Growth, Integration and Regional Inequality in Europe[§]

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Abstract

This paper challenges the ability of the conventional literature initiated by Barro and Sala-i-Martin (1991, 1992) to detect actual convergence or divergence trends across countries or regions and suggests an alternative dynamic framework of analysis, which allows for a better understanding of the forces in operation. With the use of a SURE model and time-series data for eight European Union (EU) member-states, we test directly for the validity of two competing hypotheses: the neoclassical (NC) convergence hypothesis originating in the work of Solow (1956) and the cumulative causation hypothesis stemming from Myrdal's theories (1957). We also account for changes in the external environment, such as the role of European integration on the level of inequalities. Our findings indicate that both short-term divergence and long-term convergence processes coexist. Regional inequalities are reported to follow a pro-cyclical pattern, as dynamic and developed regions grow faster in periods of expansion and slower in periods of recession. At the same time, significant spread effects are also in operation, partly offsetting the cumulative impact of growth on space. Similar results are obtained from the estimation of an intra-EU model of inequalities at the national level, indicating that the forces in operation are independent of the level of aggregation. Our findings challenge the conventional wisdom in the European Commission about the evolution of regional inequalities and have important policy implications.

Key words: regional inequalities, growth, convergence, integration, European Union,

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1. Introduction

Economic theory has an ambiguous message concerning the relationship between growth and regional inequality. This uncertainty and the discussion around it started in the late 1950s. Following Solow (1956), proponents of the neoclassical (NC) paradigm argue that disparities are bound to diminish with growth, because of diminishing returns to capital. In a competitive environment, regional labor and capital mobility as well as regional trade will also work in favor of factor price convergence, reinforcing the negative relation between growth and regional inequality.

However, other schools of thought tend to agree with the basic claim of Myrdal (1957) that growth is a spatially cumulative process, which is likely to increase inequalities. Despite significant differences among strands of research, whether one examines older theories of development (Rosenstein-Rodan 1943, Fleming 1955, Hirschman 1958, Perroux 1970), theories of urban growth (Segal 1976, Henderson 1983, 1986, 1988, 1999), the new economic geography school (Krugman 1991, 1993a, 1993b, Fujita, Krugman and Venables 1999, Thisse 2000), or the endogenous growth school (Romer 1986), a similar argument arises: economic growth has a tendency to be associated with some sort of agglomeration and requires a minimum threshold of resources and activities in order to take place. Once it starts however, it is likely, depending on the strands of research, to be self-sustained, spatially selective and cumulative in nature.

On empirical grounds, the message derived from empirical analyses is also unclear. Most NC convergence analyses at a national and sub-national level – such as those conducted by Barro and Sala-i-Martin (1991, 1992) – have tended to report moderate convergence rates, which hover at levels of 2 per cent per annum. In contrast, other studies (including some European Commission reports) find either no convergence or outright divergence.

This paper re-examines from a critical theoretical and empirical viewpoint the convergence literature and aims at providing a new dynamic framework of analysis, which allows for a better understanding of the forces in operation described by the two sides involved in the debate.

The remainder of the paper is organized as follows. Section two presents a critique on the methodology used by the convergence literature. Section three proposes an alternative approach to analyze the relationship between growth and regional inequality. Section four presents the estimated model and the empirical results for the EU, while section five presents the conclusions of the paper and suggestion for further research.

2. A Critique of the Convergence Literature

The basic NC β-convergence model, as proposed by Barro and Sala-i-Martin (1991, 1992), for the evaluation of convergence or divergence trends across countries or regions adopts the following form:

$$\frac{1}{T}\ln\left(\frac{Y_{i,t}}{Y_{i,t-T}}\right) = \alpha + \ln Y_{i,t-T}\left(\frac{1-e^{\beta t}}{T}\right) + \varepsilon_{i,t-T} \tag{1}$$

where $Y_{i,t}$ represents GDP per capita of the country or region *i*; T is the period of analysis; ß is the coefficient and ε is the error term. A negative value for the slope coefficient β indicates convergence of GDP per capita across territorial units of analysis, in a given time period, while a positive value indicates divergence. This model has significant advantages – including its simplicity – for our understanding of the evolution of regional inequalities, but it also has important disadvantages.

(a) Cyclical effects

Perhaps the most serious disadvantage of the widely-used NC β-convergence model is that it ignores the influence of cyclical effects on growth. To the extent that business cycles are not synchronized across units of analysis, something that can be expected for countries with different levels of development and a low degree of economic integration (Dickerson *et al.* 1998), convergence or divergence trends heavily depend upon the choice of time period. Figure 1 illustrates the argument.

Given two countries (or regions) with different economic cycles and different initial levels of development (country A being wealthier than B), and assuming that population remains constant over time, the choice of time period greatly affects the findings of a NC β-convergence model. If the time interval chosen is [t, t+k], the model will report convergence (b coefficient negative and significant). If the time interval chosen is [t+k, t+m], divergence will be the result (b coefficient positive and significant). Finally, if the time interval chosen is [t, t+m], the model will show no tendency for either convergence or divergence (b coefficient insignificant). Several other instances where the outcome of the estimation depends on the choice of time interval chosen could be imagined.

Insert Figure 1 around here

(b) Relative importance of each region

Another equally serious disadvantage of the NC β-convergence model is that it tends to overlook the relative size or importance of each country or region, treating all observations as equal. Table 1 and Figure 2 present an example with three regions, one of which is very small, in order to illustrate the argument. It becomes clear that the performance of a minuscule region in terms of size (region C) can significantly affect the diagnosis of the model and alter our perception of convergence or divergence trends. Although region A is richer and grows faster than region B, signaling a clear case of regional divergence (see dotted line in Figure 2), the model may not produce a positive slope coefficient if the performance of region C is also accounted for. Under scenario 2, the model fails to see a clear case of divergence, where the metropolitan region A grows faster than region B, because the tiny region C blurs the picture. This inability of β-convergence models to take the relative size of observations into consideration may therefore lead to unrealistic results. Other measures of inequality do not suffer from this shortcoming. For comparative purposes, we report in Table 1 the weighted coefficient of variation, which accounts properly for the relative importance of region (C) and produces a greater value for period t+k, indicating that regional divergence is the prevailing tendency in both scenarios.

