and in the context of a neoclassical convergence model.

3. Regional Growth through the Prism of Convergence and Divergence

3.1. Patterns of Inequality and Polarisation

Our empirical investigation uses data on regional labour productivity, defined as gross value-added per employee, covering the period 1990–2008. In parts of the analysis we also use data on regional GDP (GVA plus net transfers) and GDP per capita (resident population). We use regional data at the NUTS3 level, covering 1,276 regions across Europe, 190 of which are located in the CEE.[1] Our focus is with the analysis of regional productivity, as this is the relevant variable for the two main theoretical approaches on the issue of regional growth (neoclassical convergence and the Kaldor–Verdoorn Law).

We start our analysis by examining the evolution of regional disparities in labour productivity at the country level and for each of the two groups of countries (CEE and EU15). Figure 1 plots the coefficient of variation of regional labour productivity across the 25 countries of our sample (summary measures of disparity and polarisation are presented in the Appendix). As can be seen, regional disparities

Figure 1. Evolution of regional disparities in labour productivity across EU countries. Note: Coefficients of variation of the within-country distribution of labour productivity; author's calculations.

have increased in the majority of the CEE countries (first three rows of plots). Among the countries in this group, only one (Slovenia) shows a clear and lasting trend of declining disparities (sigma-convergence). Disparities in Poland have been rather stable and in Romania and Bulgaria they have alternated trends, but all other CEE countries have experienced almost continuously rising regional disparities. The picture is generally different in the EU15 sample, were disparities have remained rather stable throughout the period and in many cases have declined over time. Thus, whereas in the EU15 there is some mild evidence of sigma-convergence, in the CEE sample the evidence rather strongly suggests a widening of disparities at least at the national level—with the coefficient of variation almost doubling in some cases (Czech Republic, Estonia).

This picture is reproduced when examining regional disparities not within countries but within each of the two groups (CEE and EU15). In the CEE, disparities in regional labour productivity rose sharply during the 1990s with the coefficient of variation across the sample rising from around 0.33 in 1990 to 0.58 in 1999 and stabilising somewhat thereafter but remaining at very high levels (0.55 in 2004–08—see Appendix). In contrast, disparities in the EU15 group were declining in the 1990s and rose only modestly in the 2000s (from 0.21 to 0.23). More interestingly, the evolution of the distribution of regional labour productivities was also very different across the two groups. As is shown in Figure 2, the distribution is strictly uni-modal and very leptokurtic in the EU15 sample, at least since the mid-1990s, and has remained so up to 2008, despite some widening of the distribution in more recent years. In contrast, the CEE distribution saw a significant widening over time, becoming bi-modal at least since the late-1990s and increasingly skewed to the right. Undoubtedly, this evolution shows a tendency of polarisation in the CEE sample, with values around the median (10.6) having very low densities, and a significant number of regions having values over twice the median.

It thus seems evident that the evolution of regional disparities in both the CEECs and the CEE region at large has been notably different from that of the EU15, as the CEE sample is characterised not only by widening disparities (sigma-divergence) but also by a relative polarisation in the distribution of labour productivities across regions; while, in contrast, regional disparities in the EU15

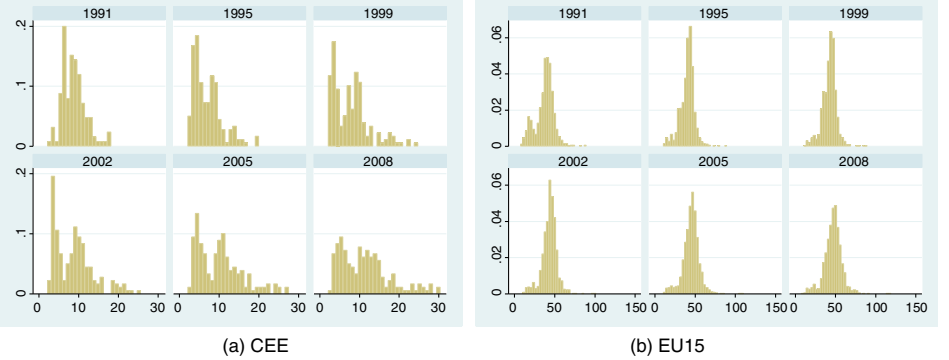

Figure 2. Evolution of the cross-national distribution of regional labour productivity. (a) CEE, (b) EU15.
Note: Author's calculations.

are much lower, generally non-rising and distributed around a single mode. Next we examine how these patterns are captured in an econometric analysis that draws on the two dominant models of neoclassical convergence and cumulative causation typically employed in the literature.

3.2. Testing Convergence and Cumulative Divergence

As is well known, the empirical formulation of the convergence hypothesis makes regional growth a function of initial regional incomes, as follows:

$$\Delta(y-l)_{i,t} = b_0 + b_1(y-l)_{i,t=0} \tag{1}$$

where y is the log of output, l is log employment, i and t index regions and time, respectively, and $b_1 < 0$, reflecting catch-up convergence. In turn, the cumulative causation hypothesis is typically examined using the Kaldor–Verdoorn equation (Kaldor, 1970), which makes productivity growth (typically, in manufacturing) a function of total output growth:

$$\Delta(y-l)_{i,t} = c_0 + c_1\Delta(q)_{i,t} \tag{2}$$

where q stands for total output in the economy. The coefficient c_1 in Eq. 2 is supposed to capture the presence of increasing returns to scale and thus of tendencies for (cumulative) divergence. Although there is no direct relation between equations 1 and 2, empirically $c_1 > 0$ in Eq. 2 implies that $b_1 > 0$ in Eq. 1 (see Cibulskiene & Butkus, 2007 for relevant discussion). We examine this in Table 1.

