More Similar and Less Equal: Economic Growth in the European Regions

By

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I. Introduction

In recent years, the empirical literature on economic growth has devoted increasing attention to the issue of regional disparities. The stylized fact is that in Western Europe economic differences are much higher at the regional level than at the national one.[1] For instance, in 1990 the richest European region[2] (Hamburg in Germany) enjoys a per capita income almost six times higher than the poorest one (Voreio in Greece), even controlling for differences in the cost of living. At the same time the gap between these two countries is not so relevant, since Germany is only 2.5 times richer than Greece.

This huge degree of disparity raises some interesting questions. (1) Are the poorest regions growing at a rate higher than the richest, so that they are catching up? (2) Does the tendency to converge pertain to labor productivity or does it also affect per capita income? (3) Do all sectors show a similar converging process? (4) What is the process underlying the tendency to converge? More specifically, is this

[1] The degree of inequality is obviously larger if we consider all countries in the world. See Parente and Prescott (1993) for a well-documented account of disparities at the country level.

[2] I will use throughout the paper the word "region" as a common-sense proxy for the more correct "sub-national territorial unit", since we actually deal with various administrative entities.

an automatic process, driven by market conditions or are there other relevant factors – such as distributive policy measures, technological diffusion, structural change or institutions – that play an important role?

Without doubt, these are not easy questions to answer. Very often opposite theoretical and empirical findings have been provided. It is worth mentioning that there is still a large debate in the literature about the appropriate model that has to be used to address these issues (neoclassical, catching up or endogenous growth models), the statistical method (simple linear cross-section estimates, time-series, sigma-convergence or stochastic analysis of the distribution dynamics), the variables and geographical units of analysis (per capita income, labor or total productivity; world or OECD countries, states or regions).[3]

As for the European Union, so far there have been few studies on the regional growth process, mainly because of the lack of regional data. Some authors (Barro and Sala-i-Martin 1991; Sala-i-Martin 1996; Armstrong 1995; Fagerberg and Verspagen 1996) have chosen a rather limited number of countries in order to study a longer time horizon.[4] Others (Neven and Gouyette 1995; Quah 1996 b; Lopez Bazo et al. 1997) have preferred a broader territorial coverage restraining their analysis to the 1980s. It is not an easy task to compare the previous results since there are too many differences in the observational units, economic variables, data sources, and time periods. However, a broad summary of the findings is that the regional disparities seem to have diminished over the 1960s and 1970s, while over the 1980s the convergence results are less clear-cut.

The main purpose of this paper is to describe, on the basis of a new data set, the evolution of economic disparities across all regions belonging to the 12 member countries of the European Community during the 1980s. Specifically, since the findings on the growth process

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[3] To get an idea of the effort the economic profession has devoted to these topics it is sufficient to consider that during 1996 three well-known general journals have hosted special debates on the topics of growth: *Economic Journal* (July), *European Economic Review* (6), and *Empirical Economics* (1). In those contributions, the interested reader can find a comprehensive overview of the research's frontier. Moreover, several single papers have been published in almost all general journals during the last year. For a recent survey see de la Fuente (1997).

[4] Usually it has been included data for the regions of Germany, France, United Kingdom and Italy, starting from 1950. The source of these long-term data is Molle (1980). An historical overview of the economic disparities among the European regions can be found in Molle and Boeckhout (1995).

are highly affected by the proxy used to measure it, the analysis is performed in terms of per capita income and labor productivity. The first variable expresses the flow of wealth to the average citizen, while the second captures the degree of efficiency of the production system and they both provide interesting and complementary information. Moreover, I study the convergence process for the three main economic sectors and, to my best knowledge, this is the first time that it has been done at the European regional level. The sectoral analysis is very important because it highlights crucial elements, like structural change and differences in sectoral productivity, that remain unseen in the aggregate approach. The aim of this paper may appear limited, relative to the broad and complex problems that have to be answered. However, the presented systematic account of the evolution of regional disparities in the European Union is preliminary to the analysis of their causes that is left to future research.

The main results of the empirical analysis are the following. First, there has been a clear tendency for aggregate labor productivity convergence across the European regions over the 1980s. This finding is robust to various measures of dispersion. Second, per capita income does not show any tendency to converge. Over the period considered, regional dispersion has remained almost constant, so that the income differences of the European citizens are still extremely large. Third, at the sectoral level, the picture is far more complex. There is not unconditional β-convergence in agriculture, which indeed shows an increase in the regional dispersion. On the other hand, the industrial and services sectors reveal that a convergence process has occurred, while the dispersion in the distribution tends to remain constant over time.

The paper is divided in the following sections. Section II discusses two methodological issues. Section III documents the evidence of labor productivity convergence. The growth process of per capita income is analyzed in Section IV. In Section V, other measures of dispersion across European regions are presented. The convergence results at the sectoral level are discussed in Section VI. Some concluding remarks are reported in Section VII. The Appendix discusses the database in greater detail.

II. Some Methodological Issues

In this section, I discuss two crucial issues for any such growth study as this. The first has a more general content and deals with the choice of the dependent variable. The second is specifically related to

a regional analysis in Europe and refers to the correct definition of the territorial units.

1. The Choice of the Dependent Variable

The empirical literature on growth rate differentials based on Solow's model has mainly used per capita product (Barro and Sala-i-Martin 1991, 1992; Mankiw et al. 1992 among the best-known writings). Only recently there has been some attempts to use a labor productivity measure (Wolff 1994; Paci and Pigliaru 1997a). In the following, I will note that the Solow's model only predicts convergence of output per worker and I will identify which assumptions allow to use per capita output.

Let us remark resolutely that the neoclassical growth theory deals only with the output per worker variable. This is so because the relevant input in the production function is the amount of labor and not the population. However, as far as "we are assuming that full employment is perpetually maintained" (Solow 1956: 67) and, we should explicitly add, the participation rate does not change, we are allowed to use product per capita instead of labor productivity. In such a case, there is a fixed proportion between population and employees. Clearly in cross-country studies (such as the growth rate regressions) we must add the additional hypothesis that both the time-invariant unemployment and participation rates must be equal across economies. Only under these hypotheses will total employment increase at the exogenous population growth rate, making correct to use per capita output as the dependent variable in the convergence equation derived by the Solow growth model and also in other growth models based on production functions.