Insert Table 1 and Figure 2 around here

(c) Conditional model

The final critique relates to the use of β-convergence in conditional convergence models. Conditional convergence models usually include a number of economic, structural or demographic characteristics of the countries or regions included in the analysis as independent variables and estimate their impact on growth. By doing this, however, they remove the influence of all these (usually important) structural variables and find tendencies to convergence among countries or regions that do not exist in reality. Some authors are careful enough to acknowledge that these models in fact do not measure convergence among regions, but convergence towards the 'steady state' (a concept derived from the NC school) of each region. Even in this case, the models tell us nothing about regional convergence, as different regions may have different 'steady states'.

These pitfalls significantly alter our perception of convergence and divergence trends and of the evolution of territorial disparities, especially in those cases where the size of the economic units included in the analysis is very different and lack of, or imperfect, economic integration implies that the units of analysis have different economic cycles. The analysis of the evolution of economic disparities across the EU by means of β-convergence models represents one of the most important examples of these downsides at work. The extreme difference in size between units of analysis has an important effect on our perception of convergence. At a national level, the population of Germany, the largest country in the EU, is almost 200 times the population of Luxembourg, the smallest member state. Five of the current member states have less than one tenth of the population of Germany. These huge differences are also repeated in economic terms. The size of the German economy is 117 times that of Luxembourg and almost 25 times that of Ireland. If regions are included in the analysis, the differences widen. The population of the Åland islands in Finland is more than 3,000 times smaller than that of Germany, and more than 700 times smaller than that of North Rhine-Westphalia in Germany, the largest region in the EU. The economic gap is roughly similar.

β-convergence analysis results are also affected by the fact that some of the smallest countries in the EU have also experienced the highest rates of growth. During the 1990s growth rates in Ireland and Luxembourg have been three and two and a half times the EU average respectively. The largest countries of the EU, both in population and economic terms, have had, in contrast, relatively poor economic performances. Both Italy and France grew below the European average between 1990 and 2000, whereas Germany and the UK were close to the EU average.

Another important caveat for the use of β-convergence models at the EU level is the wide differences in economic cycles across countries. Table 2 presents the results of the simple correlation between the economic growth rates of individual member states and that of the EU as a whole at different stages of European integration. Despite the progressive harmonisation of European and national economic cycles as economic integration progresses, significant differences between national and European cycles exist. Growth cycles in EU member states show little correlation with European cycles. Luxembourg, Denmark, and Ireland are the extreme examples of lack of compliance between national and European cycles. No statistically significant association between national growth and European growth rates is found for any of the periods of economic integration. In the remaining EU countries, with the exception of France and Italy, national economic cycles also differ significantly from the European cycle at different stages of integration, with the UK cycle even becoming more different as integration progresses (Table 2). Regional economic cycles within the EU, in contrast, tend to follow national cycles closely (Cuadrado Roura *et al.*, 1998).

Insert Table 2 around here

3. A model of regional inequality and growth

In view of the problems linked to the analysis of the evolution of territorial disparities using β-convergence models, in the following section we propose an alternative dynamic approach to the relationship between growth and regional inequality, which will be later applied to the measurement of disparities within the EU.

(a) Existing literature

Until the revival of growth and convergence literature in the late 1980s and early 1990s, the debate on regional inequality was mainly influenced by Williamson (1965), who claimed that relatively advanced countries are characterized by a negative relation between the level of regional inequality and the level of development. Equation (2) depicts this inverse relation for a measure of regional inequality (r) and GDP per capita (Y), under the condition that Y is greater than a threshold level Y* characterizing advanced countries[1].

$$r = \theta(Y), \quad \theta_Y < 0 \;\; \forall \; Y \geq Y^* \qquad (2)$$

This relation, which depicts long-term processes, is in line with NC postulates as well as with explanations connecting diminishing disparities with decreasing rates of concentration in metropolitan centers. From this perspective, regional disparities in more developed countries are expected to be lower due to a combination of factors such as a more equal spatial allocation of political power (Friedmann 1969), diseconomies of agglomeration prevailing after some level of concentration (Petrakos and Brada 1989), technological diffusion, coreperiphery spread effects, the existence of transport infrastructure that increases the locational choice of private capital, etc. In brief, the combination of market forces and policy factors in advanced economies is likely to yield, in the long-run, lower spatial inequality.

Not all scholarly research, however, shares Williamson's approach. Berry (1988) has claimed that regional inequalities expand or contract during the economic cycle, depending on whether the economy is in an expanding or declining phase. This position, which directly links high rates of economic growth with increasing inequalities, is in line with the argument about the spatially cumulative nature of growth made by Myrdal (1957), as well as with the discussion of the impact of agglomeration economies on the regional allocation of resources (Henderson 1983, 1986, 1988, 1999, Krugman 1991, 1993a, Thisse 2000). The rationale of this claim is, in outline, that expansion cycles begin in advanced regional centers, where the interaction of agglomeration effects and market size provides a lead over other regions. These effects may be related to the quality of human resources, the science base of the region and its interaction with industry, the quality of the service sector, the links between economic and political decision-making, or the intra-sectoral or inter-sectoral formal and informal relations among neighboring firms. What Berry suggests in his analysis, is that economic processes tend to be associated, in the short-to-medium term, with increasing spatial inequality, as leading regions are in a better position to take advantage of the opportunities generated by an economic boom.

