

REGIONAL CONVERGENCE IN THE EUROPEAN COMMUNITY

Damien J Neven and Claudine Gouyette

Discussion Paper No. 914
February 1994

Centre for Economic Policy Research
25-28 Old Burlington Street
London W1X 1LB
Tel: (44 71) 734 9110

This Discussion Paper is issued under the auspices of the Centre's research programmes in **International Macroeconomics and International Trade**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as a private educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions. Institutional (core) finance for the Centre has been provided through major grants from the Leverhulme Trust, the Esmée Fairbairn Trust, the Baring Foundation, the Bank of England and Citibank; these organizations do not give prior review to the Centre's publications, nor do they necessarily endorse the views expressed therein.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

ABSTRACT

Regional Convergence in the European Community*

This paper assesses convergence in output per head across regions in the European Community (EC), for the period 1975–90. We use three alternative methodologies to measure convergence, which yield consistent results. We observe that there are strong differences in the pattern of convergence across sub-periods and across subsets of regions. If Southern Europe seemed to catch up in the early 1980s, it stagnated, at best, in the second part of the 1980s. The regions in Northern Europe, on the other hand, tended to stagnate or diverge in the first part of the 1980s but converge strongly thereafter. This pattern is consistent with the view that North European countries have adjusted better to the main change in policy regimes which occurred in the mid-1980s, namely the implementation of the Single Market programme and the entry of Spain and Portugal into the EC in 1985. This evidence also lends support to the view that trade liberalization can exacerbate disparities. Finally, our evidence indicates that the distinction between the North and the South of the EC is likely to be more relevant in the analysis of growth patterns than the distinction between the centre and the periphery. Preliminary evidence on migration indicates that the population in the Southern regions responds much more slowly to wage and unemployment differences. This may partly explain why Southern regions have not converged after 1985.

JEL classification: F15, F20, R11

Keywords: regions, European Community, convergence

Damien J Neven
Université de Lausanne
DEEP-HEC
BFSH-1
1015 Lausanne
SWITZERLAND
Tel: (41 21) 692 4013

Claudine Gouyette
Université de Liège
Boulevard du Rectorat 7
4000 Liège
BELGIUM

*This paper is produced as part of a CEPR research programme on *Market Integration, Regionalism, and the Global Economy*, supported by a grant from the Ford Foundation (no. 920-1265). We would like to thank Sandrine Rainotte for excellent research assistance, André Sapir for useful discussions and Jean-Pierre Urban for comments on an earlier version of this paper. We are very grateful to the European Commission for providing us with the REGIO database and to Eric Ollinger (EUROSTAT) for giving us access to additional data.

Submitted 5 January 1994

NON-TECHNICAL SUMMARY

Disparities in output and income across regions has been a concern for the European Community since its inception. The objective of reducing disparities across regions in the EC is actually set out in the preamble of the Treaty of Rome. In the 1980s, and following the entry of Greece in the Community, this objective has been emphasized further. In 1987, two years after the entry of Spain and Portugal, the Community acquired an explicit requirement (in the Single European Act) to undertake a regional policy aimed at reducing disparities. Since then, annual spending on regional policy has approximately doubled to some 14 billion ecu. At the Edinburgh summit, late in 1992, the principle of a further increase in Community spending for regional policy was also agreed. This decision was motivated in part by the perception that North-South disparities actually increased in the early 1980s. This evolution has been documented by the Commission in the fourth report on social and economic developments in the regions of the Community (CEC, 1991).

At a time when the objective of convergence across regions has become politically acceptable, new models have provided additional arguments in terms of economic efficiency to justify a regional policy, which previously lacked clear foundations and relied mainly on equity considerations. The neoclassical prediction that the output (and income) of different regions should tend to converge over time towards a steady state (which may, however, differ across regions) has been challenged. A variety of new growth models have been put forward which assume some non-convexity in production, or some externality arising from the accumulation of human capital. In these models, regional output per head can actually diverge (see van der Ploeg and Tang (1992) for a survey). Agglomeration economies have also been emphasized (see Krugman (1991) and Krugman and Venables (1990)), which can lead to centripetal forces and uneven growth patterns.

In this context, the question of whether convergence across regions occurs is indeed important. In particular, if it turns out that the neoclassical model provides a good account of regional evolution, regional policy will be harder to justify in terms of economic efficiency.

There is an additional reason for assessing the pattern of regional evolution in the particular case of the European Community. The accession of Spain and Portugal in 1985 and the implementation of the Single Market programme correspond to a second significant change of policy regime. Both involved a liberalization of trade and factor movements. According to the neoclassical paradigm (see Barro and Sala-i-Martin (1991)) such liberalization should, in principle, enhance the process of convergence (of output but not necessarily income) across regions. This hypothesis has also received some empirical

support (see Ben David (1993)). On the other hand, trade liberalization in the presence of increasing returns or agglomeration economies may not accelerate convergence (see Krugman and Venables (1990) and Grossman and Helpman (1990)), even though it may enhance average growth (see Baldwin (1989)).

We use three alternative methodologies to measure convergence, which yield consistent results. We observe that there are strong differences in the pattern of convergence across sub-periods and across subsets of regions. If Southern Europe seemed to catch up in the early 1980s, it stagnated, at best, in the second part of the 1980s. On the other hand, the regions in Northern Europe tended to stagnate or diverge in the first part of the 1980s but converge strongly thereafter. This pattern is consistent with the view that North European countries have adjusted better to the main change in policy regime which occurred in the mid-1980s, namely the implementation of the internal market programme and the entry of Spain and Portugal into the Community in 1985. This evidence also lends support to the view that trade liberalization can exacerbate disparities. Preliminary evidence on migration indicates that the population for the Southern regions responds much more slowly to wage and unemployment differences. This may partly explain why Southern regions have not converged after 1985.