Needless to say, these strong hypotheses are severely violated in most cases. Certainly they do not hold with respect to the European regions.[5] As we will see in Section IV, the unemployment and the participation rates vary highly over time and across regions. Thus we must be aware that if we are interested in testing the prediction of the neoclassical growth model – or the technology gap – it is compelling to use the labor productivity variable. This does not mean that the per

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[5] It is also hard to accept that the countries in the World Bank data set have the same unemployment and participation rates. The only case where these hypotheses may hold is probably the states of the United States, due to its high level of economic integration and factor mobility.

capita income is a fruitless measure. On the contrary, it gives important information if we are interested in comparing the economic standard of living across economies with the purpose of implementing distributive policies.

What we want to stress here is that the evolution over time – and the cross-regional differences – in this income measure does not depend only on differences in the marginal productivity of capital, as it should be according to the prediction of Solow's model. The levels of per capita income and its changes are also strongly affected by the cultural and social conditions that determine the participation rates, by the institutional factors that rule the labor market, by the fiscal policy that decides on the amount of regional transfers and so forth. Per capita income is a variable much more complex than labor productivity and it cannot be fitted within the simple framework of the neoclassical growth model.

Since the two variables are so different, it is not surprising that they may give opposite results in terms of predicting the convergence process. I will present detailed econometric evidence on this point in the next two sections. Here, let me just give a simple example to illustrate this point using actual data for two economies: a large *Land* in Germany, Nordrhein-Westfalen, and a small Spanish region, Rioja. At the beginning of our story, in 1980, the labor productivity ratio between Rioja and Nordrhein is 0.89. The gap appears much higher, 0.77, if we consider per capita income. This difference mainly arises because the German worker has to sustain with his product another 1.13 persons in his Land, while the Rioja's employee has to share his product with other 1.46 persons. Let us look at the end of the period. In 1990, Rioja completed the catching-up process and the labor productivity ratio between the two regions is now equal to one. In the meanwhile, the per capita income ratio has decreased to 0.74. Again, the difference is due to a worsening of the relative conditions in the labor market of the poorer region, namely a higher unemployment and a lower participation rate. In 1990, the ratio between the non-working and working populations in Nordrhein has decreased to 0.99, while in Rioja it is still high at 1.41.

So in this very simple, but emblematic example we get a convergence story if we look at labor productivity, while we get a divergence picture using per capita income. It is my belief that both stories are interesting. The first deals with basic economic mechanisms, not necessarily and not only the Solowian ones. The second story involves other composite social, cultural, and political elements and it must be

analyzed by means of more complex models than the simple Solow mechanism.

Another relevant point to be considered is which measure should be used in the numerator of our dependent variable: gross domestic product (GDP) or value added (VA)? Again, thet answer depends on what we are looking for. Since the main differences between GDP and VA are government transfers, indirect taxes and capital rewards, we should use GDP per capita to analyze the economic wealth of the region, while VA per worker has to be preferred as the proper measure for labor productivity.[6]

2. The Choice of the Territorial Unit

The second general issue I want to discuss refers to the correct choice of the sub-national unit of analysis. This point does not seem relevant in the United States case where unambiguously the states are the proper sub-national unit to be used, given the federal organization of the country. It becomes crucial when, as in studies on the European regions, we are comparing sub-national units of countries whose constitutional bases are so different, spanning from the federal system of Germany to the very centralized government in France.

The most used source of data for regional studies in Europe is Eurostat's data bank, *Regio*, which considers four geographical levels of analysis, called NUTS (Nomenclature des Unités Territoriales Statistiques).[7] For some countries, this classification turns out to be artificial, based mainly on a statistical concern, and it fails to identify uniform regional areas in terms of economic and social elements.[8] Nonetheless, several researchers have simply picked a single dividing level (usually NUTS-2). I, however, believe that the level to be chosen is a crucial issue since our findings on the growth process are affected

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[6] I am well aware that it would be better to use hours of labor instead of number of employees, but the former variable is unavailable at the regional level. However, this approximation may not cause too much bias since, due to the European Community's legislation, weekly labor hours are quite similar across the European countries.

[7] Starting from the more aggregate territorial unit, and limiting the analysis to the twelve members of the European Union over the 1980s, the *Regio* data bank reports the following groups: NUTS-0: European Community Countries (12 units); NUTS-1: European Community Regions (71); NUTS-2: Basic Administrative Units (183); NUTS-3: Subdivisions of Basic Administrative Units (1044).

[8] For instance, NUTS-2 for the United Kingdom and Denmark has been defined only for Eurostat use and it has no relationship with the actual administrative organization of the countries. The same happens for NUTS-1 in Greece and Italy.

by the way the observations are selected. Therefore, following the advice of various national statistical offices we have picked for each country a sub-national unit with an acceptable degree of economic homogeneity and, possibly, some sort of administrative and policy functionality. Moreover, we have tried to set up our database to represent evenly the northern and southern European regions. This is an important feature since if the north is over-represented in the data set, as it actually is in most other studies (Barro and Sala-i-Martin 1991; Neven and Gouyette 1995; Fagerberg and Verspagen 1996) the analysis of the convergence process may be biased. We have selected the following 109 territorial units (the complete list is reported in the Appendix): NUTS-0 (countries) for Denmark, Luxemburg, Ireland; NUTS-1 for Belgium (3 Régions), Germany BR (11 Länder), Netherlands (4 Landsdelen), United Kingdom (11 Standard regions); NUTS-2 for Italy (20 Regioni), France (22 Régions), Spain (17 Comunidades Autònomas), Portugal (5 Comissaoes de Coordenaçao Regional), Greece (13 Development regions).

For these regions, we have series on gross domestic product, population, value added and employees. The last two variables are divided into the three main sectors – agriculture, industry, and services – and this important feature allows to analyze the convergence process at the sectoral level.

Whereas our database is comprehensive as far as geographical coverage is concerned, the temporal span is limited to the period 1980–1990. Actually, there is a trade-off between geographical and temporal coverage since for several countries such as Portugal, Greece, and Spain there are no official regional data available before the 1980s. Moreover, we must be very cautious in using regional data back to the 1950s and 1960s since the congruity over time of these series is far from being demonstrated.[9] Although short, the period under analysis is quite interesting because, with the entrance of Greece in 1981 and Spain and Portugal in 1986, the European Community embraced economies with very different income and productivity levels and economic structures so that the prospect for a reduction of regional disparities became even a more compelling issue.