The relation between regional inequality and economic growth has been recently tested by Petrakos and Saratsis (2000) using Greek data for a period of 26 years (1970-95). Equation

[1] According to Williamson, relation (2) is a bell shaped function of Y, which implies that for any value below the threshold level Y*, it becomes a positive function of Y. Similar bell shaped relations have also been found by El-Shakhs (1972), Wheaton and Shishido (1981) and Petrakos and Brada (1989).

(3) shows a version of the estimated model, where r is a measure of regional inequality[2] and g is the annual growth rate of national GDP.

$$r_t = \varphi(g_t), \quad \varphi_g > 0, \quad t = 1, \ldots 26 \qquad (3)$$

The estimated slope coefficient was found to be positive and statistically significant, providing empirical support to the hypothesis that periods of economic expansion have been accompanied in the case of Greece by a noticeable expansion of regional inequalities, since the evidence implies that recovery begins in the more advanced regions of the country. This finding concurs with Berry's (1988) position and has some points in common with the cumulative causation theory of Myrdal (1957).

Similarly, a number of studies dealing with the study of economic disparities in Europe have highlighted that European economic integration – i.e. the Single European Market (SEM) and the Economic and Monetary Union (EMU) – is contributing to the concentration of economic activity in core areas and, thus, to an increase in regional inequalities. The reasons for this increasing concentration of economic activity are related to the locational behavior of capital, to the degree of periphericity and the accessibility of the various regions to major European markets, to variations in productive structure, as well as to existing differences in levels of technological and human capital development (Amin *et al.* 1992, Camagni 1992, Brülhart and Torstensson 1996, Rodríguez-Pose 1998, EC 1999, Midelfart-Knarvik *et al.* 2000). Most of these arguments have been made from a theoretical perspective. The number of empirical studies on the impact of integration on intra-national inequalities is still rather limited.

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[2] The measure of inequality used is the coefficient of variation (CV), which was estimated for the 51 NUTS III regions of Greece

(b) Towards a synthetic dynamic framework

Although more than four decades have passed since Solow (1956) and Myrdal (1957) set the theoretical grounds for the debate on the relationship between economic growth and regional inequality, subsequent theoretical and empirical work has not managed to reconcile these two views in one model and provide direct evidence in favor of one or the other[3]. The majority of the existing convergence analyses, due to the inherent shortcomings mentioned earlier, have been unable to incorporate in a model these two competing hypotheses and to test directly for their validity. Some questions thus still remain largely unanswered. Are advanced countries bound to experience over time decreasing levels of inequality, as the NC model and Williamson claim? Are economic cycles a driving force of inequality, as Berry argues? Are the two seemingly opposite views compatible? Do changes in the external environment, such as the process of EU integration, have an impact on the direction and the level of inequalities?

We aim to answer these questions by constructing a general model of regional inequality, growth and integration, which is presented in equation (4).

$$r_{it} = f(g_{it},\ y_{it},\ s_{it}), \quad f_g>0, \quad f_y<0, \quad f_s><0 \qquad (4)$$

$$i = 1, \ldots, N \quad \text{(countries)}$$

$$t = 1, \ldots, T \quad \text{(time)}$$

The dependent variable of the model (r) is a measure of regional inequality within each country i, over a time period t. The first independent variable (g) measures national GDP

[3] Camagni (1992) has made the claim that inequalities tend to increase in the short-to-medium term and to decrease in the long run without however providing any empirical evidence in support of his argument.

growth rates, the second (*y*) measures GDP per capita and the third (*s*) is a measure of national integration within the group of countries under consideration.

According to our hypothesis, an economic cycle driven process of regional inequality implies, *ceteris paribus*, that higher national growth rates will result in a higher level of regional inequality ($f_g>0$). This means that, in the short-to-medium term, market processes will (at least initially) trigger cumulative effects, bringing about greater inequality. Recent explanations of this initial cumulative character of market processes include the new economic geography emphasis on the interplay of agglomeration economies, backward and forward linkages, critical threshold and market size (Krugman 1991, 1993a), and the endogenous growth focus on increasing returns to scale of investment in knowledge-intensive activities (Romer 1986).

In our framework, we introduce long-term development processes, represented by variable y, in an inverse causal relation with regional inequality ($f_y<0$). This can be justified either on the basis of the traditional NC arguments, or on the basis of diseconomies of agglomeration that may prevail in the long term, after the initial economies of agglomeration become negative externalities. In other words, we expect, *ceteris paribus*, more developed countries and regions to benefit from greater processes of spread, ultimately leading to lower spatial inequalities than in less developed countries.

The proposed setting of the model implies that in principle both short-term and long-term processes are in operation at the same time, with forces exerting conflicting influences on internal regional structures. This specification allows for the possibility that both processes have significant temporal impacts, the magnitude of which can be estimated empirically and separately.

We do not have a priori expectations about the impact of European integration on internal regional disparities. Although a section of scholarly literature has discussed the possibility of weaker or less-developed member-states being put under greater pressure due to increasing competition at the European level (Padoa-Schioppa 1987), there has so far been limited discussion of whether this pressure primarily affects more or less advanced regions internally. Petrakos and Saratsis (2000) have claimed that one of the reasons for the decline of regional disparities in Greece over the last two decades has been the inability of the more advanced and more exposed regions to face stronger competition in increasingly integrated international markets. If this is the case, economic integration may be associated with decreasing internal disparities when the advanced economies within the country are incapable of competing. In the cases where advanced regions benefit more or lose less from internationalization, integration may be associated with increasing internal disparities.