As can be seen in cols. 1–2, the convergence hypothesis is well validated by the data as we find strong evidence of convergence in both the CEE and the EU15.[2] Convergence is slower in the CEE and statistically much weaker, resulting in a differential in the so-called 'half-life condition' of just over two years (8.3 versus 10.4), although the overall fit of the regression is lower in the much-bigger EU15 sample suggesting a greater differentiation in regional growth trajectories in this sample.

Despite this—admittedly, basic—confirmation of the 'convergence hypothesis', however, when testing the Kaldorian specification (cols. 3–4) we obtain a positive and statistically significant effect for regional output growth. This is puzzling, as it clearly suggests a process of cumulative divergence in contrast to the inference drawn from cols. 1–2.[3] Adding to this is the fact that, as with the convergence coefficient, the so-called Verdoorn coefficient is also larger (and statistically more significant) in the EU15 than in the CEE sample—by some 30%. These results remain robust when we nest the two specifications (cols. 5–6): in both groups of countries we obtain simultaneous evidence of neoclassical convergence and cumulative causation. In the EU15 the convergence and Verdoorn coefficients decline (by 30% and 8% respectively) and in the CEE they rise (by 11% and 3%, respectively), but in all cases they maintain their high statistical significance.

In cols. 7–8 we examine whether the simultaneous evidence of convergence and cumulative causation may be driven by different growth trajectories among different sub-groups of regions. Specifically, it is possible that a group of regions—presumably the most advanced ones—benefit more strongly by increasing returns

Table 1. Neoclassical convergence and the Kaldor–Verdoorn law

	Neoclassical convergence		Kaldor–Verdoorn model		Nested model		Nested model with group effects	
	EU15	CEE	EU15	CEE	EU15	CEE	EU15	CEE
Productivity ($t-1$)	−0.084⋆ (0.003)	−0.067⋆ (0.006)			−0.058⋆ (0.002)	−0.074⋆ (0.006)	−0.068⋆ (0.003)	−0.087⋆ (0.007)
Output growth			0.712⋆ (0.014)	0.551⋆ (0.037)	0.658⋆ (0.012)	0.568⋆ (0.033)	0.649⋆ (0.012)	0.565⋆ (0.033)
High-p/y status							0.014⋆ (0.001)	0.032⋆ (0.005)
Constant	0.326⋆ (0.012)	0.182⋆ (0.017)	−0.012⋆ (0.002)	−0.069⋆ (0.016)	0.203⋆ (0.009)	0.216⋆ (0.016)	0.238⋆ (0.010)	0.321⋆ (0.019)
Year FE	39.17⋆	36.81⋆	60.96⋆	36.24⋆	53.74⋆	42.13⋆	55.03⋆	44.00⋆
Country FE	153.76⋆	53.86⋆	32.89⋆	31.50⋆	134.21⋆	66.69⋆	152.68⋆	72.20⋆
Obs	20,402	3,176	20,400	3,176	20,400	3,176	20,400	3,176
Regions	1,086	190	1,086	190	1,086	190	1,086	190
R^2	0.173	0.239	0.407	0.366	0.461	0.420	0.468	0.428

Notes: Heteroskedasticity-corrected standard errors in parentheses (using the Davidson & MacKinnon, 1993 correction). Asterisks (⋆) denote significance at the 1% level.

(thus producing a positive Verdoorn coefficient in the pooled sample), while convergence takes place among the regions exhibiting low-to-medium levels of productivity. The results only partly support this hypothesis. The coefficient on the dummy for high-productivity regions[4] is positive and statistically significant in both samples, suggesting that regional growth is ceteris paribus higher in more advanced regions (by 1.4 percentage points in the EU15 and notably more, by 3.2pp, in the CEE). Further, the convergence coefficients increase in both samples (both by around 17%), suggesting that convergence is indeed speedier 'at the bottom'. However, in both EU15 and CEE, the Verdoorn coefficients remain practically unchanged, implying that this effect is not driven by the process of divergence (and club-formation) 'at the top'.

4. The Regional Kuznets Curve and the Process of Transition

4.1. Theoretical Considerations

Analytically, both theoretical streams examined so far see the process of regional growth as conditioned on the regional development context—negatively for neoclassical convergence and positively for the cumulative causation approach. The puzzle of the obtained evidence pointing simultaneously to both convergence (Table 1) and divergence/polarisation (Table 1 and Figures 1 and 2), and the fact that the former appears stronger in the EU15 sample, where levels of development are significantly higher, while the latter is stronger in the less developed CEE region, invites us to consider the possibility that the process of *convergence itself* may also be conditional—this time on the context of national development, possibly along a non-linear path, whereby inequalities first rise, as economies start to grow out from initially low levels of development, and then subside, as national economies advance.

This is essentially the process described by Williamson's (1965) 'regional Kuznets curve' (henceforth, RKC). According to this, regional disparities, originally low for low levels of development, rise sharply as the process of national development accelerates and economic activity concentrates to take advantage of scale and agglomeration economies. In later phases, as connectivity across space improves (e.g., through infrastructure investment or declining transportation costs) and congestion diseconomies start biting, new growth opportunities emerge in more peripheral regions and disparities start subsiding.[5] Formally, the RKC hypothesis makes regional disparities a non-linear function of national development:

$$\mathrm{Var}(y_i - l_i)_t = d_0 + d_1(y_N - l_N)_t + d_2(y_N - l_N)_t^2 \qquad (3)$$

where the subscript N indexes the national level and $d_1 > 0$, $d_2 < 0$. Studies drawing on this formulation have provided evidence in favour of the RKC (Barrios & Strobl, 2006; Ezcurra & Rapun, 2006; Francois & Rojas-Romagosa, 2008) without examining specifically the growth process at the regional level. It is however possible to express this relationship in terms of regional growth in a way more consistent with the neoclassical convergence model.

