



INSTITUTO UNIVERSITARIO  
de Análisis Económico y Social



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## New regional convergence in productivity and productive structure.

Application to european southern countries

*Andrés Maroto Sánchez  
Juan Ramón Cuadrado Roura*

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## NEW REGIONAL CONVERGENCE IN PRODUCTIVITY AND PRODUCTIVE STRUCTURE. APPLICATION TO EUROPEAN SOUTHERN COUNTRIES

### ABSTRACT:

Diverse approaches have been used to analyse the hypothesis of convergence between European regions. This paper is particularly focused on productivity trends and the effects of changes in regional productive structures, which seems to be the main source of the observed productivity convergence. The crucial mechanism explaining this last process (labour apparent productivity) is the transfer of labour from the less productive activities to the most ones, a fact that has been particularly important in the poorest regions. The apparent exhaustion of this process runs in parallel to the progressive end of regional convergence in income per capita. So convergence of productive structures seems to be the factor explaining the apparent contradiction between the observed convergence of aggregate productivity levels and the absence (or clear reduction) of productivity convergence within the different sectors. The analysis intends to show that the convergence process is probably exhausted through this way. The core point of the paper is sigma convergence in GDP approach as well as the productive structure convergence. The paper takes as a reference those regions included in five European Mediterranean countries (Spain, France, Italy, Greece and Portugal), but it always compare with the aggregate behaviour in the EURO zone. Data base used come from the *European Regional database by Cambridge Econometrics*, and the time period ranges from 1980 to 2006.

**KEY WORDS:** Regional convergence; Productivity; Productive Structure

**JEL:** R11, R23, O40

### RESUMEN:

La convergencia entre países y regiones en Europa es uno de los temas que mayor interés y estudio han recibido en los últimos años. Este documento de trabajo se centra en uno de los aspectos relacionados con la convergencia: el papel de la productividad y los cambios en la estructura productiva. Uno de los mecanismos que favorecen la convergencia en productividad laboral es la transferencia de recursos desde sectores poco productivos a aquellos más dinámicos, sobre todo en las regiones más atrasadas. En los últimos años parece observarse una aparente pérdida de dicho mecanismo, lo que se ha traducido en un progresivo declive de la convergencia regional en renta per capita. Por tanto, la convergencia en la estructura productiva parece ser uno de los factores explicativos de la aparente paradoja entre la convergencia en niveles de productividad agregada y la ausencia (o al menos reducción) de la convergencia en productividad a nivel sectorial. El trabajo trata de mostrar cómo la convergencia regional en algunos países europeos parece haberse acabado, al menos a través de dicha vía del cambio estructural. Para ello se utiliza la sigma convergencia, tomando como referencia las regiones incluidas en cinco países del Sur de Europa (España, Francia, Italia, Grecia y Portugal), y tomando como referencia el comportamiento medio de la zona Euro. La fuente estadística utilizada es la *European Regional database de Cambridge Econometrics*, y el período analizado abarca desde 1980 hasta 2006.

**PALABRAS CLAVE:** Convergencia regional; Productividad; Estructura productiva

**JEL:** R11, R23, O40

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## 1. INTRODUCTION

Regional convergence is actually a principle of the European Regional Policy, included nowadays under the umbrella of the 'wider and more diffuse concept of 'economic and social cohesion'<sup>1</sup>. Regional economic convergence is also one of the topics which have received particular attention by the economists, both from a theoretical and analytical point of view. Apparently, such interest started in the 1990s., mainly after the introduction of concepts such as ' $\sigma$  convergence', ' $\beta$  convergence', 'convergence clubs' and others. But, their deep roots can be found at least in the 1960s., when Easterlin (1960), Borts (1960), Borts and Stein (1964) and Siebert (1969), forecast a regional convergence process at the long run, departing from a neoclassical approach. As it is well known, this had not been accepted previously by authors like Myrdal (1957) or Hirschman (1958), underlying the role of market forces and the trends to spatial concentration of production, or later on by Clark, Bradley and Wilson (1969) introducing the concept of the economic potential favouring the central regions.

