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Heading for Divergence? Regional Growth in Europe Reconsidered*

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Abstract

This article analyses regional growth in the European Union (EU) in the post-war period. We examine the levels and growth of per capita GDP for a sample of 70 regions, covering six of the EU Member States. We find that after a slow, but steady reduction of differences in GDP per capita across European regions during most of the post-war period, there are now some signs of a reversal in this trend. This does not imply that differences in levels of productivity and income across European regions are now reduced to a negligible level. Rather, the explanation is that other variables, notably R&D effort, investment support from the EU, the structure of GDP and differences in unemployment have had a diverging impact. We also find some support for the idea of a 'Europe at

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different speeds', with at least three different 'growth clubs' characterized by different dynamics, productivity and unemployment levels.

I. Introduction: What Drives Regional Growth-rate Differences?

In recent years there has been a surge in empirical work on growth. This work has, with few exceptions, focused on cross-country differences. Although convenient in terms of data availability, this tends to 'aggregate away' important differences between smaller geographic entities within countries. For example, in the dataset that we analyse below, the ratio of GDP per capita between the richest (Hamburg, Germany) and poorest region (Calabria, Italy) was about 3:1, while for the two countries as a whole the difference in GDP per capita was almost negligible (all comparisons for 1990). This implies that the difference in GDP per capita between the richest and poorest region in our sample is roughly the same order as the difference between Germany and a developing country such as Costa Rica or, alternatively, South Africa.[1] We can only guess what the differences would have been, had we been able to include countries like Ireland, Portugal, Spain or Greece.

Within the EU, such big differences in per capita GDP across regions have always been regarded as undesirable. Therefore, various policy measures to reduce these differences have been invented, such as the so-called structural funds, investment loans, etc. A vital question for the EU is, to what extent these policy instruments really help the relatively poor regions of Europe to catch up. The answer to this question, however, requires knowledge about what drives regional growth differences. What determines whether or not a region converges towards the average, falls behind or, alternatively, forges ahead of the others? This article attempts to throw some light on the issue, drawing on recent developments in economic theory and new and better data on regional developments across Europe.

Much of the contemporary policy discussion in Europe is based on the idea that convergence in income (and productivity) depends on convergence in certain macroeconomic characteristics (inflation, public sector deficit, external account, etc.). Hence, the focus has largely been on the question of, to what extent convergence in these factors can be achieved. The empirical basis of this way of looking at things seems to be at best weak. There is not much evidence supporting the assumption that macroeconomic characteristics have an impact on differences in growth rates, given that the influence of other factors is properly taken into account. The available evidence from cross-country samples clearly shows that the correlations – if any – between macroeconomic characteristics and growth are not robust (Levine and Renelt, 1992).

[1] According to the Penn World Tables, version 5.5.

The scholarly work on European convergence seems either to be based on the traditional neoclassical theory of economic growth (Barro and Sala-i-Martin, 1992), or to consist of measurement exercises without any specific theoretical base.[2] A central assumption in neoclassical growth theory is that technology is a public good, e.g. that all regions and countries benefit from technological progress, which is assumed to be exogenous, to the same extent. Another is that there are decreasing marginal returns to the accumulation of capital per worker. Hence, profit opportunities are better in poor regions or countries (where there is relatively little capital available for each worker) than in the rich ones. Thus, if markets are allowed to work, and everything else is assumed identical, poor regions (or countries) should be expected to outgrow the rich ones. In the end, they will share the same level of income and grow at the same rate. The role of government, then, is essentially that of letting markets work. Hence the emphasis in policy analyses on avoiding too much interference in the economy, but instead fostering a stable macroeconomic climate and a roughly similar set of incentives (over time and across regions and countries).

The neoclassical assumption of technology as a (global) public good does not carry much empirical support. On the contrary, decades of research on the creation and diffusion of technology within and across country borders has shown that technology is often a very local affair, embedded in firms, clusters of firms, regions and countries (Dosi, 1988). Although diffusion may – and does – take place, successful cases normally involve a host of other supporting factors (Fagerberg, 1988). These are facts that any theory that wants to throw light on the convergence–divergence phenomenon has to account for. Another problematic aspect is the assumption of constant returns to scale, effectively ignoring the substantial positive spillovers that investments in, say, education or R&D may have. This deficiency in the 'old' growth models has recently led to the so-called 'new growth theories' (Verspagen, 1992). It is our view that these problems support a call for more theoretical and empirical work on regional growth in Europe, as suggested by Neven and Gouyette (1995, p. 64).