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[9] For instance, the series on Italian regions used by Barro and Sala-i-Martin (1991) is highly inconsistent and leads to biased results as shown by Mauro and Podrecca (1994).

III. Convergence in Labor Productivity

We begin our analysis with a geographical portrait of the growth process. Figure 1 shows the annual average growth rate of labor productivity over the 1980–1990 period for the 109 European territorial units we have identified. We have grouped our regions in four clusters, splitting them around the Community's average growth of 2.04 percent. At a first glance, it seems that the country effects are predominant (this feature of the European growth process has been

Figure 1 – *Labor Productivity Average Growth in the European Regions*
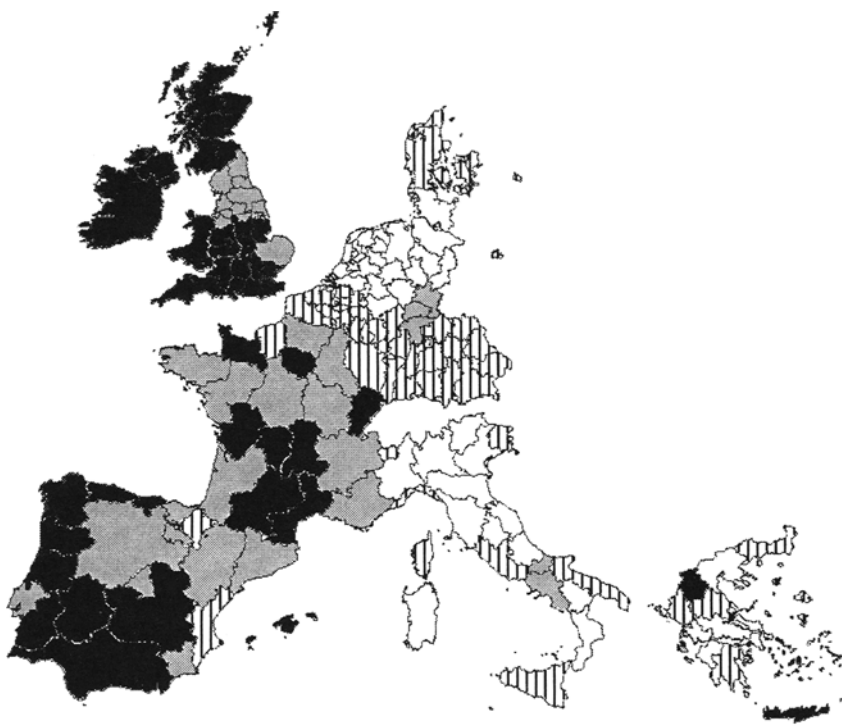
☐ g < 1.6 ||| 1.60 ≤ g < 2.04   ▨ 2.04 ≤ g < 2.6   ■ g ≥ 2.6

Note: g = value added per worker, percentage annual average growth rate 1980–1990
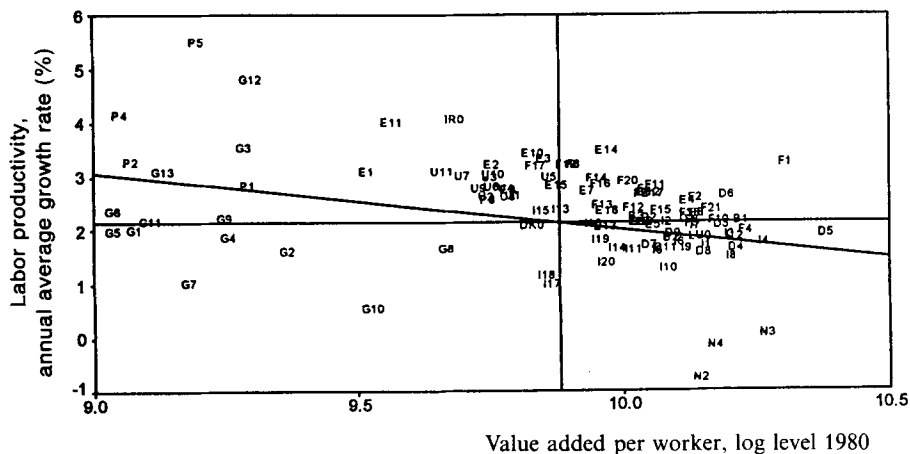European Community average = 2.04.

remarked by Molle 1980). Most regions within each country appear either below or above the European Community average. In the first group we find Germany, Italy, and the Netherlands; in the second France, Spain, and Great Britain. Only Greece shows a broader regional variance in the growth rates. Another remarkable element is that over the 1980s the west-east differential of growth rates seems more prominent than the expected north-south one.

The recent empirical studies of β-convergence have tried to explain the growth differentials in terms of initial conditions. From a Solow model with Cobb–Douglas technology and exogenous saving rates and technological progress, the unconditional convergence process can be described by the following linear equation:

$$(1/T) \log(y_{it}/y_{i,t-T}) = a + b \log(y_{i,t-T}) + u_{it}.$$

However, it has now been accepted that the existence of a negative and significant coefficient for the initial conditions, that is an unconditional β-convergence process, is compatible with both neoclassical and technological diffusion models (Sala-i-Martin 1996). In other words, there is an observational equivalence in the results of the two models and more research is required to assess what underlines the convergence mechanism: decreasing returns to capital or technological catching up. Moreover, if the aggregate framework is abandoned in favor of a more realistic multisectoral approach, as in Paci and Pigliaru (1997a), then it has been shown that the observed process of aggregate convergence can hide important structural change phenomena. Finally, several contributions (Bernard and Durlauf 1996; Quah 1996a; Galor 1996) have demonstrated that conditional convergence results can mask the presence of the multiple locally-stable convergence clubs predicted by various endogenous growth models. Therefore in what follows, I will use the simple cross-sectional linear estimates as a way of documenting the growth process, without trying to use them as evidence in favor of a particular analytical model.

An effective representation of the convergence process is presented in Figure 2 where, for each region, the average productivity growth rate is plotted against its initial value. It can be noted that there is a weak tendency to converge across the European regions over the 1980–1990 period. Regions with a lower productivity level in the initial year have grown faster than the richer ones. Again, it is possible to detect some country-specific clusters of regions, Greece and the Netherlands are the most clear examples. This suggests that the productivity growth processes in those regions are not only influenced by

Figure 2 – *Labor Productivity Convergence across European Regions 1980–1990[a]*

Value added per worker, log level 1980

[a] Internal axes set at the European Community averages.