1. Introduction

The objective of this paper is to evaluate empirically the process of convergence across regions in the European Community between 1975 and 1990.

Disparities in output and income across regions has been a concern for the European Community since its inception. The objective of reducing disparities across regions in the EC is actually laid down in the preamble of the Treaty of Rome. In the eighties, and following the entry of Greece in the Community, this objective has been further emphasised. In 1987, two years after the entry of Portugal and Spain, the Community has received an explicit competence (in the Single European Act) for undertaking a regional policy aimed at reducing disparities. Since then, the annual spending on regional policy has by and large doubled to reach some 14 billion Ecu. At the Birmingham summit, late 1992, the principle of some further increase in Community spending for regional policy has also been agreed. This decision has been motivated partly by the perception that North-South disparities have actually increased in the early eighties. This evolution has been documented by the Commission in the fourth report on social and economic developments in the regions of the Community (CEC, 1991). However, as indicated below, the evidence on convergence presented by the Commission is potentially misleading.

At the time when the objective of convergence across regions has become politically acceptable, there has also been a renewed interest for the economic analysis of convergence. In terms of *principles*, the neo-classical prediction that output (and income) of different regions should tend to converge over time towards a steady state (which may however differ across regions) has been challenged. A variety of new growth models have been put forward which assume some non-convexity in production, or some externality arising from the accumulation of human capital. In these models, regional outputs per head can actually diverge (see van der Ploeg and Tang (1992) for a survey). Agglomeration economies have also been emphasised (see Krugman, 1991, Krugman and Venables, 1990), which can lead to centripetal forces and uneven growth patterns.

These developments have affected the *policy* debate; the new growth models have provided additional arguments in terms of economic efficiency to justify a regional policy, which lacked clear foundations and relied mainly on equity considerations. Whether regional policy can effectively increase the growth of *lagging* regions and foster convergence can still be questioned: whereas calibration exercises (see Pereira, 1992) tend to suggest that regional transfer can indeed enhance growth, econometric (see for instance, Bachetta, (1993)) and case

study evidence (see for instance Faini et al. (1993) for evidence on the mezzogiorno) have cast some doubts on the efficiency of regional policy.

Some controversy has also arisen with respect to the empirical assessment of convergence (see for instance Barro (1992), Barro and Sala i Martin, (1991), Blanchard and Katz (1992), Quah (1992), Mankiw, Romer and Weil (1992) and Dowrick and Gemmel (1991)). A correct assessment of convergence is indeed important ; as indicated above, whether convergence actually occurs across regions and countries sheds some light on the relevance of the new growth models. Similarly, whether centripetal forces are observed could give some indication of the importance of agglomeration economies. This, in turns, matters for the assessment of regional policy. If it turns out that the neo-classical model provides a good account of regional evolution, regional policy will be harder to justify in terms of economic efficiency.

There are at least two additional reasons for assessing the pattern of regional evolution in the particular case of the European Community. Both are related to significant changes in the policy regimes that have occurred in the eighties. First, as indicated above, the European Commission has followed a pro-active policy of reducing disparities and has stepped up the size of its intervention since 1987. Whether a change in the pattern of convergence can be traced out since then would give some indication on the effectiveness of regional policy. It is however very unlikely that our sample will pick up this effect. Indeed, our sample stops in 1990 (the complete sample in 1989), and the implementation of the reform of structural funds has been delayed by about 18 months, so that actual disbursements of the Community have not increased much until late 1988. Since the effect of additional disbursements is likely to be felt with a significant lag, our sample is almost certainly too short. As additional data becomes available, it should still be possible to gain some insights on the effectiveness of structural funds.

The accession of Spain and Portugal in 1985 and the implementation of the internal market programme correspond to a second significant change of policy regime. Both the internal market programme and the accession involve a liberalisation of trade and factor movements. According to the neo-classical paradigm (see Barro and Sala i Martin, 1991) such liberalisation should in principle enhance the process of convergence (of output but not necessarily income) across regions. This hypothesis has also received some empirical support (see Dan Ben David, 1993). At the opposite, trade liberalisation in the presence of increasing returns or agglomeration economies may not accelerate convergence (see Krugman and Venables, 1990, Grossman and Helpman (1990)) even though it may enhance average growth (see Baldwin, 1989). One can reasonably presume that some of the effects of this major change in policy regime should be felt

in our sample. Indeed, one can trace out a strong increase in trade and factor movements as early as 1986-87, mainly between the North and the South of Europe (see Neven and Vickers, 1992). Some of the growth effect associated with these changes should thus be felt by 1990.

Accordingly, it may be adequate, but with much caution, to associate sharp changes in the pattern of convergence in the late eighties to the trade liberalisation that occurred in 1985 and to get some insights on the empirical relevance of scale and agglomeration economies for the process of regional growth.

Section 2 of the paper briefly discusses the measure of convergence and reviews existing evidence on regional disparities in the Community. Section 3 presents our results. Section 4 discusses some possible explanations behind observed patterns. It emphasises the difference in migration behaviour between the North and the South of the Community. Section 5 concludes.

2. Measuring convergence

Intuitively, convergence between economic series, like output per capita in different regions, will occur when the difference between the series become arbitrarily small over time, or alternatively that the probability that the series will differ by more than some specified amount becomes arbitrarily small.