As an alternative to the traditional neoclassical perspective in this area, we have in previous work analysed international growth rate differences from a 'technology-gap' perspective. Basically this is an application of Schumpeterian thinking to the international economy.[3] The main factors taken into account in this approach are the impact of differences in innovative efforts across countries,

[2] For instance, Neven and Gouyette (1995, p. 64) conclude that their work 'describes a pattern of regional evolution ... and ... offers little to explain it'.

[3] Although Schumpeter did not extend his analysis of innovation-diffusion to the international economy, this seems to be a quite natural way to proceed from his work. Indeed, the so called "neotechnological" trade theories of the 1960s were heavily inspired by Schumpeter (Posner 1961, Vernon 1966). More recent analyses of international economic developments drawing on Schumpeterian insights can be found in Dosi *et al.* (1990).

the potential for imitation and the capacity to exploit advances in technology, whether developed indigenously or elsewhere in the world (Fagerberg, 1987, 1988; Verspagen, 1991). This perspective, although less formal than many other approaches in this area, has the great advantage that it is consistent with the existing knowledge on innovation and diffusion processes. Many of the assumptions and derived predictions can also be made consistent with 'new growth theories' that focus on innovation as the driving force of capitalist development (Romer, 1990; Grossman and Helpman, 1991). Our earlier empirical work on cross-country samples confirms the importance of national technological capabilities (and other supporting factors) for successful catch-up. Real world catch-up is far from the easy, mechanical process envisaged by the traditional neoclassical approach in this area (see, e.g., Abramovitz, 1994).

What we will do in this article is to apply this framework to regional growth rate differences within Europe. Although 'national systems of innovation' (Lundvall, 1992; Nelson, 1993) may differ, such differences may be even more pronounced on a regional level. Indeed, much of the theoretical and empirical literature on technological systems focuses on regional differences. However, some of the other supporting variables commonly taken into account in cross-country studies may be less relevant at the regional level. For instance, many cross-country studies include the savings rate (or investment share) as an exogenous variable, although much theoretical work in this area points to saving and investment as endogenous. The inclusion of these variables may be defended on the ground that national capital markets differ and – in spite of recent developments – are poorly integrated, at least with respect to long-term investments in industrial projects. This argument does not apply to the regions within a country, and it may (arguably) also be of little relevance within the EU.

The rest of this article is organized as follows. Section II looks at the facts on convergence in levels of per capita GDP in the EU over the post-war period. Based on the finding that intra-European catch-up appears to have come to an end, Section III introduces some variables that may help to explain this pattern. It is shown that the potential for catch-up is not exhausted. What seems to have happened is that other factors, among them some related to EU policies, have pushed towards divergence. Section IV looks in more detail at the hypothesis of a 'Europe at different speeds'. The analysis seems to suggest that there exist at least three different 'growth clubs' characterized by differences in unemployment levels, as well as the impact of the variables taken into account in the analysis. Section V summarizes the arguments and considers the lessons for policy-making.

II. Convergence or Divergence in Productivity Levels across European Regions?

To what extent do the regions of Europe converge towards a growth path characterized by roughly similar levels of income (GDP per capita)? Previous work in this area (Barro and Sala-i-Martin, 1991; Sala-i-Martin, 1994; Neven and Gouyette, 1995) indicates that convergence takes place, but at a rate too slow to be consistent with the traditional neoclassical growth model (Solow, 1956).[4]

To answer this question, we present in Table 1 (A) estimates for different periods between 1950 and 1990.[5] The data comprise 70 regions from six EU member countries.[6] For the period up to 1970, the results indicate that substantial catch-up took place. The estimate suggests that the poorest region of Europe grew 4.3 per cent faster than the richest one. However, the impact of catch-up on growth became gradually weaker through time. For the period 1970–90, the results suggest that the poorest region would grow 2.4 per cent faster than the richest one. For the most recent subperiod, the 1980s, there is not much evidence at all for catch-up.

One way to compare these results with previous work is to calculate how long it would take for the poorest region to catch up with the richest one. For the 1950s and 1960s the results suggest that, starting in 1950, it would take roughly 50 years to eliminate the difference between the poor and the rich. This is consistent with previous work by Barro and others. The results for the 1970s and 1980s, when taken together, are broadly consistent with this pattern: starting in 1970 it would take around 30 years to close the remaining gap. Thus, in both cases the results suggest that the gap would be closed around the year 2000. However, the results for the 1980s do not confirm this pattern.[7] This raises the question of whether the

[4] The Solow model predicts that the growth path of any country or region converges to a steady state, which, on the assumptions of labour mobility (or equal growth rates of the population) and public technological knowledge, is the same for every country. Barro and Sala-i-Martin (1992) show that such a convergence process can be represented by the following equation:

$$\hat{y} = a - \frac{1-e^{\beta T}}{T}\log(y_0)$$

where y is per capita GDP, or productivity, T is the period over which convergence takes place, and a hat (^) represents a proportionate growth rate. This process has been termed 'ß-convergence' (Barro and Sala-i-Martin 1991). Other measures of convergence include σ-convergence (the coefficient of variation), or ergodic distributions deriving from a Markov-chain process. Neven and Gouyette (1995) show that these different measures provide consistent results.