Table 1 – *Labor Productivity Convergence across European Regions*

	Regr. 1	Regr. 2	Regr. 3
Constant	0.125 (5.05)	0.125 (3.93)	0.200 (8.21)
Log productivity 1980	−0.011 (−4.19)*	−0.010 (−3.31)*	−0.017 (−7.23)*
Dummy "south"		0.000 (0.022)	
R^2 adj.	0.14	0.12	0.65
F-test	17.5	8.69	34.0

Note: Dependent variable: value added per worker, annual average growth rate 1980–1990. – Estimation method: OLS; number of observations: 109; t-statistics in parentheses; level of significance: * = 1 percent. – Regr. 3 includes significant national dummies for the Netherlands (−), Greece (−), Italy (−), Spain (+), and France (+).

the initial conditions but are also affected by other factors that are specific to each country.

The regression results reported in Table 1 confirm these findings. In regression 1 the log of the initial productivity level turns to be negative and significant, showing that a process of unconditional convergence has occurred across the European regions over the 1980s.

However, this process appears to be quite slow since the speed of convergence is about 1.2 percent per year and the explanatory power of the regression is low (R^2adj. $= 0.14$).

The standard procedure in the convergence studies is to add some additional explanatory variables to control for differences across economies (like institutions, policies and spatial eternalities) other than the initial productivity level. The most simple way that I follow in this study is to add some dummy variables for different groups of regions. Of course, a more complete analysis will require the explicit definition of these control variables and their inclusion in the convergence equation.

A stylized fact of the European development is the existence of a gap between north and south. As a matter of fact, most of the European Community resources devoted to regional policy have been directed to the southern regions.[10] Therefore in regression 2 a dummy for the southern European regions is included to control for their lower development level (capital, technology, infrastructures, etc.). However, the dummy "south" turns out to be not significant. This means that over the 1980s regional growth in southern Europe as a whole was not characterized by specific factors that are not already explained by the initial productivity level. Interestingly, the econometric results do not change if we replace the dummy "south" with a dummy defined for the "Objective 1" regions.

In the previous figures, we found some hints of country-specific regional behavior, therefore we have included in our equation a set of national dummies. In regression 3 only the significant dummies are reported, based on the t-test. The main result is that a process of β-convergence still characterizes the European regional growth, since the initial productivity level is negative and significant. At the same time the significance of several national dummies implies that some groups of regions are growing along a country-specific path toward their steady state. In other words, both a global European and some local convergence processes have taken place. More specifically, it appears that regions in Greece, the Netherlands, and Italy are converg-

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[10] The southern region group includes all regions in Greece, Spain, Portugal, and the Italian eight Mezzogiorno's regions. The most relevant policy measures of the European Union are directed to the "Objective 1" regions which grossly correspond to the southern regions, the main differences being the exclusion of seven Spanish regions and the inclusion of Ireland and Corse. However, there are other regional policies in favor of rural and industrial declined areas. The regional policies of the European Community are examined, among others, by Molle (1994), Dignan (1995), and CEC (1996).

ing along a path that is lower than the European Community average, while the opposite happens for the French and Spanish regions.

As we have already stressed in the Introduction, this outcome is compatible with both a neoclassical growth model with diminishing returns to capital, with endogenous growth models characterized by the presence of multiple convergence equilibria, and with technology-gap models with a slow rate of technological diffusion. Moreover, before reaching any conclusion on the mechanisms that have led to the convergence results at the aggregate level we must consider explicitly the process of structural change within the economies. As we made clear above, it is beyond the limited scope of this paper to interpret the empirical results as evidence in favor of a particular theoretical model.

IV. Convergence in Per Capita Income

We must be aware that the previous evidence in favor of productivity convergence does not mean that there is more equality in the standard of living of the European population. As we have shown with an example in Section II, it is possible to reach even the opposite outcome, divergence, when looking at the evolution of per capita income. Let us then discuss the econometric results reported in Table 2. The initial value of income per capita is never significant, neither in the unconditional (regr. 1) nor in the conditional convergence equations (regr. 2 and 3 with south and national dummies, respectively).

Table 2 – *Income Per Capita Convergence across European Regions*

	Regr. 1	Regr. 2	Regr. 3
Constant	0.056 (2.93)	0.022 (0.70)	0.035 (1.88)
Log GDP per capita 1980	−0.004 (−1.85)	−0.000 (−0.09)	−0.001 (−0.69)
Dummy "south"		0.003 (1.32)	
R^2 adj.	0.02	0.03	0.15
F-test	3.40	2.59	6.32

Note: Dependent variable: GDP per capita, annual average growth rate 1980–1990. – Estimation method: OLS; number of observations: 109; t-statistics in parentheses. – Regr. 3 includes significant national dummies for the Netherlands (−), and France (−).

Table 3 – *Measures of Labor Market Dispersion
across European Regions*

	Max.	Min.	St. dev.
	percent		
Participation rate			
1983	64.4	42.9	5.1
1990	67.4	42.3	5.4
Employment rate			
1983	96.7	77.5	4.0
1990	98.4	73.9	5.1

As far as the per capita income is concerned the European regions are
not converging toward a common steady-state level, and neither are
they converging along national or southern European paths. These
results are in sharp contrast with those of the previous section regard-
ing labor productivity. As I will show below, the reasons for this
difference depend mainly on the labor market and on demographic
elements.

Some measures of labor market differences across the European
regions are reported in Table 3. The participation rate shows a high
degree of variation, spanning in 1990 from a maximum of 67 percent
in Denmark to a minimum of 42 percent in the Greek region of Voreio
Aigaio. The regional differences are also very high in terms of employ-
ment rate. The highest employment rate is 98.4 percent in Luxemburg,
while the lowest rate is 73.9 percent in Andalucia, Spain. In general,
the richer and initially more productive regions of northern Europe
show higher participation and employment rates than the poorer
southern European regions. Even more important for the convergence
process is the change in the dispersion over time. In the period 1983–
1990, the standard deviation increased from 5.1 to 5.4 for the partic-
ipation rate and from 4.0 to 5.1 for the employment rate.