If the intuition behind economic convergence seems clear enough, its measure is not straightforward and a number of alternative methodologies have been suggested (see Hall, Robertson and Wickens, 1992). The simplest measure of convergence, usually referred to as σ convergence, involves a decline over time of the cross-sectional dispersion of the variable at hand. Since most studies of convergence examine output per capita, this type of convergence is usually presented in terms of the evolution over time of the standard deviation of output per capita across regions. This is the measure adopted by the European Commission in its occasional reports on the social and economic developments in the regions of the Community.

Barro and Sala i Martin (1991) suggest a measure, dubbed conditional β convergence, which involves a test for mean reversion. They show that this measure can be related to the transitional growth process in a neo-classical model. The transition process of output per capita in region i at time t , (y_{it}) and over the period T , can be approximated (Barro and Sala i Martin, 1991) as :

$$(1/T) \log (y_{it}/y_{i,t-T}) = x_i^* + \log(y_i^* / y_{i,t-T}) (1 - e^{-\beta T})/T + u_{i,t}$$

where x_i^* is the steady state growth rate, y_{it} is the output per worker adjusted for technological progress and y_i^* is the steady state level of output per worker adjusted for technological progress. The coefficient β is as rate of convergence, which measures the speed at

which y_{it} approaches y_1^* . This convergence is conditional to the extent that it is affected by the steady state values x_1^* and y_1^* , which may differ across regions. In order to identify β , it is therefore necessary to control for cross-regional differences in steady state values. In practice, since it is difficult to control for technical progress, the differences between $y_{i,t}$ and $y_{i,t}$ are simply ignored. The equation which it estimated then becomes :

$$(1/T) \log (y_{i,t}/y_{i,t-T}) = \alpha - \log(y_{i,t-T}) (1 - e^{-\beta T})/T + u_{i,t} \quad (1)$$

Accordingly, testing for convergence in this model amounts to a test for mean reversion.

Various types of conditioning variables can be introduced to account for differences in steady state value of output per head across regions. Barro and Sala i Martin (1991) in their study of convergence among US states introduce regional dummies (for sub-groups of states) and some sectoral variables which represent the deviation of the state's industrial structure from the national average. Barro (1991) introduce some measure of human capital. Mankiw, Romer and Weil (1992) consider investment and population growth rates and human capital.

The relation between β and σ convergence is easy to illustrate: it is clear from equation (1) that the dispersion of output per capita does not necessarily decrease over time, even if there is β convergence, because of the random shocks $u_{i,t}$. New shocks can temporarily increase the dispersion of income across regions even when there is an underlying process of convergence towards a steady state. In this respect, σ convergence could be misleading³.

As pointed out by Quah (1992), one of the underlying assumptions behind the estimation of β convergence is that each region has a steady state growth path. He suggests however that this assumption is not supported by cross-country data, which show a strong instability in the underlying process of growth. Accordingly, he develops an alternative methodology which does not impose any restriction on the data. This methodology views the process of convergence as a transition process across a number of possible states and he assumes that it can be modelled as a Markov chain. The distribution of countries' income per head relative to the average is represented by a number of discrete intervals. The transition matrix of the Markov process is then estimated by calculating from the data, the probabilities that a country in any particular interval will shift to the other intervals in the following period. He then computes the ergodic distribution of the process and evaluates whether this distribution is consistent with a pattern of convergence.

³ There are other measures of convergence which rely on cointegration tests. See Hall, Robertson and Wickens (1992).

This alternative methodology is attractive to the extent that it does not impose any constraint on the data. However, it is at this stage mostly a descriptive analysis.

Most of the empirical literature on convergence has focused either on US states or a sample of countries. Barro and Sala i Martin (1991) consider the convergence *within* EC countries on a sample of 73 regions in the North of Europe (among the original six members, the UK and Denmark) for the period 1950-1985. Because of data limitations⁴, they could not however assess convergence among EC regions⁵. They conclude that there is over the period 1960-1985, a conditional convergence within countries at a rate (β) of about 1.8 % per year (a rate slightly lower than that estimated across US states). The Commission of the European (CEC, 1991) has also assessed σ convergence across regions until 1987 : they observe that the standard error of output per capita decreases until the early seventies, then increases until 1985, after which it seems to fall slightly.

3. Estimations and results

We have used the three methodologies presented above to assess convergence among regions of the EC between 1975 and 1990. Like previous studies we concentrate on measuring convergence in terms of output (GDP) per head. Output is measured in purchasing power parities. Our sample includes all 172 regions at the NUTS II level for the period 1980-1989.

Before measuring convergence, we provide a description of the data and characterise (following Blanchard and Katz, (1992)) the stochastic behaviour of GDP per head.

3.1. The stability of relative output

We try to exploit somewhat the time series element of our data and get some insight into the evolution of regional output per head relative to the EC average. More precisely, we investigate the stochastic behaviour of the relative output per capita, $y_{1,t}/y_t$. As before $y_{1,t}$ denotes the output per head in region 1 at time t and y_t denotes output per head in the EC. We check whether the series of relative output per head are stationary. Pooling the data together we estimate two auto regressive processes for the log of relative output per head, one with a single lag and the other with two lags. We also allow for country dummies. In all cases, evidence from the

⁴The original data is expressed in terms of index numbers (regional GDP/head relative to the national average).

⁵ They also use data from two different sources which are not obviously consistent. Data for those years at which the samples overlap actually differ across sources.

augmented Dickey-Fuller test⁶, indicate that the hypothesis of a unit root cannot be rejected at the 5 % level, so that the series is stationary.