[5] We subsitute the exponent term on the r.h.s. of the equation in note 3 by a single coefficient, enabling the interested reader to calculate the value of ß.

[6] The countries were Belgium, France, Germany, Italy, Netherlands and the United Kingdom. The appendices to this paper list sources, precise definitions and the regional breakdown of the countries.

[7] This finding is consistent with a slowdown in convergence since the mid-1970s observed in country-data (see, e.g., Verspagen, 1995).

Table 1: Europe – Convergence or Divergence in Income Levels

	Constant	$LG_{\text{start year}}$	R^2 (R^2–adj.)	*n*
A. Testing the convergence hypothesis				
1950–70				
(1.1)	0.066 (18.2)	–0.029 (5.84)	0.39 (0.38)	68
1970–90				
(1.2)	0.060 (13.3)	–0.018 (5.94)	0.31 (0.30)	68
1980–90				
(1.3)	0.028 (4.12)	–0.006 (1.51)	0.02 (0.01)	67
B. Including country dummies				
1950–70				
(1.4)	*DUMMIES*	–0.019 (9.64)	0.89 (0.89)	68
1970–90				
(1.5)	*DUMMIES*	–0.006 (1.82)	0.54 (0.51)	68
1980–90				
(1.6)	*DUMMIES*	0.0005 (0.12)	0.37 (0.32)	67

Notes: The dependent variable is the average annual compound growth rate of GDP per capita over the period; *LG* = log of GDP per capita; *DUMMIES* = France, Germany Italy, Belgium/Netherlands and UK; absolute value of *t*-statistics (corrected for heteroscedasticity) in brackets behind parameter estimates; *n* = number of regions included in the test.

post-war trend towards convergence in productivity and income across Europe has now come to an end.[8]

The slow, but steady convergence prior to the 1980s that this and other studies have documented cannot automatically be quoted in support of a Solow-type growth model. Actually, based on reasonable parameters, Solow-type models predict much faster convergence. Similar results have been shown to hold for cross-country samples. To explain this discrepancy, it has been argued (e.g. Sala-i-Martin, 1994) that either the concept of capital has to be substantially broadened (for instance by including educational efforts) or one has to revert to a framework that focuses on technology diffusion. Opting for the first alternative, Barro and Sala-i-Martin (1991, 1992) have chosen to augment the production function with human capital and other factors (so-called 'conditional ß-convergence'). Following the second option, we have in previous work included

[8] Neven and Gouyette (1995) conclude that there are different trends for convergence in the 1980s for north and south Europe. Given that we extend our data backwards to 1950, and will collect additional data for the 1980s used below, we cannot include as many regions as they have in their sample. This implies we have only a few southern regions in our sample, and cannot test for different trends over the 1980s between the North and the south.

variables reflecting efforts to develop and implement technology. However, for the present sample of European regions, data for conditioning variables are generally not available before 1980 (see the next section).

As a rough test of the impact of other, unidentified conditioning variables, we have in Table 1 (B) repeated the same regressions including country-specific constants (so-called fixed effects). In general, when country dummies are included, the estimated contribution from catch-up to faster growth for the poor regions is lower than in the case without country dummies. For instance, for the period 1950–70, our model (without dummies) predicts that the poorest region would grow 4.3 per cent faster than the richest one. With dummies, the contribution from the catch-up factor is estimated to be only 2.8 per cent (still a substantial number). For the period 1970–90 the introduction of dummies reduces the estimated contribution of catch-up from 2.4 to 0.8 per cent. For the most recent subperiod there is no contribution whatsoever from the catch-up factor when dummies are included. These results must be interpreted with care since the country-specific variables taken into account here reflect a number of factors about which we know very little. What is important is that these results confirm (and strengthen) our earlier results on the weakening of the catch-up process through time.

Thus, for what they are worth, the results indicate that the post-war trend towards convergence in levels of productivity and income levels across Europe may have come to an end. This is not a result of a process in which the differences in income and productivity across Europe have been reduced to a negligible level, as one might expect. On the contrary, these differences remain quite substantial: in 1990 the ratio of GDP per capita between the richest and poorest region was approximately 3:1 (compared to approximately 4:1 40 years earlier). This is not a result which is easily explained by Solow-type models.