There are social, cultural, religious and economic elements that
determine these huge cross-regional differences. Some of them are the
natural birth rate, the net immigration rate, the age composition of the
population, the women's entry in the labor market, the structural
composition of the economy, and the degree of regional asymmetry in
the business cycle. It goes far beyond the aims of this paper to inves-
tigate these issues. I want only to stress here that these complex

elements have to be included into the analysis to account for the absence of a convergence process in terms of per capita income. Moreover, it is important to remark that the different results of the convergence process in terms of income per capita and labor productivity represent a crucial issue for the European Union's policymakers whose aim is to endorse income equality across member States and not only to ensure the competitive conditions necessary for productivity convergence across economies.

V. Other Measures of the Growth Process

In this section, I present additional measures of dispersion that may help in highlighting other aspects of the growth process. Another widely used indicator is the σ-convergence, calculated as the standard deviation of the log levels over time, which studies how the cross-regional dispersion of some economic variables evolves over time. Although σ- and β-convergences illustrate different phenomena, they are related since absolute β-convergence is a necessary but not a sufficient condition for σ-convergence (Sala-i-Martin 1996). That is, we may have high intra-distribution mobility that leads to β-convergence but still it does not generate a reduction in the distribution dispersion itself.

In Figure 3, as expected, there is no evidence of a decrease in the cross-regions dispersion of the per capita income. The standard deviation remains almost constant over the 1980s. Further, considering

Figure 3 – *Sigma Convergence across European Regions*
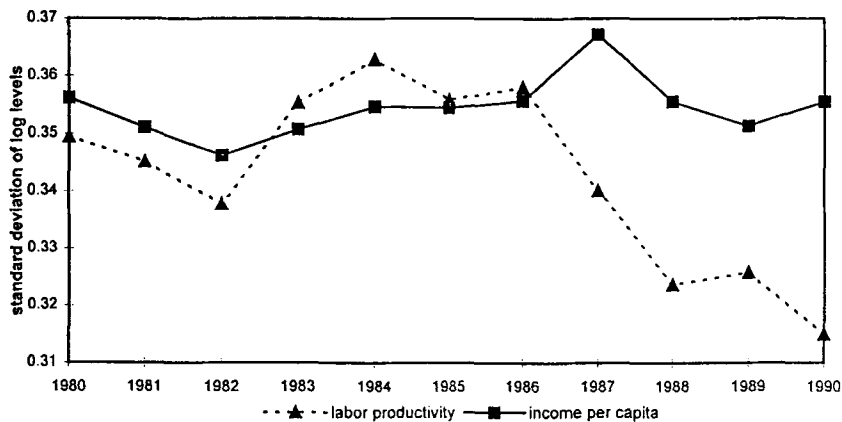
labor productivity we can again observe that the dispersion across the European regions decreases. In particular, it is worth noting that most of the reduction in labor productivity dispersion occurred after 1986 when Spain and Portugal fully joined the European Community. It appears that a stronger integration and trade liberalization have helped the process of convergence across the regional production systems. However, the productivity convergence process seems to have been achieved at the cost of increasing unemployment, hence widening the income disparities across the European regions.[11]

Additional insight on the phenomenon can be obtained by looking at the evolution of the entire distribution (Figure 4) and at other descriptive measures of dispersion (Table 4). For per capita income, it appears that the entire distribution is almost identical in 1980 and 1990. Moreover, the bottom-top ratio indicates a divergence pattern between the poorest and the richest group of regions in the distribution. As for the labor productivity the decrease in the dispersion which we detected in the aggregate distribution is mainly due to a convergence process that has taken place among the middle-ranking regions, while the dispersion between the extreme tails of the distribution has not significantly decreased over the 1980s.

VI. Sectoral Convergence

The debate on convergence, especially at the regional level, has almost exclusively focused on aggregate output movements, neglect-

Table 4 – *Measures of Dispersion across European Regions*

	Max.	Min.	St. dev.	Bottom-top ratio
	(index EU = 100)			(10 regions)
Labor productivity				
1980	145	38	0.349	0.320
1990	148	37	0.315	0.335
Income per capita				
1980	197	35	0.356	0.286
1990	192	34	0.356	0.279

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[11] The adjustments of regional labor markets to external shocks are analyzed by Abraham and Van Rompuy (1995) for a selected sample of European regions. Their findings cast serious doubts on the ability of regional labor markets to absorb rising regional unemployment.

Figure 4 – *Distribution Patterns across European Regions*

—— 1980   ------ 1990

Labor productivity
(st.dev: 1980 = 0.349 , 1990 = 0.315)

Income per capita
(st.dev: 1980 = 0.356 , 1990 = 0.356)
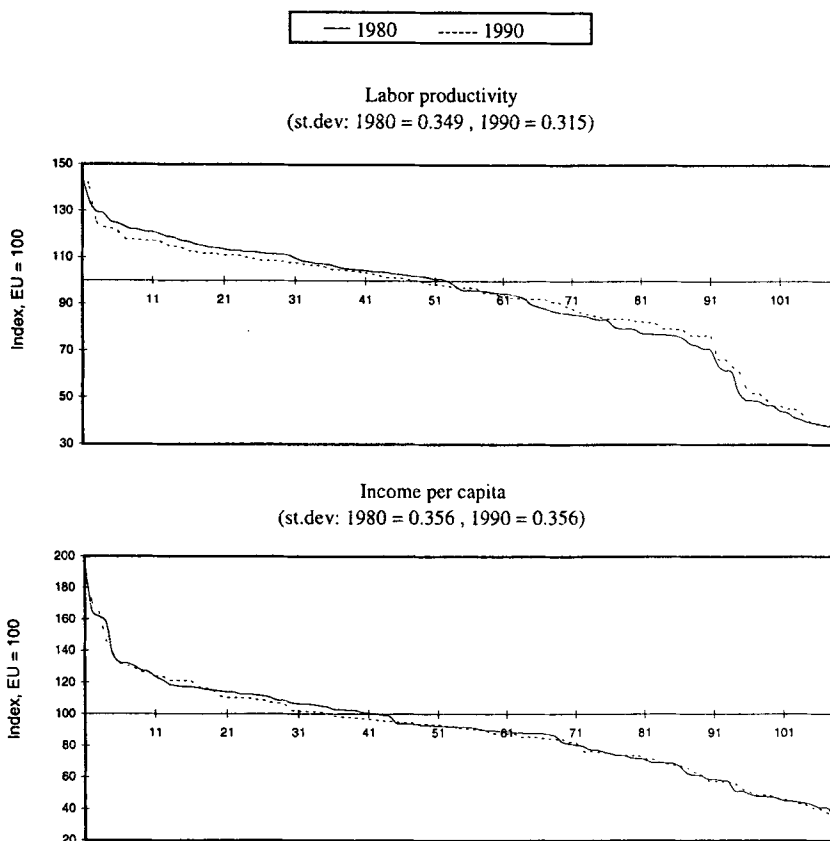
ing productivity disparities at the sectoral level. This feature, probably due to a lack of sectoral regional data, represents a serious drawback for a complete interpretation of the growth processes. In fact, the specialization of the production system at the regional level is very pronounced so that the aggregate growth patterns are highly affected by the structure of the economy and its changes. Among the few papers that have investigated the convergence process at the sectoral level it is worth mentioning Bernard and Jones (1996 a) on the states of the United States, Bernard and Jones (1996 b) and Wolff (1994) for the OECD countries, and Paci and Pigliaru (1997 a, 1997 b) on the Italian and European regions. These studies have shown how the convergence path is highly differentiated among various economic