4. The model of intra-national regional inequalities

(a) The specification of the model

Given the limited number of observations over time and the limited number of member-states with complete regional GDP per capita time series in the EU, we resort to the use of Seemingly Unrelated Regression equations (SURE). This specification has the advantage of increased degrees of freedom, while allowing, at the same time, for the estimation of different coefficients for each, or some, of the right-hand side variables of the model[4]. The SURE model – specified for eight EU countries and for a period of 17 years (1981-1997) – can be compactly written as:

$$\boldsymbol{Y_i} = \boldsymbol{X_i B_i} + \boldsymbol{e_i}, \quad \text{where } i = 1,2,\ldots,8$$

where, each $\boldsymbol{Y}_i$ is of dimension (*17 x 1*), $\boldsymbol{X}_i$ is of (*17 x 4*), and $\boldsymbol{B}_i$ is (*4 x 1*).

In a regular SURE estimation the disturbance (*e*) variances are supposed to be constant over time, but different for each equation. Two disturbances in different equations, but at the same time period, will be correlated if contemporaneous correlation exists. Thus, the covariance for equations 1 and 2, for instance, would be:

$$\mathrm{cov\,ar}(\mathrm{e}_{1t}\mathrm{e}_{2t}) = \mathrm{E}[\mathrm{e}_{1t}\mathrm{e}_{2t}] = \sigma_{12}$$

for a given time period *t*.

Two disturbances in different equations, and for different time periods (for instance, equation 1 in time period *t*, and equation 2 in time period *t+1*) are uncorrelated:

$$\mathrm{cov\,ar}(\mathrm{e}_{1,t}\mathrm{e}_{2,t+1}) = \mathrm{E}[\mathrm{e}_{1,t}\mathrm{e}_{2,t+1}] = 0, \quad \text{for time periods } t \text{ and } t+1.$$

The covariance matrix of the joint disturbances for the regular SURE would be:

$$\Omega = E[ee^{'}] = \Sigma \otimes I_T$$

[4] Pooling techniques were also an option, however, regression results were in general inferior and therefore are not reported here.

In this paper each cross-sectional unit represents a time-series for a particular country. It is likely for these time-series to exhibit serial correlation. It is for this reason that the regular SURE model is extended to allow for the presence of autocorrelation, and it is assumed that:

$$\boldsymbol{Y}_i = \boldsymbol{X}_i\boldsymbol{B}_i + u_i,$$

and,

$$u_{it} = \rho_{it} u_{(t-1)} + v_t$$

where, v_t is uncorrelated across observations (see, for instance, Greene 2002, Judge et al. 1985). The autocorrelation coefficients, as are estimated by LIMDEP[5], are equal to $1 - \frac{DW_i}{2}$, where DW_i is the Durbin-Watson statistic using the single equation, equation by equation ordinary least squares residuals.

The calibration of the model for each country will have a different measure of fit, given by the adjusted R^2 for each separate equation. However, a measure of fit for the whole system of equations is also estimated here. The estimation process of adjusted R^2 for a whole SURE system is given in standards econometrics textbooks, based on McElroy's (1977) formulation[6]. However, Buse (1979) gives a more extensive presentation of the estimation method, especially for the case where the disturbances are autocorrelated.

The estimated system of regressions is given by equation (5):

[5] LIMDEP 7.0 was used for the empirical estimation of the model.

[6] An introductory presentation can be found, for instance, in Greene 2002 or Judge et al. 1985

$$r_{it} = \beta_{0i} + \beta_{1i}\, g_{it} + \beta_{2i}\, y_{it} + \beta_{3i}\, s_{it} + u_{it} \qquad (5)$$

$$u_{it} = \rho_i u_{i(t-1)} + v_{it}$$

$i = 1, \ldots, 8$ *(countries: B, GR, E, F, NL, I, P, UK)*

$t = 1, \ldots, 17$ *(time period: 1981-97)*

$N_{i\,X\,t} = 136$ *(total number of observations)*

where r_{it} is a measure of regional disparities for each country in our sample over the period 1981-97, g_{it} is a measure of national growth performance, y_{it} measures the national level of development of each country, and s_{it} measures the degree of economic integration of each country with the EU.

(b) The variables

The dependent variable r_{it} is the population-weighted coefficient of variation estimated for each country on the basis of regional data provided at the NUTS II level for the entire period under consideration:

$$r_{it} = \sqrt{\sum \left[\left(x_{ijt} - \bar{x}_{it}\right)^2 * \left(p_{ijt} / p_{it}\right) \right]} \Big/ \bar{x}_{it} \qquad (6)$$

Table 3 provides information for r_{it} for the eight member-states of the EU with more than one region and for which complete series of regional GDP data are available for the entire period 1981-1997. These countries are in alphabetical order: Belgium, France, Greece, Italy, the

Netherlands, Portugal, Spain and the UK. Figure 2 shows the evolution of the population-weighted coefficient of variation for some of these countries[7].

Insert Table 3 and Figure 2 around here

On the basis of this information a number of interesting observations can be made. First, there are significant differences in the levels of inequality among EU members in terms of GDP per capita. France, UK and Italy seem to experience relatively higher regional disparities than do Belgium, Greece and the Netherlands. Second, if the adjustment of the Dutch regional accounts (see footnote 7) is not taken into consideration, disparities have increased in seven out of the eight countries included in the analysis during the period under consideration, Portugal being the only exception (again, see footnote 7). Third, Figure 2 provides evidence of – in addition to the linear up-wards or down-wards trend – an observable cyclical behavior in the evolution of r_{it} in most countries, which indicates the influence of economic cycles on regional disparities and provides support to our basic hypothesis in equation (5).