The coefficients of the auto regressive processes are presented in table 1, together with the implied impulse responses to an innovation of 1.

Coefficient	AR(1)	AR(2)
α_1	0.9901	1.0495
α_2		- 0.5964
Dickey-Fueller test	-4.24326	-3.95704
Impulse responses		
$i = 1$	i	i
2	0.990	1.0495
3	0.980	1.0422
4	0.971	1.031
5	0.961	1.020
10	0.915	0.966
20	0.828	0.866
30	0.750	0.777

These estimates suggest that relative outputs per head return to their mean after a shock but extremely slowly. After 30 years, only 25 % of the shock has been absorbed. This pattern can be compared to that observed in the US ; estimating a auto regressive process for relative income per head among US states, Blanchard and Katz (1992) reports that 43 % of the shock is absorbed after 10 years and about 80 % after 20 years. The process of reversion to the mean is

⁶ In principle, this test is designed for time series and would require longer series but it can be used when there is a large number of cross-sectional units (see Breitung and Meyer, 1991) .

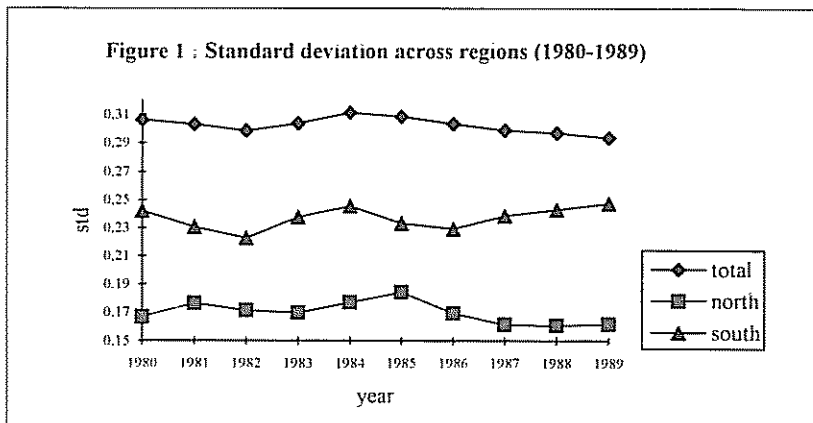
therefore much slower in Europe than in the US. Given that NUTS II regions are significantly smaller than US states, one would a priori expect the opposite.

We ran the same auto regressive processes for two sub samples, namely the regions on the North of Europe and those in the South. In what follows, the South of Europe includes Spain, Portugal, Greece and the Italian regions to the South of the Latium. The series are stationary in both cases. We observe however that the process of reversion to the mean is significantly slower in the South of Europe than in the North. For instance, in the South it takes about 20 years to absorb 10 % of the shock⁷.

We now turn to the analysis of convergence and review the three methodologies in turn.

3.1 σ convergence

We first compute the standard error of the log of output per capita ($\log y_{i,t}$) over the entire sample. As indicated in figure 1, we observe that if regional disparities had a somewhat erratic behaviour in the early eighties, some process of convergence seems to set in as of 1984. The evolution which was identified by the CEC (1991) for the period 84-87, seems therefore to be confirmed by the additional observations for 88-89.

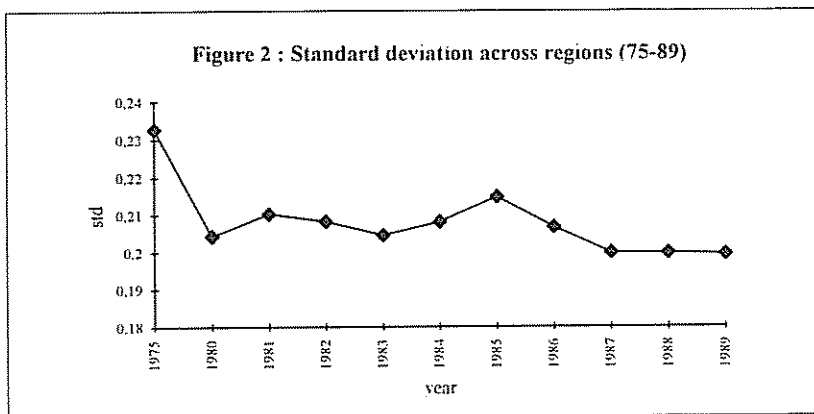


Convergence has also been assessed separately for the North and the South of Europe. Results are presented in figure 1. First, it appears that the Northern regions are more homogenous in terms of output per head than the Southern group. A different pattern is also observed over time

⁷ Details of these calculations are available on request from the authors.

for the two groups. The dispersion among Northern regions is somewhat erratic in the early eighties but falls in the second part of the decade. In the South, by contrast, there is tendency for the dispersion to fall in the early years and to increase thereafter.

As indicated above, we also have information of a restricted sample of 107 regions for 1975. Convergence is also assessed for this alternative sample which includes mostly northern European regions and the results reported on figure 2. We observe that disparities are reduced from 1975 to 1980, stagnate in the early eighties and fall thereafter. Overall, for the eighties, this pattern is similar to that observed in the sample of Northern regions discussed above.