The debate came out again at the end of the 1980s., mainly through additional contributions supported by the same neoclassical model on the expected evolution of productivity and the income per capita by countries and/or regions (Abramovitz, 1986; Baumol, 1986; Baumol and Wolff, 1988; Dowrick and Nguyen (1989) and others). Nevertheless, the 1990s. has surely been the richest period in terms of contributions – both theoretical and empirical – to the convergence / non-convergence debate. Barro and Sala-i-Martin (1991, 1992 and 1995) have pushed the interest on the problem and a long list of authors has made new contributions to extend this debate. At the end, two great schools can be differentiated: the school of convergence (territorial disparities will tend to be reduced or even to disappear at the long run) and the school of divergence (disparities may continue to exist, due not only to market forces but to some elements shown by the endogenous growth theories too). Additionally, some authors (Chatterji, 1993; Chatterji and Dewhurst, 1996 and, particularly, Quah, 1993a, 1993b, 1996a and 1996b) have introduced new elements to the convergence analysis, as the existence or not of 'clubs' of regions/countries in the economic growth processes.

Unfortunately, as pointed out by Cuadrado et al. (2002), despite the large number of works, empirical evidence does not offer conclusive results of any of the dominant positions. Analyses carried out under a

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<sup>1</sup> The consolidated text of the European Union Treaties (April, 15, 2008) makes a clear reference to one of the principal aims to be accomplished by the Union: to reach a higher economic and social cohesion between the states and regions of the European Community.

neo-classical approach underline the existence of convergence, generally of the *conditional* type, while critical approaches point out a marked trend towards *polarisation* or to an evident *heterogeneity* of behaviours by regions, where convergence and divergence are present. The European Union case offers sufficient examples showing that both trends occur simultaneously: regions growing faster do not coincide with the most developed; likewise slow growth is not only confined to the most or the least developed regions. Recent trends seem to indicate that a rather complex process exists in which the most significant characteristic is the high heterogeneity in the behaviour of different regional economies.

This paper does not aim to close nor to avoid the debate, but to contribute to feed it. Our purpose is not to discuss the theoretical aspects of convergence/divergence processes but to adopt an approach we consider may help to better understanding the evolution of disparities in some European countries. Our focus is mainly empirical and our objective is to contribute to clarify what figures seem to show us about regional convergence, departing from two main ideas or hypothesis. The first is that regional performances within any country are clearly linked to the behaviour of such country economy as a whole. The second is that regional convergence, both inside each country and when we compare the evolution of some countries, is linked to the evolution of industrial structure as well as to the evolution of employment per capita and labour productivity. This last idea was already presented some years ago by Cuadrado et al. (1999) through an analysis on the Spanish regions.

In our case, we are going to analyse the evolution of regional economic disparities in five European countries: France, Italy, Greece, Portugal and Spain during the period 1980-2006. To achieve our objectives, the paper is organized as follows. In Section 2 some synthetic comments will be made on the convergence analysis in the literature. Section 3 will show the data to be used in our empirical analysis and some issues on the methodological approach employed. Section 4 includes the main results of the analysis carried out. Once presented the stylized trends to converge of regions of the selected countries to the average of GDP per capita of the EURO zone, we will show the results obtained when confronting country trends to regional performances. Lately, the main results of the analysis of the two components of GDP per head: labour per capita and labour productivity will be shown. Finally, this section 4 includes also the results of our convergence analysis of the productive structures by regions. All these leads to some final conclusions which will be synthesized at section 5.

## 2. A PREVIOUS NOTE ON THE CONVERGENCE ANALYSIS

Convergence may be understood as a reduction of income per capita (GDPpc) disparities between national/regional economies. Other variables, like employment, unemployment or labor productivity, can also be analyzed in terms of convergence. The concept itself is not new. It has been widely used and some traditional instruments were employed to measure it in the past<sup>2</sup>. More than a decade ago, this type of convergence started to be called *sigma convergence* to differentiate of other ideas of convergence, as *beta convergence*, a concept directly related to the catch-up hypothesis, as a process whether poor countries/regions tend to grow faster than the richer ones.

The literature offers a great number of works and publications focused on the convergence processes, proposing methods to approach them and empirical analysis to check if trends to converge do exist or not. Surprisingly, the results of such analysis show some coincidences but many discrepancies too. Some of such disagreements are due to the methodological approach chosen, but they come also, at least in the European case, from differences in the time period analyzed, data sources used and the delineation of regions. Quah (1992) underlined that regional growth is a complex process, which displays instabilities and cyclical fluctuations, and all them may influence the results according to the period elected. On the other hand, several authors have also pointed out that the 'regions' defined are neither internally homogeneous nor uniformly large (i.e. the case of NUTS-2 regions in the EU); they are the result of historical and/or political decisions inside each country and do not always have clear relationship to socio-economic variables<sup>3</sup>.