III. Accounting for the Diverging Trends of the 1980s

How to account for this apparent shift in trend? This is what we try to explore in the following. It is our contention that the potential for catch-up through imitation might still be present in the 1980s, but that the realization of this potential depends on other factors which have to be taken into account to reveal the true impact of diffusion on growth. Furthermore, there might also be diverging factors at work, perhaps most notably differences in innovative activity, which also have to be taken into account.

The basic model that we wish to apply is one in which productivity growth depends on the scope for catch-up, efforts devoted to innovation, the capability to exploit advances in technology commercially (independent of origin) and other, relevant factors. In doing so, we encounter the problem that data are not easily forthcoming, particularly not for technological activities. Soete (1981) distinguishes between 'technology output measures' (e.g. patents) and 'technology input measures' (e.g. R&D). The former are often regarded as better measures of innovative efforts than the latter, which often reflect efforts related to both innovation and diffusion. R&D, for instance, clearly matters for both (Cohen and Levinthal, 1989). In this case we have two available data sources, R&D employees in the business sector (RDE) and the number of EU-sponsored R&D projects (RDP). Both are in a sense 'technology input' indicators, reflecting the supply of skilled labour and financial support to R&D, respectively. Thus, these variables do, to some extent, reflect both innovative efforts and the capability to exploit technological advances commercially.

To these variables we add others that may contribute to the explanation of differing regional performance. Following the theoretical literature in this area, we adopt the assumption that investment is endogenous. But we allow for an exogenous component, the support to investment projects from EU sources (EUI). We also test for the sensitivity of including investment as an exogenous variable. Furthermore, we investigate the possibility that differences in economic structure may have an impact on productivity growth. This hypothesis, well known from the development literature, rests on the assumption that the prospects for productivity growth are much better in 'modern' sectors than in 'traditional' sectors, such as agriculture. In order to examine this issue, we include the share of agriculture in employment (AGR), which is expected to act as a growth retardant, as one of the independent variables. Another set of factors that are commonly assumed to impact on growth are those related to the labour market, such as wage-setting, skill-mismatches, migration, etc. Unfortunately, we do not have data on such variables. What we do know something about is the outcome of these process, i.e. the rate of unemployment (UE), which we shall use here as a rough proxy.

Five different sets of regressions are presented (Table 2). The first includes the scope for catch-up, R&D efforts and directed credit (investment loans), the second uses European transfers instead of investment loans, the third adds differences in economic structure and unemployment. The fourth and fifth test for the sensitivity of including investments and country dummies, respectively. Each set contains two regressions, one using R&D employment, the other using R&D projects, as measure of innovative efforts or the capability to exploit technology. The former is based on fewer observations than the latter, since we lack data on R&D employment for the UK and the Netherlands.[9]

Generally, the inclusion of R&D efforts (RDE or RDP) and directed credit (EUI) leads to a significant increase in the explanatory power of the model (2.1

[9] The correlation between our two R&D variables is nearly perfect, thus indicating that the RDP variable measures R&D input in general, rather than the EU-support aspect.

Table 2: Accounting for the Lack of Convergence in the 1980s (1980–90)