Independent variables g_{it} and y_{it} are measured respectively by real GDP growth rates and real GDP per capita in the period 1981-97 (European Economy 2000). Finally, independent variable s_{it},, which is a proxy for European integration, is measured for each country by the ratio of its intra-EU trade:

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[7] The sharp declines in the weighted coefficient of variation (r_{it}) in the Netherlands and Portugal during the 1980s respond to different factors in both countries. In the Netherlands, the fall is purely the result of changes in the national account system: the GDP of its richest region, Groningen, fell sharply after it was decided to assign revenues from North Sea oil and gas pits to the whole of the country, instead of just to the province of Groningen. In Portugal, the sharp fall in the coefficient of variation responds to the wild fluctuations in the GDP of the region of Alentejo during the 1980s. As a consequence, results for Portugal should be viewed with caution.

$$s_{it} = (X^{EU}_{it} + M^{EU}_{it})/(X_{it} + M_{it}) \quad (7)$$

Here, the assumption is that higher ratios of intra-EU trade imply a higher ratio of integration among country-members.

(c) The results of the model

Equation (5) is estimated using a SURE – autocorrelation corrected model and the results are reported in Table 4. In order to test for the cross-border validity of our hypotheses and to improve the robustness of the model, we have imposed restrictions on β_1 and/or β_2 coefficients. As a result, we have estimated three alternative models. The first model makes the assumption that the impact of growth on inequality is the same for all countries; the second model makes the same assumption for GDP per capita levels, while the third model makes the same assumption for both variables.

Insert Table 4 around here

The results of the estimation confirm the hypotheses presented in equation (5). We observe that in all three models the coefficients of growth (β_{1i}) are positive and statistically significant, while the coefficients of GDP per capita (β_{2i}) are negative and statistically significant. The overall explanatory power of the model, given by adjusted model R^2 is satisfactory, ranging from 54% to 60%. As a result, our analysis provides evidence to support the claim that growth performance and the overall level of development significantly affect the evolution of regional inequalities in each member-state of the EU. *Ceteris paribus*, economies with a faster rate of growth will tend to experience a higher increase in regional inequalities, while countries with a higher GDP per capita will tend to experience lower levels of inequalities. It becomes clear that, in the countries under examination, both cumulative causation and neoclassical type of processes are present, exerting their influence on regional inequality in opposite directions.

The impact of economic integration on regional inequality varies from country to country. The coefficient of integration (β_{3i}) is in all models positive and significant in the case of France and Spain, negative and significant in the case of Belgium, the Netherlands and Portugal and insignificant in the case of Greece, Italy and UK. A positive and significant coefficient here implies that as a country becomes more integrated within the EU, its internal disparities tend to increase. These results are difficult to interpret and further research on the link between trade integration and inequalities is needed before any firm conclusions can be reached. In any case, it is worth noting that France and Spain, the two countries with a positive and significant coefficient, are relatively large countries in the EU context and also share an increasing coefficient of variation and increasing disparities during the 1981-97 period. Belgium, the Netherlands and Portugal, the three countries with a negative and significant coefficient, are by contrast relatively small. These observations justify (at least) two hypotheses with respect to the impact of integration on regional disparities. The first (and rather unlikely) hypothesis suggests a possible ‘size effect’, conditioning the impact of integration on country size. The second, focusing on the examples of France and Spain, draws attention to a possible ‘cumulative’ effect, by which integration increases inequalities in countries experiencing already increasing inequalities. In other words, the opening of borders to trade is likely to amplify internal conditions, by making wealthier regions more capable to compete in integrated markets.

5. A model of intra-EU inequalities at the national level

At this point, it is important to raise a question about the geographical level of aggregation in which the forces of concentration and dispersion we have discussed determine inequality. Are intra-EU inequalities among country-members also affected by economic cycles? Are our findings at the national level also applicable at the European level?

Figure 4 depicts the population-weighted coefficient of variation (r_t) of GDP per capita of the 15 current members of the European Union for the period 1960-2000, on the right y axis. The Figure also includes the GDP growth rate of the EU in the same period, on the left y axis. We first observe that inequalities among country-members have decreased considerably over the period under examination. Second, inequalities seem to follow a cyclical pattern of change, which is related to the pattern of economic performance of the EU, with inequalities increasing during the crisis of the mid-1970s and early 1990s and decreasing during the expansion of the 1960s, 1980s and late 1990s. Third, inequalities remained high in the 1960s and the early 1970s, when GDP growth rates were also high, and declined in the 1980s and the 1990s, when growth rates became significantly lower.

Insert Figure 4 around here

In order to examine whether our findings are also valid at the EU level, we estimate equation (7) using GLS, which allows for the correction of autocorrelation in the residuals:

$$r_t = \gamma_0 + \gamma_1 g_t + \gamma_2 y_t + \gamma_3 s_t + u_t \qquad (7)$$

$$u_t = \rho u_{(t-1)} + e_t$$

N = 41

The dependent variable r_t is the population weighted coefficient of variation of the GDP per capita of member-states, presented in Figure 4. The independent variables g_t and y_t are the GDP growth of the EU-15 (Figure 4) and the GDP per capita of the EU-15 respectively for the period 1960-2000. Finally, s_t represents the share of total trade that takes place within the EU. The results of the estimation are reported in Table 5.

Insert Table 5 around here

The results show that γ_1, the coefficient of GDP growth is positive and significant, providing evidence that aggregate economic growth in the EU tends to have a *ceteris paribus* cumulative character, favoring advanced countries and increasing intra-EU inequalities in the 1960-2000 period. We also observe that $\gamma_{2,}$ the coefficient of GDP per capita is negative and significant, providing evidence that spread effects associated with higher levels of GDP per capita are also in operation during the same period. The coefficient of integration (γ_3) is negative, but insignificant, implying that this model cannot provide any evidence for the impact of EU integration on inta-EU inequality.

5. Conclusions and policy implications

This paper has challenged the conventional way of measuring convergence across states and regions in the EU and has proposed a theoretical and empirical model which allows for short-to-medium-term processes related to economic cycles and long-term processes related to diverse levels of GDP per capita to have an independent impact on regional inequality. Our results indicate, first, that disparities at the national and the EU level exhibit pro-cyclical behavior in the short-term, increasing in periods of expansion and decreasing in periods of slow growth. Second, they show that long-term processes embodied in the level of development tend to favor a more equal allocation of activities and resources over space. Finally, our results are inconclusive about the impact of economic integration on regional inequality. Although, at first sight, integration seems to amplify existing intra-national trends, further analyses are needed before any firm conclusions can be reached.