3.2 β convergence

We have estimated various versions of the basic convergence equation (1). First we estimate a model of unconditional convergence on the complete sample (I), without any variable to pick up cross regional differences in steady states. We then include country dummies. Because of missing observations and unreliable data, we perform the estimation for the period 80-89 on a sample of 142 regions (sample I). Additional data for the period 75-80 are available for a sample of 108 regions from the North of Europe⁸ and the same equations basic equations are estimated on this second sample (sample II). Additional conditioning variables will also be considered : first, following Barro (1990), we include a proxy for the industrial structure, which is available for 110 regions (sample III). As proxy for human capital, we use information on

⁸ The data has been extracted from the REGIO database of the European Commission.

school enrolment which is only available for a subsample of 85 Northern European regions⁹ (sample IV). Finally, because sample III and IV, do not completely overlap we estimate an equation including proxies for industrial structure and human capital for the period 75-89 on a sample of 73 regions (sample V).

The Dutch region of Groningen was also dropped from the sample because of the somewhat artificial nature of the output recorded in that area, which include all production of gas from the North Sea in the Netherlands. This region was the most affluent in the Community in the early eighties but declined markedly relative to others as energy prices fell throughout the second part of the eighties. The inclusion of Groningen in the sample would therefore bias the estimates in favour of finding convergence.

Table 2. β convergence 80-89 (rate of convergence in %)

Sample	I	Is	In
Unconditional model	$\beta = 0.53^*$	$\beta = 0.43$	$\beta < 0$
	(-2.53)	(-0.706)	(0.004)
	$R^2 = 0.04$	$R^2 = 0.00$	$R^2 = 0.00$
With country dummies	$\beta = 1.11^*$	$\beta = 1.78^*$	$\beta = 1.13^*$
	(-3.67)	(-2.394)	(-2.539)
	$R^2 = 0.26$	$R^2 = 0.11$	$R^2 = 0.58$

Sample I : $n = 141$, sample Is : $n = 43$, sample In : $n = 98$, t statistics of the estimated parameter $(1 - e^{-\beta T})/T$ in parentheses. A single (double) * denotes a parameter significant at the 5 % (10%) level. Parameters in italics are not significant at the 10 % level.

As indicated by table 2, it seems that the regions of Europe had a tendency to converge over the eighties but at a very slow pace relative to that observed in the US. For instance, Barro (1991) and Barro and Sala i Martin (1991) report convergence rates often in excess of 2 % per year. The fit of these equations is also very poor in absolute terms and relative the US estimates.

⁹ Unfortunately, school enrollment data can only be constructed for the Northern European regions and for 1975. Surprisingly, Eurostat has stopped collecting this information thereafter.

The general tendency for regions to converge conceals a difference between the North (sample In) and the South (sample Is) of Europe. There is no evidence that there is a convergence process, neither among Northern regions, nor among Southern regions, when country effects are not controlled for. This suggests that the (unconditional) convergence observed during the period in the whole sample could be associated with Southern regions catching up with the North. When country effects are allowed for, Southern regions seem to converge faster among themselves than the regions of the North (among themselves).

Table 3. β convergence 80-85 (rate of convergence in %)

Sample	I	Is	In
Unconditional model	$\beta = 0.251$	$\beta = 2.55^*$	$\beta < 0$
	(-1.519)	(-2.310)	(1.47)
	$R^2 = 0.02$	$R^2 = 0.09$	$R^2 = 0.02$
With country dummies	$\beta = 2.01^*$	$\beta = 4.44^*$	$\beta = 0.26$
	(-3.99)	(-2.974)	(-0.537)
	$R^2 = 0.27$	$R^2 = 0.15$	$R^2 = 0.35$

Table 4. β convergence 85-89 (rate of convergence in %)

Sample	I	Is	In
Unconditional model	$\beta = 0.77^*$	$\beta < 0$	$\beta = 1.08^{**}$
	(-2.22)	(1.44)	(-1.79)
	$R^2 = 0.03$	$R^2 = 0.02$	$R^2 = 0.03$
With country dummies	$\beta = 0.42$	$\beta < 0$	$\beta = 1.86^*$
	(-0.86)	(-0.084)	(-3.040)
	$R^2 = 0.32$	$R^2 = 0.38$	$R^2 = 0.77$

Breaking up the sample in two sub periods (see tables 3 and 4) suggests a more complicated pattern. First, we observe a strong instability of the estimated convergence coefficients across sub-periods ; whereas regions seem to converge in the first part of the decade, poorer regions don't seem to catch up in the later part. This instability could be due to the existence of shocks that have differential effects on region's income. For instance, the low coefficient estimated for

the later part of the eighties may simply reflect the relative decline of agricultural activities and heavy industries which were also concentrated in the poorer regions of the Community. We attempt to control for such effects below by introducing additional explanatory variables.

This evolution also conceals a sharp difference between the North and the South of Europe. A strong process of convergence (up to 4.4 % a year) is observed among Southern regions in the first five years, at the time when disparities among Northern regions are at best constant. The reverse pattern obtains however for the second half of the eighties : in that period, there is a strong process of convergence in the North, whereas Southern regions do, at best stagnate¹⁰

As indicated above, data on output per head is available as of 1975 for a subset of 108 regions, mainly from the North of Europe. We estimated unconditional convergence equations for the period 1975-1989 on this alternative sample. Results are presented in table 5 and confirm the instability of the convergence coefficient. It appears that convergence has occurred over the period 75-89 and at a particularly sustained rate towards the end of the seventies. Estimates for the periods 80-85 and 85-89 on this sample are not reported and confirm those presented above which suggest that convergence has by and large stopped (among Northern regions) in the first part of the eighties and accelerated in the second part of the decade.