Imagine an initial stage of very low development nationally, where the whole economy is employed in the production of a set of goods (say, agriculture) under constant returns to scale and thus all regions have similar levels of productivity. In

this economy, all regions grow at a very similar pace, at or around the national growth rate, and small idiosynchratic deviations from the national level of productivity are 'corrected' instantaneously resulting in very high observed speeds of convergence. In algebraic form,

$$\Delta(y-l)_{i,t} = z_0 + z_1\Delta(y-l)_{N,t} + z_2(y-l)_{i,t-1} \quad (4)$$

with $z_0 \approx 0$, $z_1 \approx 1$ and $z_2 < 0$. As the national economy grows and labour productivity increases, conditions emerge for the adoption of new technologies and/or the introduction of new products,[6] some of which will be characterised by increasing returns to scale. Idiosynchratic deviations at the regional level will ensure that not all regions reach this stage simultaneously. Those that do so first, will obtain an advantage which, due to the nature of the new technology (increasing returns), will be cumulative. Higher profitability and productivity gains in these regions and perhaps also stronger consumption externalities (agglomeration effects) will shift investment towards them, instigating a process of regional divergence, while at the same time pushing upwards the average (national) level of development. In this instance national growth will be a less accurate descriptor of regional growth (so that z_1 becomes statistically less significant[7]) and neoclassical convergence will be reversed (so that $z_2 \geq 0$, or at least $z_2^B > z_2^A$, if the lagging regions continue to converge—where A and B index stages of development).

Provided that the less well-off regions are not permanently prevented from the adoption of the new technology, and in the absence of any systematic shocks favouring the more advanced regions, with the passage of time the lagging regions will also move to the new production regime (that is, as long as they continue to grow while in stage B). This will instigate a return to the process of convergence, so that $z_2^C < 0$ (where C stands for the new stage of national development).[8] Naturally, the picture will be different if in the course of stage B some forces emerge to perpetuate the agglomeration advantage of the leading regions. In line with endogenous growth theory, such forces may well be endogenous—for example, due to the embeddedness of human capital into physical labour or due to a positive correlation between levels of productivity and the incidence of positive technology shocks. However, such forces may also be exogenous—if for example a national shock favours systematically high-productivity regions. As we discussed in the first part of this paper, the post-communist transition experienced by the CEE countries may well represent such a national shock that may have favoured the more advanced regions, selectively directing there new technologies embodied in foreign investments and reinforcing their agglomeration advantages. In contrast, in more advanced economies with more developed credit markets, lower political uncertainties and overall risks and better institutional and physical infrastructure to facilitate mobility, the conditions for the emergence of centrifugal forces, and thus of regional convergence, will be stronger.[9]

We can thus identify two alternative paths within stage C. In path C1, agglomeration forces are persistent and possibly reinforced, resulting in continuous divergence ($z_2^{C1} \geq 0$, so that the convergence path is monotonic but not necessarily concave); while in path C2 agglomeration forces die out and convergence re-emerges ($z_2^{C2} < 0$, so that the convergence path is concave but non-monotonic (hump-shaped))—until perhaps a new technological shock

starts the convergence–divergence cycle again. We can represent these trajectories in algebraic form by extending Eq. 4 as follows:

$$\Delta(y-l)_{i,t} = D^S z_0 + \sum_S D^S z_1 \Delta(y-l)_{N,t} + \sum_S D^S z_2 (y-l)_{i,t-1} \qquad (5)$$

where D^S is a set of binary dummies indexing stages of national development (S = {A, B, C1, C2}). Drawing on our discussion, we expect z_2 to follow a non-linear (initially, hump-shaped) path along stages of development and the *statistical significance* of z_1*to decline over time*, at least initially. We moreover expect that for higher levels of development (stage C), the coefficient z_2 to be more negative in the EU15 sample and (more) positive in the CEE sample. We examine the validity of these predictions next.

4.2. Empirical Results

To perform our analysis we need to identify different stages, or thresholds, of development across which the direction and intensity of convergence may differ. This is not a straightforward task, especially as it is not practically possible to derive a universal definition of 'stages of development' across our two samples.[10] Opting thus for the use of group-specific definitions of 'stages', we were confronted with a number of options, ranging from adopting an exogenous classification, either ad hoc or by drawing on existing international classifications, to deriving our groups endogenously, e.g., through cluster analysis. For our analysis we favoured a simpler classification method, largely due to its simplicity, splitting each of the two samples (EU15 and CEE) on the basis of the treciles (33rd and 66th percentiles) of the group-specific distributions of national incomes (GDP per capita).[11] This is convenient, as it splits each sample independently into three group-specific 'stages of development', in line with our theoretical stages A, B and C, and avoids the practical problems of a universal definition of stages of development.

Nevertheless, we also developed an alternative classification, driven there by our early findings and the experimentation with other classification schemes. This was as follows. First, we applied a linear scale transformation (distance from minimum divided by range) to standardise the distribution of GDP per capita within each group. We then derived trecile thresholds from these standardised distributions and merged them, producing five distinctive categories ('stages': from the lowest trecile of the CEE distribution to the top trecile of the EU15 distribution), and applied subsequently these thresholds to the two standardised distributions separately. As these thresholds did not overlap (i.e., the 33rd percentile of the EU15 distribution was above the 66th percentile of the CEE distribution), in effect this classification is identical to the simple treciles classification above, with the only difference that, additionally, 'stage C' (the upper trecile) of the CEE distribution and 'stage A' (lower trecile) of the EU15 distribution are split each into three sub-stages. This provides us with a more detailed picture for the 'early' stages of development in the EU15 and for the 'late' stages of development in the CEE which, as we will see, helps unveil some very interesting patterns.