These findings have significant implications for theory and policy. On theoretical grounds, our paper has provided evidence that both concentration and dispersion processes are in operation at both the national and the EU level, and possibly at any level of aggregation. This implies that the arguments presented by the two sides of the 40-year old debate are both correct and empirically valid. This is true as much for the mainstream and highly celebrated NC model, as for the 'cumulative' approach. There is only a difference of time horizon. NC effects tend to be stronger in the long-term, while cumulative effects follow the economic cycle and are more effective in the short-to-medium-term. The question of the relative strength of these two opposite forces of spatial change at different levels of aggregation remains open and should be the subject of further research.

Our findings may also have significant implications for policy-making. The conventional understanding in the European Commission is that economic growth is the main vehicle for decreasing regional inequalities (EC 1999). This view remains largely unchallenged, despite the recent increase in intra-national inequalities in a period of relatively high growth rates. Our findings strongly challenge this belief. We have provided evidence that intra-national and intra-EU inequalities have a pro-cyclical character and tend to increase in periods of economic expansion.

Why is this relation critical for policy? A negative relationship between growth and inequality implies that in the long-term inequalities will disappear and, as a result, there is limited scope and a declining need for regional policy. On the other hand, a positive relation between growth and inequality implies that, no matter what other factors may affect the evolution of inequalities, economic growth will always generate new inequalities. Obviously, each relationship is associated with a different future for regional policy. Although the intention and the practice of the EC is to view regional policy as a project with a finite horizon and budget, our findings suggest that this view is based on a misconception about the fundamental forces driving inequalities. They suggest that, regional policy must be an important and permanent ingredient of public policy. They also suggest that, contrary to conventional wisdom, it should have a pro-cyclical rather than an anti-cyclical dimension.

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Figure 1. An example of ill-detected convergence or divergence trends due to unsynchronized business cycles.

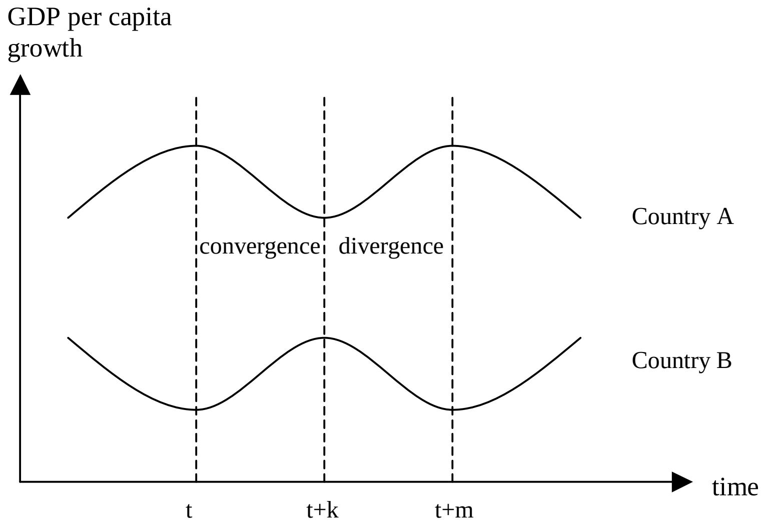

Table 1. An example of ill-detected convergence trends based on heterogeneous samples with respect to size.

Regions	Population (Million)	GDP per capita in period t (million $)	GDP per capita growth in period [t, t+k] (%) (Scenario 1)	GDP per capita growth in period [t, t+k] (%) (Scenario 2)
A	4.0	20	25	25
B	1.5	14	7	7
C	0.1	6	**16**	**33**
CV(w)		*.44*	*.52*	*.49*

Figure 2. An example of ill-detected convergence trends based on heterogeneous samples with respect to size.

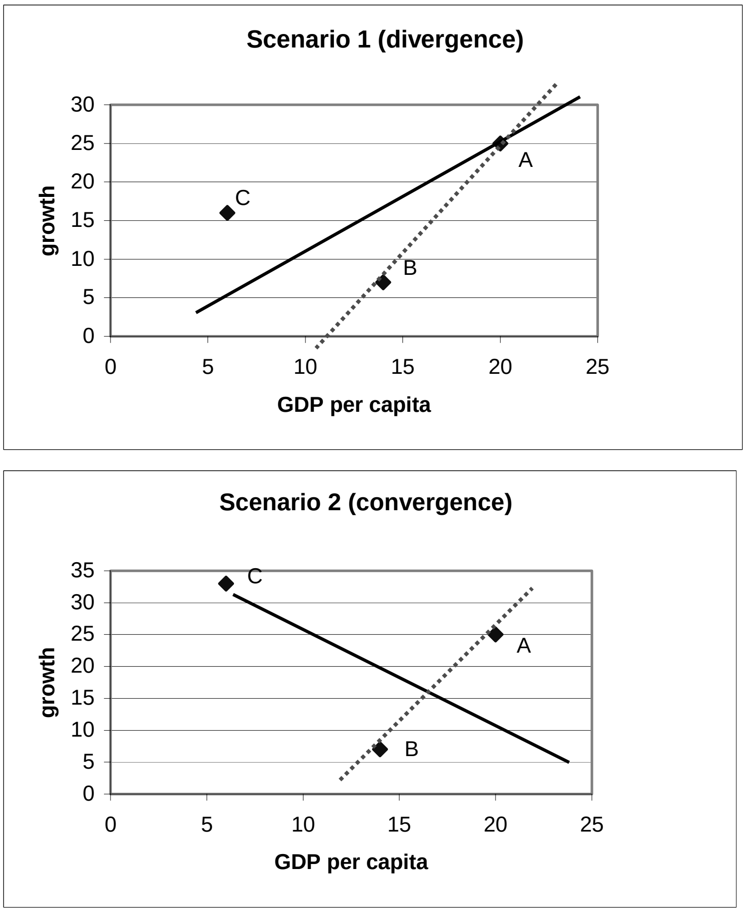

Table 2. Correlation between national and EU economic cycles in different stages of European integration.