Table 5. β convergence 75-89 (rate of convergence in %) - sample II

Period	75-89	75-80
Unconditional model	$\beta = 1.95^*$	$\beta = 3.82^*$
	(-6.05)	(-5.51)
	$R^2 = 0.25$	$R^2 = 0.22$
With country dummies	$\beta = 1.61^*$	$\beta = 3.08^*$
	(-5.11)	(-5.05)
	$R^2 = 0.47$	$R^2 = 0.56$

¹⁰ This pattern is quite robust to the definition of the "South" which is adopted: Given that data for Greece may be less reliable and that the Greek dummy is sometimes significant, we ran the regression for the South while excluding Greece. Qualitatively, results are unchanged and the size of the coefficients is not much affected.

In order to evaluate the robustness of these observations, we include a sectoral variable, which measures the extent to which output was distributed in the initial period in growing sectors. Following Barro and Sala i Martin (1991), this variable S_{it} is defined as :

$$S_{it} = \sum_j w_{jt,t-T} \log (y_{jt}/y_{j,t-T})$$

where w_{jt} is the share of employment in sector j (NACE 1 level) at time $t-T$, and y_{jt} is the output in sector j at time j at the national level¹¹. This data can be constructed for a sample of 110 regions from both the North and the South of Europe (sample III). Regions with a high score on the sectoral variable are those where the industrial structure at the beginning of the period were well represented in sectors which turn out to be growing fast at the national level. Estimates which include country dummies and the structural variable are presented in table 6. The coefficient of the structural variable is usually positive and highly significant. As expected the variance of the estimated convergence coefficient across sub-periods is reduced. The basic observation that convergence seems to have stopped in the later part of the eighties is however confirmed. Separate estimates for the North and the South of Europe also tend to confirm¹² the observation that the Northern European regions converge strongly after 1985, at a time when Southern European regions stagnate, following a period of rapid convergence in the early eighties.

Table 6. β convergence with structural variable - sample III

	80-89	80-85	85-89
Unconditional model	$\beta = 0.46^{**}$	$\beta < 0$	$\beta = 1.86^*$
	$R^2 = 0.03$	$R^2 = 0.02$	$R^2 = 0.14$
With country dummies	$\beta = 0.77^{**}$	$\beta = 1.01^{**}$	$\beta = 0.90$
and structural variable	$R^2 = 0.36$	$R^2 = 0.38$	$R^2 = 0.40$

Finally, we use school enrolment as a proxy for human capital. Data on school enrolment in 1975 is available for 82 regions in the North of Europe (sample IV). Data on both structural and human capital variables can be constructed for 73 regions in the North (sample V).

¹¹ We have also computed a sectoral variable where we use output growth at the EC level rather than the national level as a benchmark. Results do not differ significantly from those reported below.

¹² Unfortunately, the structural variable cannot be computed for Greece, so that the number of observations for the South is limited (32 data points). The estimates can be obtained upon request from the authors.

We confirm that regions with a higher level of human capital tend to experience a higher level of growth. We also find that holding human capital constant, the process of convergence is faster (the coefficient β increases marginally when human capital is added).

Table 7. β convergence and human capital (75-89)

Sample	IV	V
Unconditional model	$\beta = 2.06^*$ $R^2 = 0.25$	$\beta = 2.50^*$ $R^2 = 0.23$
With country dummies	$\beta = 1.12^*$ $R^2 = 0.48$	$\beta = 2.41^*$ $R^2 = 0.33$
With country dummies and human capital	$\beta = 1.35^*$ $R^2 = 0.50$	$\beta = 2.42^*$ $R^2 = 0.65$
With country dummies human capital and structural variables		$\beta = 2.71^*$ $R^2 = 0.65$

Overall, two stylised facts seems to emerge : first, the process of convergence among the regions of Europe is far from stable, even when we account for differences in industrial structure and it tends to slow down in the later part of the eighties. Second, it seems that Northern European regions, after a period of stagnation in the early eighties, converge strongly after 1985, at a time when Southern European regions stagnate, following a period of rapid convergence in the early eighties.

These observation should be interpreted with much caution. Indeed, our convergence equations may be misspecified. Differences in the steady state values of output across regions may not have been accounted for properly. One may argue that the North and the South of Europe have been subject to different shocks in the mid-eighties and that a negative shock has pushed the Southern regions temporarily off the transition path. It is however tempting to associate the observed pattern with the (common) shock to which regions were confronted, namely the major change of trade policy regime that occurred in the mid-eighties; as indicated above, one would expect a major trade liberalisation exercise such as the internal market programme to enhance convergence. In the presence of strong scale and agglomeration economies, trade liberalisation

may still lead to uneven patterns across regions. The evidence presented here therefore lends to some support to the view that such scale and agglomeration economies may matter. This evidence also supports the prediction expressed for instance by Krugman and Venables (1991) that Southern regions may be hurt by the process of trade liberalisation across Europe. Given the short time period which is considered here, one should still interpret these results with much caution.

In order to inquire further whether our distinction between the North and the South of Europe is appropriate, we adopted an alternative criteria to split the sample. We distinguish between the centre and the periphery, according the value of the periphery index computed by Todenburg (1989) and reported in the Commission's database. This index is a measure of the relative accessibility of regions. We considered that all regions with a periphery index below 135 would qualify as central regions and accordingly that those with an index larger or equal to 135 belong to the periphery. This threshold is however somewhat arbitrary ; it ensures that the group of regions have approximately the same number of participants.