	Constant	*Independent Variables*		R^2 (R^2–adj.)	*n*
(A) The impact of R&D and directed credit					
(2.1)	0.018 (1.90)	0.009 *RDE* (3.45)	1.349 *EUI* (4.38)		
		–0.004 LG_{80} (0.90)		0.21 (0.16)	49
(2.2)	0.037 (3.45)	0.131 *RDP* (2.84)	0.692 *EUI* (2.17)		
		–0.011 LG_{80} (2.19)		0.16 (0.12)	64
(B) The impact of R&D and EU Structural Funds					
(2.3)	0.035 (3.34)	0.0005 *RDE* (2.05)	–0.225 *RDF* (2.17)		
		–0.009 LG_{80} (1.82)		0.07 (0.01)	49
(2.4)	0.055 (4.63)	0.107 *RDP* (2.13)	–0.417 *RDF* (3.70)		
		–0.017 LG_{80} (3.12)		0.16 (0.12)	64
(C) Allowing for differences in economic structure and unemployment					
(2.5)	0.057 (2.70)	0.008 *RDE* (3.03)	1.396 *EUI* (4.04)		
		–0.037 *AGR* (1.72)	–0.061 *UE* (1.71)		
		–0.017 LG_{80} (2.24)		0.27 (0.19)	49
(2.6)	0.131 (9.54)	0.092 *RDP* (2.57)	0.795 *EUI* (3.92)		
		–0.072 *AGR* (5.47)	–0.194 *UE* (7.45)		
		–0.041 LG_{80} (8.19)		0.47 (0.42)	63
(D) Adding investment in physical capital					
(2.7)	0.092 (3.19)	0.008 *RDE* (2.83)	1.797 *EUI* (3.46)		
		–0.041 *INV* (1.48)	–0.037 *AGR* (1.57)		
		–0.129 *UE* (2.45)	–0.026 LG_{80} (2.67)	0.33 (0.22)	46
(2.8)	0.136 (9.12)	0.107 *RDP* (3.20)	0.942 *EUI* (3.51)		
		–0.021 *INV* (0.89)	–0.067 *AGR* (4.69)		
		–0.197 *UE* (6.80)	–0.041 LG_{80} (8.64)	0.49 (0.43)	61
(E) Testing for the impact of country dummies					
(2.9)	*DUMMIES*	0.001 *RDE* (3.59)	0.523 *EUI* (0.80)		
		–0.005 *INV* (0.16)	–0.038 *AGR* (1.85)		
		–0.108 *UE* (2.05)	–0.023 LG_{80} (2.60)	0.42 (0.25)	46
(2.10)	*DUMMIES*	0.100 *RDP* (3.08)	0.108 *EUI* (0.23)		
		0.008 *INV* (0.27)	–0.041 *AGR* (1.94)		
		–0.155 *UE* (3.25)	–0.027 LG_{80} (3.56)	0.56 (0.47)	61

Notes: The dependent variable is the average annual compound growth rate of GDP per capita over the period; *RDE* = R&D personnel in business enterprise per 1000 labour force; *RDP* = number of R&D projects undertaken with support from the EU divided by population; *EUI* = investment loans from the European Investment Bank and the New Community Investment scheme divided by GDP, 1985-87; *RDF* = transfers under the European Regional Development Funds scheme, divided by GDP, 1985-87; *INV* = gross fixed capital formation as a share of GDP; *UE* = unemployment rate; *AGR* = share of agriculture in GDP; *LG* = log of GDP per capita; *DUMMIES* = France, Germany, Italy, Belgium/Netherlands and UK; absolute value of *t*-statistics (corrected for heteroscedasticity) in brackets behind parameter estimates; *n* = number of regions included in the test.

and 2.2). Both variables enter the equations with the expected sign, which is also (highly) significant. The same holds when economic structure (AGR) and unemployment (UE) are added (2.5 and 2.6). Using transfers under the so-called European Regional Development Funds scheme instead of the EU investment loans, leads to a quite different result. In this case, EU support turns up with a significantly negative coefficient, indicating that this type of support goes to the slow-growing regions. While it is beyond the scope of this article to analyse the differences in impact between these different forms of EU support in more detail, the explicit investment character of the EUI variable, as well as its form of a loan instead of a transfer, seem to be a plausible explanation for the result reported here.

Adding the share of investment in GDP (INV) leads to a much smaller increase in the fit, and the variable itself enters with a negative sign, not significantly different from zero at the per cent level (2.7 and 2.8). This is not what would be expected had it been exogenous. Thus, there is not much support in the data for including investment as an explanatory variable in addition to the others. The introduction of country dummies (2.9 and 2.10) also leads to a rather modest increase in the explanatory power, when account is taken of the reduction in the degrees of freedom. The most notable impact of the inclusion of country dummies is that it renders the investment loans variable with a less significant and lower impact on growth. This suggests that EU credits are not randomly distributed across countries, e.g. that these policies systematically favour some member countries.

With respect to the impact of R&D, the results are as expected, and the estimated impact is remarkably robust across different specifications.[10] Thus, the results lend clear support to a perspective that emphasizes the importance of R&D efforts for growth. A high share of agriculture in GDP and high unemployment act as growth retardants, as predicted, but the estimates are not always significantly different from zero. However, the relatively large increase in explanatory power associated with the introduction of these variables suggests that these factors do play an important role and should be taken into account.

Finally, given the additional explanatory factors taken into account here, the scope for catch-up regains its role as an important explanatory factor behind regional growth rate differences. This holds also when country dummies are included. Indeed, the impact turns out to be quite substantial.[11]

[10] There is only one exception, when R&D employment (RDE) is used and country dummies are included (2.7). The estimated impact of R&D efforts is still positive and significantly different from zero at the 1 per cent level, but the coefficient is markedly smaller than in the other regressions.

[11] Other factors left apart, the results suggest convergence to a common income level within a few decades. This holds when both R&D efforts and structural factors are taken into account (regressions 2.3–2.8). When structural factors are not taken into account (regressions 2.1–2.2), the estimated contribution from the catch-up factor is much smaller, and the time period necessary for closing the gap much longer.