Table 2 presents the results for the model specified in Eq. 4', starting with the simple three-stage classification. As can be seen in columns 1–2, the national growth variable is highly significant and—consistent with the predictions made earlier—at 'early' stages of development it is much closer to 1, especially in CEE,

Table 2. Regional growth and stages of economic development

	Eq. 4'		$z_1 = 0$		1994–2006		Within countries		Five stages	
	CEE	EU15	CEE	EU15	CEE	EU15	CEE	EU15	CEE	EU15
Nat'l growth										
Stage 1	0.995***	1.174***			0.997***	1.520***	0.990***	1.168***	0.994***	1.098***
	(34.13)	(33.54)			(25.03)	(16.45)	(31.30)	(29.74)	(33.64)	(11.31)
Stage 2	0.959***	0.139***			0.905***	1.048***	0.955***	0.144***	0.957***	1.788***
	(25.15)	(5.092)			(18.96)	(22.20)	(24.10)	(5.31)	(25.00)	(13.04)
Stage 3	1.026***	0.922***			1.054***	0.997***	1.114***	1.032***	1.002***	1.011***
	(19.41)	(15.62)			(13.01)	(14.55)	(18.34)	(15.81)	(13.72)	(51.89)
Stage 4									1.009***	0.134***
									(14.70)	(4.927)
Stage 5									1.559***	0.887***
									(3.514)	(15.28)
Reg'l p/ty ($t-1$)										
Stage 1	−0.0255***	−0.0185***	−0.0416***	−0.0222***	−0.0391***	−0.0123***	−0.0297***	−0.0569***	−0.0254***	−0.0723***
	(−3.624)	(−6.408)	(−4.243)	(−7.163)	(−3.872)	(−3.671)	(−3.388)	(−8.951)	(−3.576)	(−9.762)
Stage 2	−0.00685	−0.117***	−0.0241***	−0.114***	−0.01000	−0.0535***	−0.0143**	−0.1205***	−0.0072	0.0058
	(−1.221)	(−25.75)	(−3.602)	(−25.59)	(−1.610)	(−16.44)	(−2.438)	(−26.237)	(−1.271)	(1.068)
Stage 3	0.00944***	−0.00238	0.00209	−0.00322	0.00852**	−0.0153***	0.00045	−0.0072**	0.0102*	−0.0207***
	(3.208)	(−0.872)	(0.528)	(−1.144)	(2.138)	(−3.952)	(0.089)	(−2.522)	(1.887)	(−5.539)
Stage 4									0.0171***	−0.1174***
									(2.728)	(−25.86)
Stage 5									−0.0236	−0.0022
									(−1.641)	(−0.818)
Year FE	1.90*	22.94***	18.99***	35.67***	1.55*	5.24***	2.06***	24.01***	1.96**	22.85***
Stages FE	11.80***	254.54***	12.24***	223.72***	10.50***	53.12***	6.10***	241.38***	6.24***	141.56***
Country FE							1.96**	24.90***		
Constant	0.0344***	0.0587***	0.0935***	0.0833***	0.0481***	0.0364***	0.0550***	0.2175***	0.0346***	0.219***
	(3.092)	(5.993)	(6.180)	(7.975)	(3.235)	(3.121)	(2.932)	(9.080)	(3.075)	(9.738)
Observations	3,173	20,402	3,176	20,402	2,466	14,114	3,137	20,402	3,173	20,402
R-squared	0.550	0.254	0.160	0.172	0.458	0.170	0.554	0.275	0.551	0.272

Notes: Heteroskedasticity-corrected t-statistics in parentheses (using the Davidson & MacKinnon, 1993 correction). The FE rows report F-statistics for the joint significance of the corresponding fixed-effects. *, ** and *** show significance at the 10%, 5% and 1% levels, respectively.

and notably more significant statistically than in later stages. The stage-specific fixed-effects are also very significant, especially in the EU15 sample, in line with our assumption that z_0 will be different across stages of national development. In contrast, the results concerning the intensity of convergence confirm only partially our earlier predictions. In stage 1, both samples produce negative and statistically significant convergence coefficients. In the CEE, the coefficient declines substantially in stage 2, becoming statistically not different from zero, and turns positive at stage 3, showing slow but statistically significant divergence. If we are to interpret our empirical stages as accurate reflections of the theoretical stages discussed earlier, then we should conclude that the convergence–divergence path followed in the CEE corresponds to the trajectory described by C1 in our earlier discussion (persistent divergence). However, as the convergence coefficient in stage 2 is clearly non-positive, it is also possible that the estimate of stage 3 simply captures our theoretical stage B (i.e., that stages 1 and 2 are both 'early' stages of development), making it uncertain as to whether the CEE regions are following a divergent or a hump-shaped path.

In contrast, the results for the EU15 sample produce a U-shaped trajectory of convergence with a very large and statistically very strong convergence coefficient in stage 2 and an insignificant but still negative coefficient in stage 3. Quite clearly, the results do not support the RKC hypothesis or any of the processes sketched out in our discussion of section 4.1. Rather, they seem to be more consistent, broadly speaking, with the non-linear convergence/polarisation paths found (but under different specifications and measures of inequality) in the studies of Ezcurra & Pascual (2007) and Petrakos et al. (2011).

The overall thrust of these trajectories is repeated consistently across alternative specifications.[12] When we exclude the national growth variable (setting $z_1^S = 0$) the path towards divergence in the CEE appears slower but is certainly in the same direction, while the EU15 results do not change. When we restrict our estimating samples to a shorter time-span, to exclude the turbulent years at the beginning and the end of the period, the CEE result is exactly as in the original model, while in the EU15 the convergence coefficient in stage 3 becomes significant. Similarly minor are the differences when we introduce country-specific fixed effects (cols. 5–6).

In the last part of Table 2 we report the results from our more refined (but asymmetric) 5-stage classification. As can be seen, some of the earlier results concerning especially the CEE sample apply in the same way in this specification. As before, the significance of the national growth variable drops continuously as we move to higher stages of development.[13] Similarly, convergence is strongest in stage 1 and it gradually loses significance, turning to statistically significant divergence by stage 4 (in line with, but more emphatically than, what was found in col.1), while the estimate for stage 5 suggests a return towards convergence, although this is not statistically significant. In contrast, in the EU15 sample the 5-stage classification produces a convergence trajectory that is qualitatively very different than before. Between stages 1 and 4, the convergence coefficient follows a very clear hump-shaped path, becoming very strongly negative in stage 4 (which corresponds to stage 2 in col.1). In stage 5, however, the direction of the path reverses and the convergence coefficient becomes insignificant. This result, which is directly comparable to the one obtained in col.1 under stage 3, explains our earlier inference concerning a U-shaped convergence trajectory in the EU15. We depict visually these convergence–divergence trajectories in Figure 3.