There is of course an strong overlap between the Southern and the peripheral group. The latter includes the former but also comprises all Irish regions, Scotland, some Danish regions and some regions North of Rome. We ran the same regressions as those presented¹³ in table 3 and 4 for the centre and the periphery. The differences that we observed between the North and the South across sub periods are by and large confirmed. Differences are however less sharp and the overall fit of the equations is significantly worse. This would suggest that the distinction between the North and the South is more relevant than the distinction between the centre and the periphery (at least, given the way in which periphery is measured).

3.4. Convergence as a Markov process

As indicated above, the methodology proposed by Quah (1992) proceeds by defining a number of states and by deriving from the data the probabilities that a region in any particular state will shift to each of alternative states in the following period.

We distinguish between 7 different states, which provide a discrete approximation of the distribution of output per head across regions. Using the same notation as above, we adopt the following definition :

¹³ Results are not presented here but are available on request from the authors.

State 1, if $y_{it} < 0.6 y_t$, state 2 if $0.6 y_t \leq y_{it} < 0.775 y_t$, state 3 if $0.775 y_t \leq y_{it} < 0.925 y_t$, state 4 if $0.925 y_t \leq y_{it} < y_t$, state 5 if $y_t \leq y_{it} < 1.075 y_t$, state 6 if $1.075 y_t \leq y_{it} < 1.225 y_t$ and state 7 if $y_t \leq y_{it}$.

The choice of these intervals is somewhat arbitrary. The definition that is adopted here ensures that differences in the initial number of regions belonging to the various states are not too large (as advised by Quah, 1992). We have experimented with several alternative definitions and the details of the results are somewhat sensitive to the definition of states. Table 8 reports our estimates of the transition matrix and the ergodic distribution which is associated with the process.

Table 8. Transition matrix and ergodic distribution

Number of observations.	Final State						
	1	2	3	4	5	6	7
74	0.960	0.040	0.000	0.000	0.000	0.000	0.000
148	0.054	0.872	0.074	0.000	0.000	0.000	0.000
258	0.000	0.040	0.821	0.139	0.000	0.000	0.000
207	0.000	0.000	0.174	0.720	0.106	0.000	0.000
165	0.000	0.000	0.000	0.122	0.794	0.084	0.000
195	0.000	0.000	0.000	0.000	0.027	0.918	0.055
138	0.000	0.000	0.000	0.000	0.000	0.087	0.913
Initial (1980) distribution	0.133	0.112	0.210	0.141	0.133	0.161	0.105
Stationary distribution	0.165	0.122	0.226	0.180	0.123	0.112	0.072

Some insight can already be gained from the observation of the transition matrix. Diagonal elements dominate, especially among the lower and higher classes. Poorest and richest regions

do not seem to modify their relative standing over time. In addition, one cannot detect any spectacular changes from year to year (strictly positive elements are only observed around the diagonal).

The characteristic of the ergodic distribution indicates that there is a limited poverty trap: even though the stationary distribution is more concentrated around the mean, the frequencies in the lower states increase relative to the initial distribution. Given the low mobility which is observed at the lower end of spectrum, one can conclude that the poorest regions of the Community are very likely to stay poor. At the opposite, one can also observe that the top three classes of the distribution become less important.

Given that sharp changes reported above in the convergence process over time, we have estimated one transition matrix for each sub-period (80-85 and 85-89). Details of the results are not reported here¹⁴. Transition matrices differ somewhat across periods; it seems that mobility in between classes is more pronounced in the second period. The ergodic distribution for the second period is also characterised by a more pronounced reduction in the frequencies of the extreme classes: this is particularly pronounced for lower part of the distribution. Indeed, whereas the two lowest classes account for more than 20 % of the distribution in the initial state, they represent less than 10% of the distribution at the stationary state.

4. The North-South divergence; some possible explanations

The various methodologies used above to assess convergence point to a fairly consistent pattern of regional evolution across time and subgroups. First, it is clear that regional evolutions in the EC tend to be slower than those observed in the US. Second, it seems that the North and the South of the Community exhibit a different pattern. Third, it appears that the pattern of convergence changes across time. On the whole, we observe that whereas Southern regions catch up in the early eighties and stagnate thereafter, Northern regions first stagnate and then converge towards the steady state.

The evidence should however be interpreted with much caution. The time serie element of our data is small, relative to the cross-section dimension, and the sub-periods that we distinguish may be unduly short. As indicated above, it is however tempting to associate the change in the pattern of convergence observed in 1985 with the major change of policy regime which occurs at that time, namely the accession of the Iberian peninsula to the Community and the implementation of the internal market programme. According to this approach, the Community has been subject to a common shock and some regions seem to have adjusted better than others. This also suggests

¹⁴ The results are available on request from the authors.

that it may be worth looking for structural explanations and try to identify differences in the adjustment processes across regions.

In what follows, we shall report on some preliminary analysis which follows this line of enquiry and tries to identify difference in the adjustment process across countries.

As indicated by Blanchard and Katz (1992), factor movements, and labour movements in particular, are central to the process of convergence in the US. He observes large and persistent disparities in employment growth across states. He shows that when regions are hit by a negative shocks, unemployment initially increases, which leads to an exit of workers so that unemployment returns to normal level because of a fall in labour supply rather than an increase in new jobs.

Accordingly, the difference between Northern and Southern regions could be associated with different migrations patterns. The lack of adjustment observed in the South could be partly associated with a relatively immobile labour force. In order to investigate this hypothesis, we have estimated a model of migration across EC regions. The REGIO database reports on annual gross migrations flows between all pairs of regions within countries¹⁵. Following a standard approach in the literature (see Faini, 1993), we include unemployment rates and relative wages in the origin region relative to those of the destination region as explanatory variables. Let i (j) refer to the origin (destination) region. Wages and unemployment are denoted respectively u and w ¹⁶. We also include the periphery index, discussed above, to test whether migrations occur less in Southern regions. The model is estimated for 1985 across 610 cross-regional flows. The dependent variable is the log of emigration/population. Results are presented in table 9.