	Customs Union	**Transition to the Single Market**	**Single Market**
	1977-86	**1986-93**	**1993-00**
Austria	0.459	0.443	0.803*
	0.214	0.320	0.017
Belgium	0.375	0.895**	0.973**
	0.320	0.006	0.000
Denmark	0.664	0.026	0.542
	0.051	0.956	0.165
Finland	0.231	0.857*	0.871**
	0.549	0.014	0.005
France	0.629**	0.933**	0.933**
	0.000	0.002	0.001
Germany	0.928**	0.083	0.979**
	0.000	0.860	0.000
Greece	0.800**	0.321	0.900**
	0.010	0.482	0.002
Ireland	0.388	0.378	0.683
	0.303	0.403	0.062
Italy	0.829**	0.957**	0.914**
	0.006	0.001	0.002
Luxembourg	0.621	0.518	-0.427
	0.074	0.234	0.291
Netherlands	0.808**	0.392	0.891**
	0.008	0.384	0.003
Portugal	0.300	0.900**	0.875**
	0.433	0.006	0.004
Spain	0.247	0.872	0.905**
	0.522	0.010	0.002
Sweden	0.406	0.835*	0.942**
	0.279	0.019	0.000
United Kingdom	0.697*	0.752	0.447
	0.037	0.051	0.266

*** and * denote significance at 1% and 5% levels respectively.*
Levels of significance below coefficients

Source: Elaborated using EUROSTAT data.

Table 3. Weighted coefficient of variation (r_{it}) for GDP per capita at the NUTSII level

Countries	1981	1990	1997
France	0,261	0,315	0,321
UK	0,303	0,307	0,310
Italy	0,265	0,258	0,271
Portugal	0,332	0,268	0,232
Spain	0,180	0,201	0,212
Belgium	0,160	0,163	0,171
Greece	0,131	0,122	0,158
The Netherlands	0,266	0,103	0,123

Figure 3. Weighted coefficient of variation (r_{it}) for GDP per capita in NUTS II regions (1981-97)