Different approaches and their supporting hypothesis have been used to analyze regional convergence in the European Union: *σ-convergence*, *β-convergence*, *convergence clubs*, the impact of *national effect*, *Markov chains* and other related models. Eckey and Türk (2007) have recently published an excellent literature report analyzing the main approaches used, their conclusions and their disparities in terms of empirical results.

Sigma convergence measures the dispersion of income or GDP per capita (or any other variable) by regions. As it is well known,  $\sigma$ -convergence only occurs if  $\beta$ -convergence takes place, but this last is not a sufficient condition for  $\sigma$ -convergence. In fact,  $\beta$ -convergence can be established with and without a decreasing dispersion of GDPpc or any other variable chosen ( $\sigma$ -convergence). The results offered by different

<sup>2</sup> See for example: Molle et al. (1980), which includes some instruments available to measure regional disparities.

<sup>3</sup> As underlined by Fingleton (1999), regression analysis with administrative units can result on spatial autocorrelation



analysis on the EU regions (EU-15, normally) show an intensive process of convergence in from mid-1960s. to mid-1970s, but only a small convergence from then onwards. Some authors even reject the  $\sigma$ -convergence hypothesis for all European regions<sup>4</sup>. Nevertheless, differences do exist when comparing different great areas of the EU. Neven (1995) identified diverse patterns of the convergence process in northern and southern Europe. While the total standard deviation of GDP per capita changes to a small extent during 1980-89 in all regions analyzed, the southern group shows trends to diverge from mid-1980s. onwards, while, simultaneously, disparities in northern EU regions have diminished during the same period<sup>5</sup>.

Beta convergence occurs when regions (countries) tend to converge to the same steady state (absolute convergence) or if regions/countries having the same initial conditions reach the same GDP per head at the long run. The hypothesis is clearly based on the principles and assumptions of the neo-classical model. As pointed out by Barro and Sala-i-Martin (1991 and 1992) in the absolute convergence model the average growth of GDP pc between the departing year '0' and the year 't' can be explained by the initial level of income. The parameter  $\beta$ , derived from the slope in the growth regression shows the rate at which regions are approaching their steady state. According to a number of empirical analysis, convergence rate takes values around 2 per 100, a figure widely discussed, not only because the empirical evidence but on the basis of some theoretical arguments. 'Conditional' convergence model includes some control variables in order to show the different conditions of regional/national economies, which allow them to converge to a different steady state.

Any case, a high number of empirical analyses on the EU regions have underlined only the existence of weak tendencies towards convergence. The annual rate appears to be clearly below 2 pr 100 and the convergence speed is tending to diminish (Cuadrado, 2001; Lopez-Bazo, 2003; Martin, 2001, Fingleton, 2003). For these authors and some others it seems clear that European regions will be covering different steady states due to their heterogeneity. Consequently, the diverse economic conditions are modeled as a function of some dummy variables like indicators of infrastructure, of structural change, education disparities and the like. If such differences are included (conditional convergence model) the period to converge is shorter compared with the absolute convergence model (Eckey and Türk, 2007).

Another approach to convergence, or better said to the differences between regions to converge, is the club convergence hypothesis. Absolute  $\beta$ -convergence model uphold that all regions should converge to the same steady state value; conditional  $\beta$ -convergence departs from the existence of initial factors determining a final level of growth lower

<sup>4</sup> See: Neven and Gouyette (1994), Lopez-Bazo et al. (1999), Cuadrado et al (2002), and Basile, et al. (2005)

<sup>5</sup> A similar result is detected by Cappelen et al. (2003).

than the steady state. Nevertheless, regions do have differences in their structural characteristics 'conditioning' their  $\beta$ -convergence and if some of them do have similar initial conditions they can probably converge to the same steady state value (Chaterji, 1993; Quah, 1996a). Empirical analyses to prove this hypothesis have proved its acceptability. Clusters of regions do appear through some analysis on the EU regions (Le Gallo and Dall'Erba, 2006; Baumont et al., 2003). Researchers using density functions of GDP pc or labour productivity have accomplished rather conclusive results on the existence of 'clubs' or 'clusters' of regions tending to different peaks (Lopez-Bazo et al., 1999; Villaverde, 2003).