activities: some sectors exhibit convergence while others display an
increase of the dispersion. Moreover, it has been stressed that the
convergence often observed at the aggregate level may result from a
process of structural change with the shares of less productive sectors
(i.e. agriculture) declining faster in the initially poorer economies.

Taking advantage of our data set, I examine in this section the
labor productivity levels and growth rates across the European re-
gions for the three main economic sectors: agriculture, industry, and
services. From Table 5 we can see that the highest degree of regional
productivity dispersion is shown in agriculture. The most productive
region in agriculture (Champagne in France) is 14 times more produc-
tive than the least one (Norte in Portugal), and the gap has broadened
over the 1980s. The productivity levels appear more uniform in indus-
try and services; for both sectors the average degree of dispersion
(measured by the standard deviation) is lower than at the aggregate
level. This means that the relatively higher source of aggregate re-
gional dispersion comes from the agriculture sector.

Figure 5 shows the evolution of labor productivity dispersion for
the three sectors over time. As we have already stressed there is an
increase in the agricultural dispersion, the differences between the
most and the least productive regions have widened over the 1980s.
Moreover, in the industrial and services sectors the degree of disper-
sion turns out to be almost constant over the period. This result
contrasts with the aggregate σ-convergence previously presented. I will
return to this point in the last section.

Table 5 – *Measures of Sectoral Labor Productivity Dispersion
across European Regions*

	Max.	Min.	St. dev.
	(index EU = 100)		
Agriculture			
1980	284	30	0.454
1990	356	25	0.521
Industry			
1980	149	36	0.300
1990	151	31	0.290
Services			
1980	134	44	0.275
1990	141	39	0.264

Figure 5 – *Sectoral Sigma Convergence across European Regions*

    — ◆ - · Agriculture · · ■ - ·Industry ——▲——Services
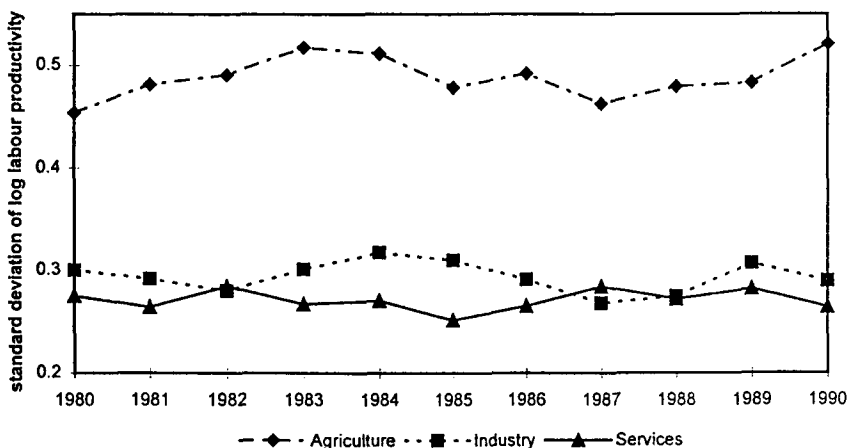
    The econometric estimates for the sectoral β-convergence are re-
ported in Table 6. In agriculture, there is no evidence of an absolute
convergence; the coefficient of the initial productivity level, although
negative, is not statistically different from zero. However, if we con-
trol for omitted variables that may influence the sectoral growth
process through the inclusion of southern and national dummies
(regr. 2 and 3), the initial productivity level becomes significant. It
means that local convergence processes have occurred in agriculture
over the 1980s. The southern European regions are converging toward
a steady-state equilibrium level that is lower than the European aver-
age. Moreover, when the national dummies are included, negative and
significant coefficients appear for Portugal, Greece, Spain, Italy and,
more puzzling, Germany.[12] It should be stressed that many regions in
Greece and Portugal still present a labor share in agriculture higher
than 40 percent. Clearly, it means that in southern Europe there is
hidden unemployment that determines huge differences in labor pro-
ductivity.
    The industrial sector is characterized by global and local conver-
gence over the 1980s. The explanatory power of the regression with
the national dummies is rather good and the catching-up speed is

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[12] The plot shows that the negative and significant coefficient for the dummy "Ger-
many" is mainly due to the bad performance of Berlin and Bremen.