IV. Europe at Different Speeds?

The results in the previous section are by no means a full account of what drives differences in economic growth in Europe. An obvious shortcoming of the regressions so far is the implicit assumption that all regions obey the same simple linear relation between growth and a number of independent variables. The idea of 'convergence clubs' (Baumol, 1986) or, alternatively, 'Europe at different speeds' contests this simple mechanic notion of growth. Rather than opting for a geographical split of our sample (as in Neven and Gouyette, 1995), we ask whether we can find a set of regional groupings characterized by differences in how the variables taken into account work. Thus we adopt, with some small modifications, the methodology suggested by Durlauf and Johnson (1992). Basically, this consists of ordering the observations in increasing order of a control variable and then find the sample split that minimizes the residual variance. Durlauf and Johnson suggest two methods. In the first, the number of splits is arbitrarily given, and is based solely upon one variable.[12] The second method is based on a branching approach. This starts by splitting the complete sample into two on the basis of the variable that gives the best fit (this is done by applying the first method with only one split for each of a number of control variables, and picking the one which yields the best fit). This procedure is then repeated for each of the resulting subsamples, until the degrees of freedom become too small, or the split into subsamples becomes insignificant.[13]

We limited the analysis to the largest of our two samples (the one with R&D projects, RDP, instead of R&D employment, RDE). Moreover, variables in Table 2 which were generally not significant at a level higher than 5 per cent (AGR, INV) were also left out of the regressions. The variables that were retained were initial GDP per capita, R&D efforts and European investment support. Although the correlation between unemployment and growth was quite high, the direction of causality is not clear; indeed it might be argued that unemployment is an endogenous variable. Rather than opting for a simultaneous model, for which we do not have all the necessary variables, we decided to include unemployment as a control variable for splitting up the sample. In principle, we applied the second Durlauf and Johnson method, but it turns out that for the three samples that we present here, the two methods lead to the same splits.[14]

[12] One would for example order the sample in increasing order of initial per capita GDP, assume a split into three subsamples, and then, by minimizing the residual variance, find the two optimal points at which to split the sample.

[13] Durlauf and Johnson apply a rather complicated, but, as they themselves admit, still ad hoc, method of deciding where to stop sub-branching the sample. We have used less formal judgement to decide when to stop sub-branching.

[14] We also experimented with LG_{80} and RDP as control variables, but neither of those variables could produce a split with a lower residual sum of squares, relative to the split based upon unemployment levels.

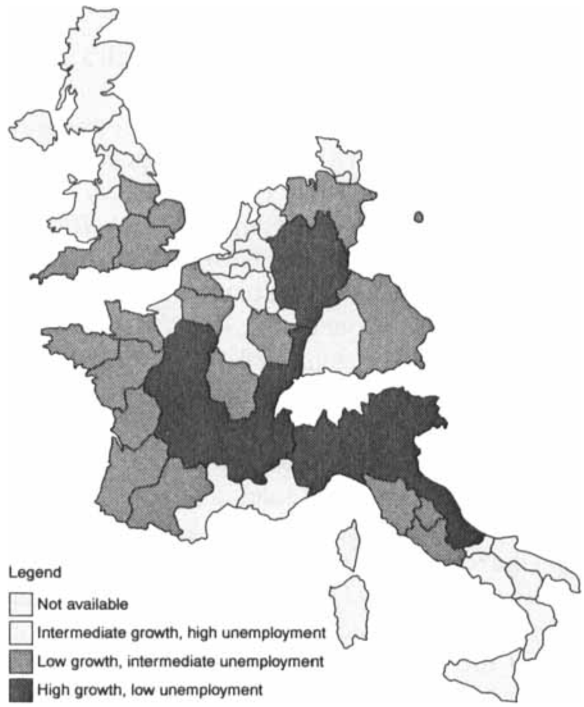

Figure 1: Growth Clubs in Europe

Table 3: Europe at Different Speeds – Searching for a Pattern

	Constant	*RDP*	*EUI*	LG_{80}	R^2 (R^2–adj.)
High unemployment (n = 23)					
(3.1)	0.059 (2.94)	0.065 (0.81)	0.211 (0.52)	–0.020 (2.06)	0.33 (0.22)
Intermediate unemployment (n = 19)					
(3.2)	0.013 (2.66)	0.355 (4.27)	–2.771 (2.18)	–0.050 (2.42)	0.62 (0.54)
Low unemployment (n = 21)					
(3.3)	0.009 (0.39)	0.053 (1.75)	0.740 (2.66)	0.003 (0.29)	0.16 (0.10)

Notes: The dependent variable is the average annual compound growth rate of GDP per capita over the period; *RDP* = number of R&D projects undertaken with support from the EU divided by population; *EUI* = investment loans from the European Investment Bank and the New Community Investment scheme divided by GDP, 1985–87; *LG* = log of GDP per capita; absolute value of *t*-statistics (corrected for heteroscedasticity) in brackets behind parameter estimates; n = number of regions included in the test.