Table 9. A model of migration across regions

Explanatory variable	Coefficient (t statistics) - $R^2 = 0.35$
Constant	-6.637 (-23.295)
$\log (u_i / u_j)$	0.216 (1.561)
$\log (w_i / w_j)$	-2.028 (-3.729)
Periphery Index i	-0.006 (-3.327)

¹⁵ Unfortunately, there is no information on flows between regions located in different countries.

¹⁶ Our wage data (from regio) refers to the average remunerations of employed workers (it excludes the self employed). Unemployment rates (also from regio) are standardised rates.

Dummy Italy	-1.141	(-7.316)
Dummy UK	0.569	(3.568)

Contrary to common findings on cross-country migrations (see Faini and Venturini, 1992), the relative unemployment rates do not seem to affect migrations decisions, whereas relative wages do¹⁷. This is however not surprising given that we deal with inter regional migrations within countries and we can expect unemployment insurance to be constant within countries. Labour movements seem to be relatively strong in UK, and relatively weak in Italy. Interestingly however, we also observe that the periphery index enters negatively and is very significant. This lends support to the view that labour movements are less prevalent in the South. This, in turn, could contribute to an explanation of the relative lack of adjustment observed in the South.

5. Conclusion

This paper has documented the pattern of regional growth which has occurred in the late seventies and early eighties. The evidence that is put forward should however be seen as indicative at best and the analysis should be replicated as additional data becomes available to check whether the conclusions that we reach can be confirmed.

If the paper describes a pattern of regional evolution, it offers little in the way of explaining it. This presentation should therefore be complemented by a systematic analysis of the factors that affect growth in general and those that affect the adjustment to a shock like the internal market programme and the accession of the Iberian peninsula.

Besides labour movement, evidence on trade, capital flows, investment, employment growth and the reallocation of resources across industries would be useful.

¹⁷ We have tested a number of alternative specifications and this finding seems relatively robust.

References

- Bachetta, P., (1993), "Regional investment and growth in the European Community", mimeo, IAE Barcelona
- Baldwin, R., 1990, "The growth effect of 1992", Economic Policy, 9, 247-283
- Barro, R., 1991, "Economic Growth in a cross-section of countries, Quarterly Journal of Economics, 408-443
- Barro, R. and X. Sala i Martin, 1991, "Convergence across states and regions, Brookings Paper on Economic Activity, 107-182.
- Barro, R. and X. Sala i Martin, 1992, "Convergence", Journal of Political Economy, 100, 2.
- Blanchard and Katz O. and L.F. Katz, 1992, "Regional Evolution", Brookings Paper on Economic Activity.
- Ben David, D., 1993. Equalising Exchange : trade liberalisation and income convergence, mimeo, University of Houston
- Breitung, J. and W. Meyer, 1991, "Testing for unit roots in panel data : are wages on different bargaining levels cointegrated ?", mimeo, Institute for Quantitative Wirtschaftsforschung.
- Commission des Communautés Européennes, 1991, "Les régions dans les années 90 : quatrième rapport périodique sur la situation et l'évolution socio-économique des régions de la Communauté", Bruxelles.
- Dowrick, S. and N. Gemmel, 1991, Industrialisation, catching up and economic growth : a comparative study across the world's capitalist economies, Economic Journal, 101, 263-275.
- Faini, R., G. Galli and C. Giannini, 1993, "Finance and development : the case of Southern Italy", in A. Giovannini (ed.), Finance and development : issues and experience, Cambridge University Press, 158-213.
- Faini, R., 1993, "Migration in the expanded EC, mimeo, University of Brescia
- Faini, R. and A. Venturini, 1992, "Trade, aid and migrations : some basic policy issues, European Economic Review, Papers and Proceedings.
- Hall, S., D. Robertson and M. Wickens, 1992, "Measuring convergence of the EC economies, The Manchester School, vol LV Supplement, 99-111

Krugman, P., 1991. "Increasing returns and economic geography", Journal of Political Economy, 99, 3.

Krugman, P. and T. Venables, 1990, "Integration and the competitiveness of peripheral industry", in C Bliss and J Braga de Macedo (eds), Unity with diversity in the European economy : the Community' Southern frontier, Cambridge University Press, 56-75.

Mankiw, G., D. Romer and D. Weil, 1992, "A contribution to the empirics of Economic growth", Quarterly Journal of Economics, VC, 2, 407-438.

Neven, D. and J. Vickers, 1992. "Public Policy towards industrial restructuring : some issues raised by the Internal Market Programme", in European Industrial Restructuring, K. Cool, D. Neven and I. Walter (eds), Macmillan, 162-198.

Pereira, A., 1992, "Structural policies in the European Community: an international comparison", mimeo, UC San Diego.

Quah, D., 1992, "Empirical cross-section dynamics in economic growth", Discussion Paper, Institute for Empirical Macroeconomics, London.

Rodenburg, H., 1989, "Central locations in the European Common Market", Research Memoranda N° 59, Central Planning Bureau, The Hague.

van der Ploeg, F. and P Tang, (1992), The Macroeconomics of growth : an international perspective, The Oxford Review of Economic Policy, 8 (4), 15-28