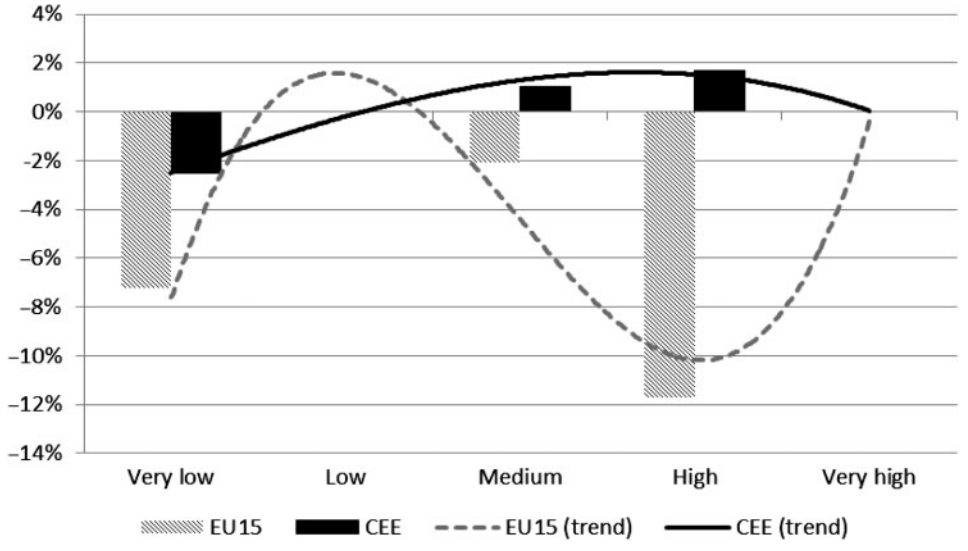

Figure 3. Convergence intensities across stages of development.
Notes: Convergence coefficients (setting equal to zero if not statistically significant) obtained from Table 2, cols. 9–10. Fitted lines are based on a third-order polynomial.

5. Discussion

There are two key points of departure for the analysis in this paper. On the one hand, that owing to processes of transition and integration, regional disparities in the CEECs increased substantially over the last two decades and regional productivities and incomes became significantly polarised. On the other, that the traditional approach to the analysis of these developments is rather limiting, as it pays little attention to the national-development context—while the two main theories typically tested on the data seem to provide contradictory results. Reflecting especially on this second point, this paper attempted to provide a link, both theoretically and empirically, between national development and the process of regional growth and convergence. Our results provide clear evidence in support of the assertion that the convergence process—and regional growth more generally—is significantly different across different levels/stages of development. The evidence obtained, across the two samples, is at least partly consistent with our adapted RKC story.

In the CEE, regional growth seems to follow a process broadly in line with our theoretical predictions: starting from convergence, divergence gradually emerges as we move to higher levels of development. The absence of a (statistically significant) 'return to convergence' at the highest stage is consistent with our assertion that transition may be favouring centripetal forces against the tendency for speedier convergence at higher levels of development. Although of course we cannot exclude the possibility that this result may simply reflect that the CEECs have not yet reached the levels of national development needed to (re-)mobilise regional convergence,[14] it should be noted that at comparable levels of development (stage 1 for the EU15 sample) the EU15 regions were converging fast—admittedly within a very different political-economic context—and thus the level of development per se does not appear in itself as a sufficient explanation for the

absence of a return to convergence. If we were to speculate on the factors that may explain this variation, quite naturally our attention would fall on the processes of post-communist transition and market integration/liberalisation that followed—in line with discussions elsewhere in the literature as reviewed briefly in the early parts of section 2.

For the EU15, the evidence concerning the RKC hypothesis is more mixed. On the one hand, at very low to medium levels of national development (stages 1–4) we do observe a path that is similar to the one described by the RKC (Figure 3). However, in no stage of development do we get convincing (statistically significant) evidence of divergence—which would be more in line with the RKC hypothesis. Moreover, we find that even at higher levels of development the convergence coefficient is not stable but rather tends to reverse. While this, too, is not part of the original RKC hypothesis, the overall convergence path depicted in Figure 3 is in fact broadly consistent with our theoretical discussion of section 4.1. Using this discussion to interpret the evolution of the convergence coefficient in the EU15, we could hypothesise that in this group technological (or other) shocks pushing towards divergence have a higher frequency but lower intensity. Thus, episodes of slower and faster convergence alternate, with more advanced regions occasionally increasing their distance from the less well-off regions, but without reversing the overall pattern of convergence (presumably, amongst the latter group of regions).

Moving beyond these interpretations, we wish to conclude by relating the main message emanating from our analysis, namely the existence of a strong link between national economic context and the process of regional convergence, to related arguments in the literature. As discussed earlier, a presumed link between national development and aspects of regional disparity has been suggested not only by Williamson's (1965) regional Kuznets curve but also in more recent contributions (Ezcurra & Pascual, 2007). However, no study has examined thus far, in a systematic way, the differentiation and *non-linearity* of the speed of convergence across different stages of economic development. A small number of empirical studies have showed that convergence speeds differ at different stages in the process of economic integration and over different national growth regimes (e.g., Tondl, 1997; Geppert & Stephan, 2008). The model recently developed by Gennaioli et al. (2013), and the empirical evidence presented there, added a different perspective, suggesting that the speed of convergence increases linearly with economic development. The evidence presented in this paper is in the same spirit as these observations. Like others, we find that the speed of convergence is not constant over time. But we also offer unique evidence showing that its evolution follows a rather deterministic path and is non-linear. We defer to future research the pursuit of a more detailed analysis of the factors explaining this.