Table 6 — *Sectoral Productivity Convergence across European Regions*

	Regr. 1	Regr. 2	Regr. 3
	A. Agriculture		
Constant	0.085	0.212	0.282
	(1.43)	(3.07)	(4.45)
Log productivity 1980	−0.006	−0.019	−0.025
	(−0.99)	(−2.62)*	(−3.81)*
Dummy "south"		−0.022	
		(−3.24)*	
R^2 adj.	0.009	0.082	0.30
F-test	0.98	5.80	8.80
	B. Industry		
Constant	0.175	0.249	0.238
	(3.84)	(4.77)	(4.22)
Log productivity 1980	−0.016	−0.023	−0.021
	(−3.42)*	(−4.40)*	(−3.57)*
Dummy "south"		−0.008	
		(−2.69)*	
R^2 adj.	0.09	0.14	0.44
F-test	11.7	9.82	13.3
	C. Services		
Constant	0.132	0.143	0.198
	(3.65)	(3.49)	(5.05)
Log productivity 1980	−0.011	−0.013	−0.018
	(−3.15)*	(−3.07)*	(−4.63)*
Dummy "south"		−0.001	
		(−0.59)	
R^2 adj.	0.085	0.071	0.52
F-test	9.94	5.12	24.6

Note: Dependent variable: sectoral labor productivity, annual average growth rate 1980–1990. – Estimation method: OLS; number of observations: 109; t-statistics in parentheses; level of significance: * = 1 percent. – Regr. 3 includes significant national dummies: agriculture: Germany (−), Spain (−), Greece (−), Italy (−), and Portugal (−); industry: Germany (−), Spain (−), France (−), Greece (−), Italy (−), and the Netherlands (−); services: Spain (−), France (−), Greece (+), and the Netherlands (+).

around 1.7 percent per year. Finally, the services sector shows a negative and significant coefficient for the initial productivity level. The dummy "south" is irrelevant, while some national convergence patterns turn out to be significant (above the average for Spain and France and below for the Netherlands and Greece) giving a good explanatory power to the regression. The convergence speed in services appears slower (1.2 percent) than in the industrial sector.

VII. Concluding Remarks

This paper has explored economic growth in European regions from various perspectives, using several statistical techniques. As preliminary point, I have discussed the definition of the dependent variable in convergence studies: labor productivity or per capita income. I argued that only the first variable should be used to test the convergence hypothesis within those models that deal with the functioning of the aggregate production function, including neoclassical, technology gap and endogenous growth formulations. On the other hand, the analysis of the growth process in terms of income per capita is more appropriate if we are interested in comparing the economic standard of living across economies and in considering the need for distributive regional policies.

The first result of the empirical analysis shows that there has been a clear process of aggregate labor productivity convergence across the European regions over the 1980s. This finding is robust to the various measures of dispersion that have been used. Moreover, the catching-up process appears stronger in the second part of the 1980s when there was an increase in the trade liberalization due to the inclusion of other southern members in the European Community. The dispersion of the aggregate distribution is mainly due to the middle-rank regions while the extreme tails of the distribution show a slight increase in dispersion. As we have already stressed, these empirical outcomes are compatible with different theoretical models.

At the sectoral level, the story is far more complex. Agriculture, which is still a very large sector in several southern European regions, does not show unconditional β-convergence. Indeed it exhibits an increase in regional dispersion over time. On the other hand, industry and services reveal convergence in productivity levels, although the dispersion in the distribution has remained constant over time.

The picture completely changes when looking at the growth process in terms of income. In this case, we have found no evidence of a

convergence process across the European regions. All statistical techniques emphasize that over the 1980s income per capita dispersion has not decreased, leaving regional income inequality at the beginning of the 1990s at the level it was a decade before.

In order to interpret these opposed outcomes we need theoretical models that are much more complex than those so far proposed in the literature. We should indeed combine neoclassical mechanisms, technological diffusion and spillovers, sectoral composition and its change within the economy, the spatial effects of production localization, regional differences in institution, culture, social norms, and the role of public policies. This list is so extensive and troublesome that it cannot even be indicated as a future research program.

Therefore, here I just link together partial explanations. The evidence in favor of productivity convergence is sufficiently clear. This process has taken place in the two largest sectors and it is confirmed at the aggregate level. Only in agriculture, the survival in the southern European regions of inflated primary sectors have prevented a global convergence process. Again, we cannot say whether convergence is the result of diminishing returns to capital or of a technological diffusion mechanism or even of active industrial policies. Considering the changes in dispersion over time, the movements of labor forces across different sectors of the economy may generate a reduction of the dispersion at the aggregate level without affecting the sectoral patterns. As a matter of fact, during the 1980s in several European regions there has been a deep change in the sectoral labor shares from agriculture to industry and services. As we have pointed out, agriculture is characterized by the highest degree of regional disparities in the productivity levels. Thus, the change in the relative shares from high- to low-dispersion sectors is compatible with the σ-convergence found at the aggregate level associated with stability in the sectoral dispersion. At the same time, we should be aware that often this change in the sectoral composition, especially in the southern European regions, is not accompanied by an actual sectoral shift of labor forces and thus by an increase in the absolute number of employees in industry and services. This phenomenon is one of the factors that explain the substantial increase of labor productivity in industry and services among the initially less efficient regions and thus the intra-distribution mobility that leads to β-convergence in these sectors. More crucially, the expulsion of labor force from agriculture may lead to an increase of the unemployment rate and a decrease in labor participation. As we have already stressed, these elements have a clear negative effect on

the population's wealth and are one of the causes of the lack of convergence in per capita income. One of the effects of the closer integration between the European economies, magnified at the regional level, seems to be a larger similarity in productivity levels of the economies reached at the cost of diminishing employment opportunities in the poorer regions.

In conclusion, European workers are becoming more similar – the productivity differences are falling – but European citizens are becoming less equal – the disparities in per capita income are not diminishing. The first trend may be considered a happy-end story with several leading characters: diminishing returns to capital, increasing openness, technological diffusion, structural change, and industrial policies. The second story, more similar to a drama, tells us that the European Union and the national governments have much more work to do, and not only on the economic grounds, to help the poorer regions increase the standards of living of their population. This is exactly what the 1.4 (less equal) fellows of the Rioja's (more similar) workers are asking for.

Appendix

The appendix describes in detail the database assembled at CRENoS, analyzing the geographical span, the variables, and their source. The database is available at the Internet address: www.crenos.unica.it.