Table 4: Means of the Three 'Growth Clubs' for the Variables in the Equations

Variable	*High UE*	*Intermediate UE*	*Low UE*
RDP	0.020	0.024	0.022
EUI	0.0031	0.0015	0.0025
LG_{80}	2.12	2.32	2.42
g	0.017	0.015	0.019

Notes: *g* = average annual compound growth rate of GDP per capita over the period; *RDP* = number of R&D projects undertaken with support from the EU divided by population; *EUI* = investment loans from the European Investment Bank and the New Community Investment scheme divided by GDP, 1985-87; *LG* = log of GDP per capita.

The results suggest three different 'growth clubs' in Europe (Table 3). Table 4 summarizes the means of the variables included in the model for these three regional groupings, and Figure 1 gives an idea of the geographical spread of the groups. First, there is a high unemployment group, which is characterized by low initial productivity, average growth of productivity, little R&D (RDP) but quite substantial EU investment loans. In this group, we find most of the northern regions in the UK, many of the southern regions in Italy, all of the BENELUX regions in our sample, as well as individual regions in other countries.[15] On the whole, this seems to be the group where many 'peripheral' regions are found. For this group, neither R&D efforts nor investment support from the EU seem to matter much. Indeed, the only factor which appears to have some impact on the differences in productivity within this group is the scope for catch-up.

The second group is one of average unemployment. This group is characterized by average initial productivity, low productivity growth, little investment support (EUI), but a high level of R&D (RDP). Many of the large urban regions of the EU (such as west Berlin, Bayern, London, Rome, but not Paris) belong to this group. There is also quite a substantial number of French regions here, of an industrial or rural character (such as Picardie or Bretagne). For these regions, the scope for imitation and R&D efforts explain a lot. Surprisingly, investment support from the EU enters with a negative sign. Thus, in this group, the investment support from the EU seems to go to the slow growers. The catch-up term is also significant, and the estimated value (impact) is much higher than in the other two groups.

For the third group (low unemployment) this pattern is reversed. Here, the scope for imitation does not matter (in fact, it has a non-significant positive coefficient), but investment support from the EU appears very important and, to some extent, also R&D efforts. The regions in this group are the real 'winners' in our sample. Not only do they have lower unemployment, they also have higher

[15] For the exact listing of regions according to group, see appendix.

GDP per capita and faster growth than the others. Here we find 'well-known growth poles', such as the North of Italy and Paris, as well as other French regions.

Thus, if these results are to be believed, EU support to R&D and investment only impacts positively on growth in regions for which the rate of unemployment is below a certain threshold level. In regions with high unemployment, i.e. where the problems are most manifest, these policies seem largely ineffective.

V. Concluding Remarks

For most of the post-war period, income and productivity levels across the regions of the European Union have been converging. The evidence considered in this article suggests that this slow, but steady convergence in productivity levels may gradually have come to an end during the 1980s. It was argued that a perspective that takes innovation diffusion and other, diverging factors into account, may explain this shift of trend. The results suggest that the potential for catch-up by poorer regions through diffusion is still there, but that its impact is masked by diverging factors, most notably differences in R&D efforts, EU investment support (but not the so-called European Regional Development Funds), industrial structure and unemployment.

It is perhaps a troubling fact that some of these 'diverging' variables are policy instruments at the Community level. However, the finding that these policies have little impact on the poorest regions in Europe is also confirmed by our analysis of different 'growth clubs' in Europe. The results indicate that there exist at least three different of such 'growth clubs', each with its own dynamics. For the group of regions where the problems are most manifest (high unemployment, low GDP per capita), both R&D support and direct credit seem rather inefficient. This clearly points to the need for a better understanding of how these policies work in different environments. Another area in need of more research is the relation between growth and unemployment across European regions. The finding that growth and unemployment are strongly inversely related certainly begs new questions about the nature and cause of this relationship.

Taken as a whole, we think that these results are important for the ongoing European policy debate about cohesion. In case our results can withstand further scrutiny (e.g. when including data for other countries, which may become available in the future), there are certainly important policy lessons to be learned about the working of investment support, knowledge generation and diffusion, and the economic role of unemployment.