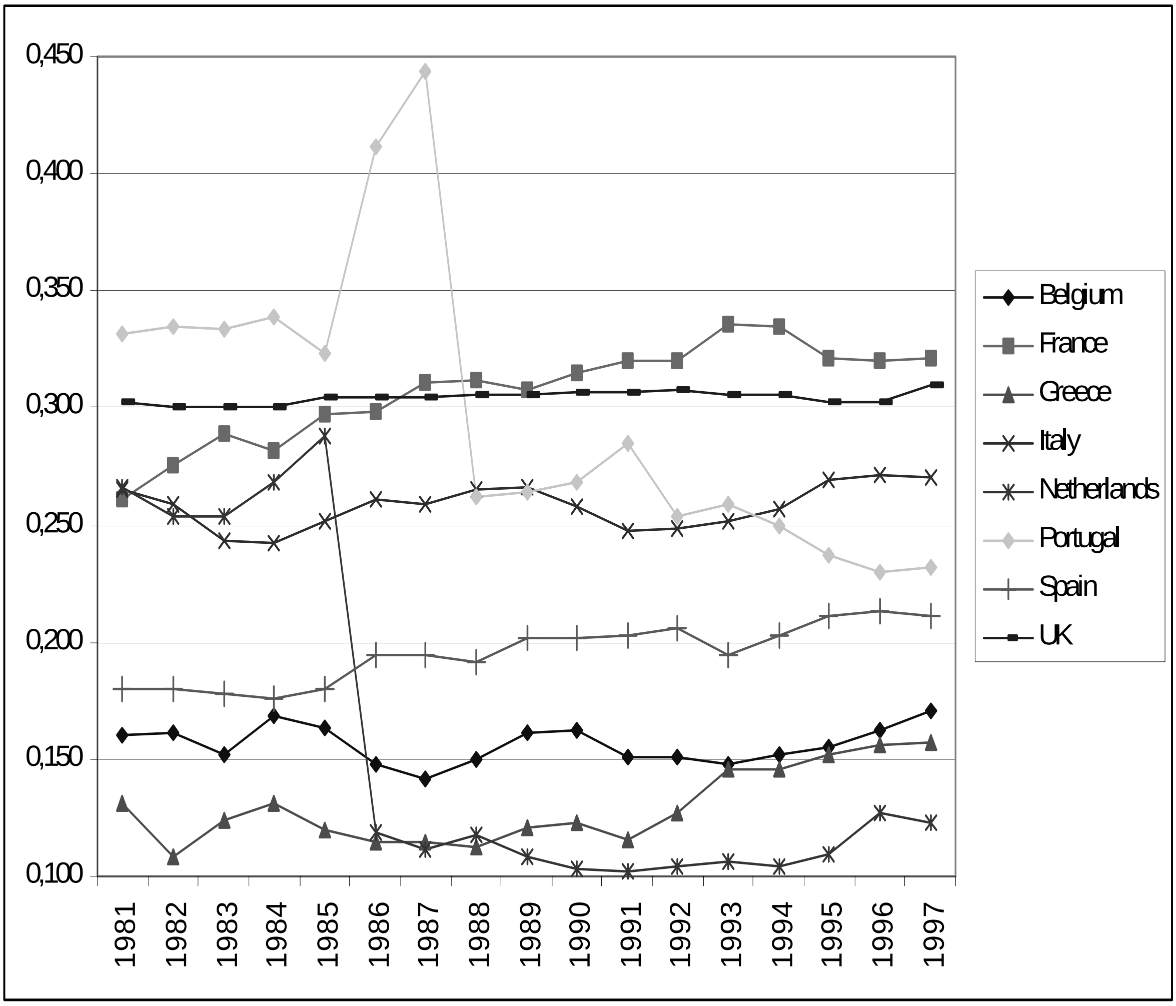

Table 4. SURE and Autocorrelation-corrected parameter estimates

Countries	Parameters	Model 1[@] Parameter Estimates	Model 1[@] t-values	Model 2[@@] Parameter Estimates	Model 2[@@] t-values	Model 3[@@@] Parameter Estimates	Model 3[@@@] t-values
1. Belgium	β_{01}	0.308	(8.49)***	0.310	(8.56)***	0.283	(7.92)***
	β_{11}	0.011	(2.76)***	0.013	(3.42)***	0.008	(2.15)**
	β_{21}	-0.008	(-2.13)**	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{31}	-0.211	(-4.29)***	-0.215	(-4.37)***	-0.172	(-3.56)***
	Rho_1	0.337		0.337		0.337	
	R^2_1-adj	0.509		0.510		0.313	
2. France	β_{02}	-0.009	(-0.27)	-0.008	(-0.23)	0.002	(0.06)
	β_{12}	0.011	(2.76)***	0.006	(1.62)	0.008	(2.15)**
	β_{22}	-0.015	(-3.57)***	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{32}	0.522	(9.19)***	0.524	(9.21)***	0.495	(9.00)***
	Rho_2	0.166		1.666		1.666	
	R^2_1-adj	0.788		0.780		0.713	
3. Greece	β_{03}	0.117	(2.96)***	0.118	(2.99)***	0.113	(2.98)***
	β_{13}	0.011	(2.76)***	0.010	(2.52)**	0.008	(2.15)**
	β_{23}	-0.012	(-2.86)***	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{33}	0.022	(0.35)	0.019	(0.31)	0.031	(0.51)
	Rho_3	0.747		0.747		0.747	
	R^2_2-adj	0.506		0.507		0.507	
4. Italy	β_{04}	0.275	(11.68)***	0.275	(11.68)***	0.269	(11.62)***
	β_{14}	0.011	(2.76)***	0.013	(3.07)***	0.008	(2.15)**
	β_{24}	-0.009	(-2.39)**	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{34}	-0.035	(-0.85)	-0.037	(-0.88)	-0.020	(-0.48)
	Rho_4	0.524		0.524		0.524	
	R^2_4-adj	0.311		0.320		0.276	
5. Netherlands	β_{05}	0.978	(2.92)***	0.968	(2.89)***	0.966	(2.94)***
	β_{15}	0.011	(2.76)***	0.005	(0.56)	0.008	(2.15)**
	β_{25}	-0.016	(-2.03)**	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{35}	-1.183	(-2.43)**	-1.161	(-2.39)**	-1.178	(-2.48)**
	Rho_5	0.386		0.386		0.386	
	R^2_5-adj	0.428		0.435		0.411	
6. Portugal	β_{06}	0.580	(7.25)***	0.579	(7.37)***	0.547	(7.18)***
	β_{16}	0.011	(2.75)***	0.014	(2.31)**	0.008	(2.15)**
	β_{26}	-0.007	(-1.34)	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{36}	-0.424	(-3.54)***	-0.423	(-3.61)***	-0.364	(-3.35)***
	Rho_6	0.165		0.165		0.165	
	R^2_6-adj	0.260		0.249		0.219	
7. Spain	β_{07}	0.131	(14.63)***	0.129	(14.44)***	0.134	(15.13)***
	β_{17}	0.011	(2.76)***	0.012	(2.99)***	0.008	(2.15)**
	β_{27}	-0.01	(-2.58)**	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{37}	0.102	(6.97)***	0.105	(7.23)***	0.102	(7.26)***
	Rho_7	0.417		0.417		0.417	
	R^2_1-adj	0.860		0.860		0.854	
8. UK	β_{08}	0.292	(22.03)***	0.293	(22.08)***	0.283	(21.69)***
	β_{18}	0.011	(2.76)***	0.011	(2.76)***	0.008	(2.15)**
	β_{28}	-0.011	(-2.85)***	-0.011	(-2.86)***	-0.008	(-2.16)**
	β_{38}	0.019	(0.74)	0.018	(0.72)	0.035	(1.41)
	Rho_8	0.179		0.179		0.179	
	R^2_8-adj	0.219		0.225		0.236	
	Model R^2-adj	0.595		0.601		0.548	

[@] Model 1 is estimated with the constraint: $\beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = \beta_{15} = \beta_{16} = \beta_{17} = \beta_{18}$

[@@] Model 2 is estimated with the constraint: $\beta_{21} = \beta_{22} = \beta_{23} = \beta_{24} = \beta_{25} = \beta_{26} = \beta_{27} = \beta_{28}$

[@@@] Model 3 is estimated with the constraints: $\beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = \beta_{15} = \beta_{16} = \beta_{17} = \beta_{18}$ and $\beta_{21} = \beta_{22} = \beta_{23} = \beta_{24} = \beta_{25} = \beta_{26} = \beta_{27} = \beta_{28}$

*** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level

Figure 4. GDP growth and country-based weighted CV in the EU, 1960-2000

Table 5. GLS, autocorrelation-corrected parameter estimates

Parameters	Parameter Estimates	t-values
γ_0	0.315	$(6.64)^{***}$
γ_1	0.016	$(2.39)^{***}$
γ_2	-0.0008	$(-3.79)^{**}$
γ_3	-0.83	(-1.02)
Rho	0.907	
R^2_1-adj	0.830	