Notes

1. The CEE countries in our sample are the 10 post-communist New Member States of the EU that acceded in the 2004 and 2007 enlargements. Cyprus and Luxemburg are excluded from our analysis. Nominal data have been deflated and expressed in constant 2000 euros. All data are from the Cambridge Econometrics European Regional Database (http://www.camecon.org).
2. The regressions in columns 1 and 2 control for country and time fixed effects. The result, however, is universally consistent across alternative specifications (regional FEs, random effects, etc).
3. The specification of Eq. 2 has received a number of criticisms in the literature (Mamgain, 1999; Angeriz et al., 2008), concerning its culpability to spurious correlation (due to simultaneity) and its implicit assumption of a

constant capital/labour ratio (Harris & Liu, 1999; Castiglione, 2011). Nevertheless, the evidence of a positive Verdoorn coefficient is obtained consistently across many alternative specifications (results available upon request) and thus seems very robust. Evidence of cumulative divergence has also been obtained for the CEE regions from a specification drawing on the Myrdalian notion of circular causation (Monastiriotis, 2013).

4. We have classified these as those regions that have belonged to the top-25% of their national distribution of regional productivities for each and every year in our sample. The results are very similar under alternative definitions, including (a) replacing the 75th percentile with the median, the mean or the national value; and (b) varying the eligibility from 'all years' to 'majority of years' or 'a subset of years'.
5. Similar arguments have been developed more recently also in the urban economics literature (Henderson et al., 2001; Duranton & Puga, 2004). Further, as we saw earlier, this process of intensifying regional convergence at more advanced stages of national development is also supported empirically in the scant literature on the topic (Ezcurra & Pascual, 2007; Gennaioli et al., 2013).
6. For example, technology products whose production is characterised by high fixed costs and thus requires a certain level of productivity so as for production to be profitable.
7. Essentially, whether z_1 becomes greater or smaller than 1 will depend on the shape of the distribution of regional growth rates and the relative size of the leading regions. In this case, z_0 will also now be different, as we depict later in Eq. 4'.
8. This requires that, despite the increasing returns technology, the returns to any individual factor of production remain diminishing (otherwise the first-mover advantage becomes permanent).
9. Similar developments are described in some models within the NEG tradition (see Krugman, 1991 and, in particular, Ottaviano & Puga, 1998, and Puga, 1999).
10. National incomes differ substantially across the EU15 and CEE countries and thus the income distributions of the two country groups hardly overlap. Besides this, given the specificity of the CEE transition context, it is in some respects questionable whether east-west differences in GDP per capita actually reflect differences in *levels* of development.
11. We have replicated the analysis for other thresholds (quartiles and quintiles—results available upon request) but the patterns were broadly consistent with those derived from the treciles and overall less informative than the alternative method described next in the text.
12. The results are also consistent across alternative estimation methods, including the GLS random effects and PCSE estimators.
13. In the EU15 sample this applied less strongly in the three-stage classification and does not seem to apply at all here.
14. This could be in line with Gennaioli et al. (2013) who claim that convergence occurs faster in more developed countries with better infrastructure and greater factor mobility. Note, however, that this prediction does not get support in the EU15 sample which represents higher levels of development.

References

Altomonte, C. & Resmini, L. (2002) Multinational enterprises as a catalyst for local industrial development: the case of Poland, *Italian Journal of Regional Science*, 1, 29–58.

Angeriz, A., McCombie, J. & Roberts, M. (2008) New estimates of returns to scale and spatial spillovers for EU regional manufacturing, *International Regional Science Review*, 31, 62–87. doi:10.1177/0160017607306750

Arbia, G., Le Gallo, J. & Piras, G. (2008) Does evidence on regional economic convergence depend on the estimation strategy? Outcomes from analysis of a set of NUTS2 EU regions, *Spatial Economic Analysis*, 3, 209–224. doi:10.1080/17421770801996664

Artelaris, P., Kallioras, D. & Petrakos, G. (2010) Regional inequalities and convergence clubs in the EU New Member States, *Eastern Journal of European Studies*, 1, 113–133.

Audretsch, D. & Keilbach, M. (2005) Entrepreneurship capital and regional growth, *Annals of Regional Science*, 39, 457–469. doi:10.1007/s00168-005-0246-9

Banerjee, B. & Jarmuzek, M. (2010) Economic growth and regional disparities in the Slovak Republic, *Comparative Economic Studies*, 52, 379–403. doi:10.1057/ces.2010.13

Barrios, S. & Strobl, E. (2006) The dynamics of regional inequalities, FEDEA Working Paper No2006-01, Foundation for the Study of Applied Economics, Spain.

Barro, R. J. & Sala-i-Martin, X. (1991) Convergence across states and regions, Brookings Papers on Economic Activity, No1.

Bellini, E., Ottaviano, G., Pinelli, D. & Prarolo, G. (2009) Cultural diversity and economic performance: evidence from European regions, Working Paper No. 63, Fondazioni Eni Enrico Mattei, Milan.

Canova, F. (2004) Testing for convergence clubs in income per capita: a predictive density approach, *International Economic Review*, 45, 49–77. doi:10.1111/j.1468-2354.2004.00117.x

Castiglione, C. (2011) Verdoorn-Kaldor's law: an empirical analysis with time series data in the United States, *Advances in Management and Applied Economics*, 1, 135–151.