Appendix A: Regions Used in the Regression, and the Composition of the 'Growth Clubs'

NUTS Code	*Country*	*'Growth Club'**	*Name*
R11	Germany	na	Schleswig-Holstein
R12	Germany	na	Hamburg
R13	Germany	2	Niedersachsen
R14	Germany	2	Bremen
R15	Germany	3	Nordrhein-Westfalen
R16	Germany	3	Hessen
R17	Germany	3	Rheinland-Pfalz
R1A	Germany	1	Saarland
R18	Germany	1	Baden-Württemberg
R19	Germany	2	Bayern
R1B	Germany	2	Berlin (West)
R71	UK	1	North
R72	UK	1	Yorkshire-Humberside
R73	UK	2	East Midlands
R74	UK	2	East Anglia
R75	UK	2	South East
R76	UK	2	South West
R77	UK	1	West Midlands
R78	UK	1	North West
R79	UK	1	Wales
R7A	UK	1	Scotland
R7B	UK	1	Northern Ireland
R311	Italy	3	Piemonte
R312	Italy	3	Valle d'Aosta
R313	Italy	3	Liguria
R32	Italy	3	Lombardia
R331	Italy	3	Trentino-Alto Adige
R332	Italy	3	Veneto
R333	Italy	3	Friuli-Venez. Giulia
R34	Italy	3	Emilia-Romagna
R353	Italy	3	Marche
R351	Italy	2	Toscana
R352	Italy	2	Umbria
R36	Italy	2	Lazio
R37	Italy	1	Campania
R381	Italy	3	Abruzzi
R382	Italy	1	Molise
R391	Italy	1	Puglia
R392	Italy	1	Basilicata
R393	Italy	1	Calabria
R3A	Italy	1	Sicilia
R3B	Italy	1	Sardegna

R21	France	3	Région Parisienne
R221	France	1	Champagne
R222	France	2	Picardie
R223	France	1	Haute Normandie
R224	France	3	Centre
R225	France	2	Basse Normandie
R226	France	2	Bourgogne
R23	France	2	Nord
R241	France	2	Lorraine
R242	France	3	Alsace
R243	France	3	Franche-Comte
R251	France	2	Pays de la Loire
R252	France	2	Bretagne
R253	France	2	Poitou-Charentes
R261	France	2	Aquitaine
R262	France	2	Midi-Pyrenees
R263	France	3	Limousin
R271	France	3	Rhône-Alpes
R272	France	3	Auvergne
R281	France	1	Langedoc-Roussillon
R282	France	na	Provence-Côte d'Azur
R283	France	na	Corse
R41	Netherlands	1	Noord
R42	Netherlands	1	Oost
R47	Netherlands	1	West
R45	Netherlands	1	Zuid
R51	Belgium	1	Vlaanderen
R52	Belgium	1	Wallonie
R53	Belgium	na	Brussel

* Growth clubs: (1) high unemployment, (2) intermediate unemployment, (3) low unemployment.

Appendix B: Definitions and Sources of the Variables Used

LG: GDP per capita in 1985 PPP to the ECU. Constructed using nationwide GDP deflator. Source for underlying data: Molle (before 1980), EUROSTAT (1980 and beyond), OECD (GDP deflators before 1980).

g: Average annual compound growth rate of *LG*, over the period specified in the text or tables.

EUI: Investment loans over the period 1985–87 (under the European Investment Bank and the New Community Instrument scheme) divided by GDP for the same period. Source for the underlying data: EUROSTAT.

RDF: Transfers under the European Regional Development Funds scheme, divided by GDP, 1985-87. Source for the underlying data: EUROSTAT.

RDP: Number of R&D projects undertaken with support by one of the programmes of the European Commission (mainly so-called Framework Programmes) over the period 1980–90, divided through by population in 1990. Projects are assigned to regions by means of their primary contractor. Source: CORDIS Database, European Commission.

UE: Unemployment rate (1983), defined as 1 – persons employed/labour force. Source for underlying data: EUROSTAT. (These data differ from the official EUROSTAT regional unemployment data, based upon survey data, which contain less valid observations.)

RDE: R&D personnel in business enterprise per 1000 labour force. Source for underlying data: EUROSTAT.

INV: Gross fixed capital formation as a fraction of GDP. Source for underlying data: EUROSTAT. Note: values for United Kingdom scaled down by using OECD data on nationwide investment/GDP ratio (scale factor: 0.31), values for Italy scaled up by factor 1000 to correct for apparent mistake in EUROSTAT units.

AGR: Share of agriculture in employment. Source for underlying data: Molle (before 1980), EUROSTAT (from 1980 onwards).

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