A. The geographical coverage

The 109 territorial units in our database are:

B	Belgium	DK	Denmark
B1	Bruxelles-Brussel		
B2	Vlaams Gewest	E	Spain
B3	Region Wallonne	E1	Galicia
		E2	Asturias
D	Germany	E3	Cantabria
D1	Baden-Württemberg	E4	País Vasco
D2	Bayern	E5	Navarra
D3	Berlin	E6	Rioja
D4	Bremen	E7	Aragon
D5	Hamburg	E8	Madrid
D6	Hessen	E9	Castilla-León
D7	Niedersachsen	E10	Castilla-La Mancha
D8	Nordrhein-Westfalen	E11	Extremadura
D9	Rheinland-Pfalz	E12	Cataluna
D10	Saarland	E13	Comunidad Valenciana
D11	Schleswig-Holstein	E14	Baleares

E15	Andalucia		F4	Haute-Normandie
E16	Murcia		F5	Centre
E17	Canarias		F6	Basse-Normandie
			F7	Bourgogne
G	Greece		F8	Nord-Pas-de-Calais
G1	Anatoliki Makedonia, Thraki		F9	Lorraine
G2	Kentriki Makedonia		F10	Alsace
G3	Dytiki Makedonia		F11	Franche-Comté
G4	Thessalia		F12	Pays de la Loire
G5	Ipeiros		F13	Bretagne
G6	Ionia Nisia		F14	Poitou-Charentes
G7	Dytiki Ellada		F15	Aquitaine
G8	Sterea Ellada		F16	Midi-Pyrénées
G9	Peloponnisos		F17	Limousin
G10	Attiki		F18	Rhône-Alpes
G11	Voreio Aigaio		F19	Auvergne
G12	Notio Aigaio		F20	Languedoc-Roussillon
G13	Kriti		F21	Provence-Alpes Côte d'Azur
			F22	Corse
IR	Ireland			
			LU	Luxemburg
I	Italy			
I1	Piemonte		N	The Netherlands
I2	Valle D'Aosta		N1	Noord-Nederland
I3	Liguria		N2	Oost-Nederland
I4	Lombardia		N3	West-Nederland
I5	Trentino-Alto Adige		N4	Zuid-Nederland
I6	Veneto			
I7	Friuli-Venezia Giulia		P	Portugal
I8	Emilia Romagna		P1	Norte
I9	Toscana		P2	Centro (P)
I10	Umbria		P3	Lisboa e Vale do Tejo
I11	Marche		P4	Alentejo
I12	Lazio		P5	Algarve
I13	Campania			
I14	Abruzzi		U	United Kingdom
I15	Molise		U1	North
I16	Puglia		U2	Yorkshire and Humberside
I17	Basilicata		U3	East Midlands
I18	Calabria		U4	East Anglia
I19	Sicilia		U5	South East (UK)
I20	Sardegna		U6	South West (UK)
			U7	West Midlands
F	France		U8	North West (UK)
F1	Île de France		U9	Wales
F2	Champagne-Ardenne		U10	Scotland
F3	Picardie		U11	Northern Ireland

The choice of the country level for Ireland is due to the lack of data at sub-national levels. We have excluded from our database the following units, since they are peripheral territories far away from the homeland and with peculiar economic conditions not comparable to

the rest of the country: the Département d'outre-mer (Guadalupe, Martinique, Guyana Française and Réunion) of France; the African dominion (Ceuta and Melilla) of Spain; the Atlantic Ocean islands (Açores and Madeira) of Portugal. Moreover, we have excluded the Groningen's country in the Netherlands since it accounts for the entire national North Sea oil revenues and therefore its productivity level is highly dependent to the international oil price movements. Finally, we have not included the Eastern German Länder since they were not members of the European Community during the period considered.

B. The variables

For the whole sample of 109 regions and for the years 1980–1990, we have collected the following variables: gross domestic product, value added, population, employees. All monetary variables are expressed in purchasing power parity (PPP) terms and at constant 1985 prices. One of the most important features of our database is that value added and employees series are also split in the three main economic sectors: agriculture, industry, and services.

The basic data source is *Regio* but since it exhibits many missing observations we have collected data from several statistical yearbooks and directly from the national statistical offices. The specific data sources (only when different from *Regio*) are reported below for each variable.

Gross domestic product. UK: our estimates are based on Central Statistical Office special update of gross value added for the whole period. Italy: Istat new regional accounts, covering the whole period. France: National Statistical Office, 1982–1990. Germany: Yearbook of National Statistical Office for the whole period.

Value added. UK: Central Statistical Office special update of gross value added (1980–1990). Italy: Istat new regional accounts (1980–1990). The national statistical offices have provided data for: the Netherlands (1988–1990), Germany (1980–1990), Denmark (1988–1990), Belgium (1980–1990), Spain (1980–1990), Portugal (1980, 1986–1990). Greek regions (1989–1990) have been estimated from the national value. For Denmark, Greece, and the UK value added is calculated at factor cost.

Employees. The national statistical offices have directly provided data for: Germany (1980–1990), France (1981–1990), Belgium (1980–1990), Spain (1980–1990), Greece (1988–1990). Italy: Istat new regional accounts (1980–1990). Denmark (1990) and Portugal (1990): Eurostat Statistical Yearbook. UK (1980) and the Netherlands (1986):

Eurostat National Accounts Yearbook. Greece (1980–1981): European Commission, Portrait of the Regions. Greek regions (1982–1987) have been estimated from national values.

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Abstract: More Similar and Less Equal: Economic Growth in the European Regions. – This paper examines the growth process of 109 European regions using a new data base. Applying various statistical tools, it concentrates on per capita income and labor productivity. The main results are the following: There has been a clear process of aggregate productivity convergence across the European regions over the 1980s. At the sectoral level, there has not been convergence in agriculture, while the industrial and services sectors show β-convergence. Most crucially, the regional dispersion in per capita income has remained almost constant so that the differences in wealth conditions of the European citizens are still extremely high.   JEL no. O40, O41, R11

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Zusammenfassung: Ähnlicher und weniger gleich. Wirtschaftswachstum in den europäischen Regionen. – Der Verfasser untersucht den Wachstumsprozeß von 109 europäischen Regionen unter Verwendung einer neuen Datenbasis. Er benutzt verschiedene statistische Maße, insbesondere das Pro-Kopf-Einkommen und die Arbeitsproduktivität. Die Hauptergebnisse sind: Bei der aggregierten Produktivität hat es zwischen den europäischen Regionen in den achtziger Jahren einen klaren Konvergenzprozeß gegeben. Auf Sektorebene gab es bei der Landwirtschaft keine Konvergenz, während der Industrie- und Dienstleistungssektor eine β-Konvergenz aufwies. Bemerkenswert ist aber, daß die regionale Verteilung des Pro-Kopf-Einkommens fast gleich geblieben ist, so daß die Unterschiede in den Wohlstandsbedingungen der europäischen Bürger immer noch extrem groß sind.