Cibulskiene, D. & Butkus, M. (2007) The influence of cumulative causation process on regional divergence in Lithuania during 1995–2003, *Jahrbuch für Regionalwissenschaft*, 27, 59–87. doi:10.1007/s10037-006-0011-2

Corrado, L., Martin, R. & Weeks, M. (2005) Identifying and interpreting regional convergence clusters across Europe, *The Economic Journal*, 115, C133–C160. doi:10.1111/j.0013-0133.2005.00984.x

Dall'Erba, S., Percoco, M. & Piras, G. (2008) The European regional growth process revisited, *Spatial Economic Analysis*, 3, 7–25. doi:10.1080/17421770701733399

Davidson, R. & MacKinnon, J. (1993) *Estimation and Inference in Econometrics*, New York, Oxford University Press.

Del Bo, C., Florio, M. & Manzi, G. (2010) Regional infrastructure and convergence: growth implications in a spatial framework, *Transition Studies Review*, 17, 475–493. doi:10.1007/s11300-010-0160-4

Duranton, G. & Puga, D. (2004) Micro-foundations of urban increasing returns: theory, in: J. V. Henderson & J.-F. Thisse (eds) *Handbook of Regional and Urban Economics*, Vol. 4, pp. 2063–2117, Amsterdam, North Holland.

Ertur, C., Le Gallo, J. & Baumont, C. (2006) The European regional convergence process, 1980–1995: do spatial regimes and spatial dependence matter?, *International Regional Science Review*, 29, 3–34. doi:10.1177/0160017605279453

Ezcurra, R. & Pascual, P. (2007) Regional polarisation and national development in the European Union, *Urban Studies*, 44, 99–122. doi:10.1080/00420980601023877

Ezcurra, R., Pascual, P. & Rapún, M. (2007) The dynamics of regional disparities in Central and Eastern Europe during transition, *European Planning Studies*, 15, 1397–1421. doi:10.1080/09654310701550850

Ezcurra, R. & Rapun, M. (2006) Regional disparities and national development revisited: the case of Western Europe, *European Urban and Regional Studies*, 13, 355–369. doi:10.1177/0969776406068590

Fingleton, B. & López-Bazo, E. (2006) Empirical growth models with spatial effects, *Papers in Regional Science*, 85, 177–198. doi:10.1111/j.1435-5957.2006.00074.x

Fingleton, B. & McCombie, J. S. L. (1998) Increasing returns and economic growth: some evidence for manufacturing from the European Union regions, *Oxford Economic Papers*, 50, 89–105. doi:10.1093/oxfordjournals.oep.a028638

Fischer, M. & Stirböck, C. (2006) Pan-European regional income growth and club convergence: insights from a spatial econometric perspective, *Annals of Regional Science*, 40, 693–721. doi:10.1007/s00168-005-0042-6

Francois, J. & Rojas-Romagosa, H. (2008) Reassessing the relationship between inequality and development, CPB Discussion Paper No107, Netherlands Bureau for Economic Policy Analysis.

Gennaioli, N., La Porta, R., Lopez de Silanes, F. & Shleifer, A. (2013) Growth in regions, NBER Working Paper No18937, National Bureau of Economic Research.

Geppert, K. & Stephan, A. (2008) Regional disparities in the European Union: convergence and agglomeration, *Papers in Regional Science*, 87, 193–217. doi:10.1111/j.1435-5957.2007.00161.x

Harris, R. I. D. & Liu, A. (1999) Verdoorn's law and increasing returns to scale: country estimates based on the cointegration approach, *Applied Economics Letters*, 6, 29–33. doi:10.1080/135048599353834

Henderson, V., Shalizi, Z. & Venables, A. (2001) Geography and development, *Journal of Economic Geography*, 1, 81–105. doi:10.1093/jeg/1.1.81

Herz, B. & Vogel, L. (2003) Regional convergence in Central and Eastern Europe: evidence from a decade of transition, in: C. Hausen, M. Resinek, N. Schürmann & M. Stierle (eds) *Determinants of Growth and Business Cycles: Theory, Empirical Evidence and Policy Implications*, pp. 155–179, Berlin, Springer.

Iara, A. & Traistaru, I. (2003) Integration, regional specialization and growth differentials in EU accession countries: evidence from Hungary, in: C. Hausen (ed) *Determinants of Growth and Business Cycles: Theory, Empirical Evidence and Policy Implications*, pp. 181–202, Berlin, Verlag für Wissenschaft und Forschung.

Kaldor, N. (1970) The case of regional policies, *Scottish Journal of Political Economy*, 17, 337–348. doi:10.1111/j.1467-9485.1970.tb00712.x

Kallioras, D. (2010) Regional inequalities in the New European Union member-states: is there a "Population Size" effect?, Discussion Paper No. 16, Department of Planning and Regional Development, University of Thessaly.

Kallioras, D. & Petrakos, G. (2010) Industrial growth, economic integration and structural change: evidence from the EU new member-states regions, *The Annals of Regional Science*, 45, 667–680. doi:10.1007/s00168-009-0296-5

Krugman, P. (1991) Increasing returns and economic geography, *Journal of Political Economy*, 99, 484–499. doi:10.1086/261763

López-Bazo, E., Vayá, E. & Artís, M. (2004) Regional externalities and growth: evidence from European regions, *Journal of Regional Science*, 44, 43–73. doi:10.1111/j.1085-9489.2004.00327.x

Mamgain, V. (1999) Are the Kaldor-Verdoorn laws applicable in the newly industrializing countries? *Review of Development Economics*, 3, 295–309. doi:10.1111/1467-9361.00069

McCombie, J. & De Ridder, J. (1984) The Verdoorn law controversy: some new empirical evidence using US state data, *Oxford Economic Papers*, 36, 268–284.

Monastiriotis, V. (2013) Regional growth in Central and Eastern Europe: convergence, divergence and non-linear dynamics, ch.4, in: R. Crescenzi & M. Percoco (eds) *Geography, Institutions and Regional Economic Performance*, pp. 77–93, Berlin, Heidelberg: Springer-Verlag.

Monastiriotis, V. & Petrakos, G. (2010) Twenty years of economic transition in the Balkans: transition failures and development challenges, *Southeastern Europe*, 34, 149–169. doi:10.1163/187633310X507493

Niebuhr, A. & Schlitte, F. (2009) EU enlargement and convergence: does market access matter? *Eastern European Economics*, 47, 28–56. doi:10.2753/EEE0012-8775470302

Ottaviano, G. I. P. & Puga, D. (1998) Agglomeration in the global economy: a survey of the 'New Economic Geography', *The World Economy*, 21, 707–731. doi:10.1111/1467-9701.00160

Paas, T., Kuusk, A., Schlitte, F. & Võrk, A. (2007) Econometric analysis of income convergence in selected EU countries and their NUTS3 level regions, Faculty of Economics and Business Administration Working Paper No. 60, University of Tartu.

Petrakos, G. (1996) The regional dimension of transition in Eastern and Central European Countries: an assessment, *Eastern European Economics*, 34, 5–38.

Petrakos, G. & Economou, D. (2002) The spatial aspects of development in Southeastern Europe, *Spatium*, 8, 1–13. doi:10.2298/SPAT0208001P

Petrakos, G., Kallioras, D. & Anagnostou, A. (2011) Regional convergence and growth in Europe: understanding patterns and determinants, *European Urban and Regional Studies*, 18, 375–391. doi:10.1177/0969776411407809

Petrakos, G., Psycharis, Y. & Kallioras, D. (2005a) Regional inequalities in the EU new member-states: evolution and challenges, in: J. Bradley, G. Petrakos & I. Traistaru (eds) *The Economics and Policy of Cohesion in an Enlarged European Union*, pp. 45–64, New York, NY, Springer.

Petrakos, G., Rodríguez-Pose, A. & Rovolis, A. (2005b) Growth, integration, and regional disparities in the European Union, *Environment and Planning A*, 37, 1837–1855. doi:10.1068/a37348

Puga, D. (1999) The rise and fall of regional inequalities, *European Economic Review*, 43, 303–334. doi:10.1016/S0014-2921(98)00061-0

Resmini, L. (2003) Economic integration, industry location and frontiers economies in transition countries, *Economic Systems*, 27, 204–221. doi:10.1016/S0939-3625(03)00040-2

Resmini, L. (2007) Regional patterns of industry location in transition countries: does economic integration with the EU matter? *Regional Studies*, 41, 747–764. doi:10.1080/00343400701281741

Rey, S. & Janikas, M. (2005) Regional convergence, inequality, and space, *Journal of Economic Geography*, 5, 155–176. doi:10.1093/jnlecg/lbh044

Römisch, R. (2003) Regional disparities within accession countries, in: G. Tumpel-Gugerell & P. Mooslechner (eds) *Economic Convergence and Divergence in Europe: Growth and Regional Development in an Enlarged Europe*, pp. 183–208, Cheltenham, Edward Elgar.

Smetkowski, M. & Wójcik, P. (2012) Regional convergence in Central and Eastern European countries: a multidimensional approach, *European Planning Studies*, 20, 923–939. doi:10.1080/09654313.2012.673560

Tondl, G. (1997) The changing pattern of regional convergence in Europe, Robert Schuman Centre Discussion Paper No. 53, European University Institute.

Tondl, G. & Vuksic, G. (2003) What makes regions in Eastern Europe catching up? The role of foreign investment, human resources, and geography, ZEI Discussion Paper No. B12, Bonn Center for European Integration Studies.

Totev, S. (2008) Economic integration and structural change: the case of bulgarian regions, in: C. Krieger-Boden, E. Morgenroth & G. Petrakos (eds) *The Impact of European Integration on Regional Structural Change and Cohesion*, pp. 248–265, London, Routledge.

Traistaru, I., Nijkamp, P. & Resmini, L. (2003) *The Emerging Economic Geography in EU Accession Countries*, London, Ashgate.

Williamson, J. (1965) Regional inequality and the process of national development a description of the patterns, *Economic Development and Cultural Change*, 13, 3–45. doi:10.1086/450136

Appendix

Table A1. Regional disparities within and across the European countries

Country	Disparity (CoV)		Polarisation		Persistence
Period	Early transition	Post accession	Early transition	Post accession	Early – Post
BG	0.22	0.26	1.73	2.08	0.38
CZ	0.09	0.21	1.26	1.78	0.30
EE	0.21	0.35	1.51	1.91	1.00
HU	0.17	0.24	1.67	1.72	0.22
LT	0.18	0.26	1.31	1.59	0.83
LV	0.38	0.52	1.55	2.68	0.49
PL	0.27	0.28	1.69	1.99	0.89
RO	0.19	0.23	1.34	1.95	0.59
SI	0.16	0.11	1.37	1.19	0.90
SK	0.17	0.21	1.43	1.45	0.33
CEE	0.44	0.55	2.82	2.82	0.63
AT	0.16	0.15	1.31	1.30	0.85
BE	0.13	0.13	1.34	1.40	0.86
DE	0.23	0.16	2.07	2.37	0.66
DK	0.10	0.08	1.20	1.15	0.61
ES	0.14	0.08	1.27	1.22	0.65
FI	0.09	0.14	1.23	1.42	0.90
FR	0.14	0.16	1.68	2.17	0.82
GR	0.54	0.30	3.45	1.96	0.05
IE	0.15	0.23	1.31	1.46	0.81
IT	0.12	0.12	1.21	1.31	0.79
MT	0.16	0.07	1.11	1.05	1.00
NL	0.15	0.17	1.61	1.56	0.76
PT	0.26	0.30	1.67	2.00	0.96
SE	0.06	0.09	1.14	1.30	0.31
UK	0.13	0.17	1.46	1.65	0.46
EU15	0.25	0.23	2.18	2.40	0.64

Notes: Early transition covers the period 1990–1995; post-accession is for 2004–2008. Comparative data are presented for the same periods for the EU15.