Finally, but, of course, not closing the possible comments on the approaches used to study convergence processes, the literature offers also some papers paying particular attention to the '*national effect*'. This implies that the performances and trends of one national economy does have an important impact on the behavior of its regions. In other words, the hypothesis is that the link of regions within one country is tighter than of regions of other countries having, as countries, different growth rates (Rodriguez-Pose, 1999; Cuadrado, 2001). One of the results of this type of approaches is that regional convergence inside the EU is clearly linked to the economic performances of different countries.

Not much general conclusions can be derived from the great number contributions made to the analysis of convergence in the EU. Nevertheless, the majority of the studies carried on along the last decade (about different periods, from the 1970s onwards) show a rather small convergence rate of European regions which tend to approach no global convergence but diverse behaviors of individual regions<sup>6</sup>. A few studies conclude that there is not convergence at all, but the short period analyzed and the cyclical movements they include may have contributed to explain this result. This is why it seems clear that regional convergence must be analyzed taking into account longer time periods.

### 3. DATA SOURCES AND METHODOLOGICAL APPROACHES

The core aim of this paper, highlighted in the introduction, is to explore the regional convergence patterns within some European countries since 1980 onwards. In order to analyze the role played by the national behaviours, the productive structures and the labour productivity, we have chosen to work with the *European Regional database* provided by *Cambridge Econometrics*.

This source provides in-depth analysis of macroeconomic data for regions and sectors across the EU27, Norway and Switzerland. Data include estimations and medium term forecasts of gross value added,

<sup>6</sup> This is a fact recognized by the 4th Cohesion Report (Brussels, 2007)

employment and other items (population, investment and remuneration, among others) for over 280 NUTS-2 regions. Based on *Eurostat's Regio* database, data and forecasts are provided for 15 economic sectors, using the ESA95 classification. The historical database covers the period 1980-2006 (1990-2006 for new member states) with annual forecasts six year ahead. The selection of this statistical source is determined by the extensive historical coverage it provides – an essential of this type of analysis – because the main alternative source of data (*Eurostat's Regio* database) is available only since 1995. This source provides a long, homogeneous and comparable set of GDP per capita, employment and productivity from 1980 to nowadays, suitable for us to explore long-term convergence and its explaining factors.

Handling with the huge amount of information of the data source described before, the final sample of the paper included only data for regions<sup>7</sup> of five European countries: Greece, Spain, France, Italy and Portugal. European reference in our analysis is EURO zone (Cambridge Econometrics' source only provides EURO zone and EU27 data, not EU15). Reasoning for this choice includes the considerable social and macroeconomic homogeneity among them; the advantage of including one central continental country, such as France; and the belonging of the other four countries (Greece, Spain, Italy and Portugal) to the known Mediterranean or South European country taxonomy (Castles, 1995; Rhodes, 1997). The breakdown by economic sectors chosen is as follows: agriculture (01-05 ISIC), manufacturing and energy (10-41), construction (45), market services (50-74), and non market services (75-95).

As was stated at the introduction, section 4 includes an empirical study of the convergence within these five European countries and whether some explaining factors have played a role or not since 1980 onwards. For this purpose, gross domestic product per capita has been chosen to approximate income per capita. Then, GDP per capita has been disaggregated into two components: employment per capita and labour productivity (measured as gross value added by employment). Finally, an index of inequality or convergence of productive structure is used in order to test the role of structural changes in the convergence patterns for the regions and time period chosen.

The reduction in the disparities in income per capita across economies, as was stated in section 2, has generally come to be referred to as *sigma convergence* (see Barro and Sala-i-Martin, 1991). This concept of convergence is normally measured by examining the evolution of the standard deviation of the logarithm of some income indicator, although other measures of dispersion can also be used for the same purpose<sup>8</sup>.

<sup>7</sup> In particular, 78 NUTS-2 regions: 13 Greek, 17 Spanish, 22 French, 21 Italian and 5 Portuguese (see Annexe 1).

<sup>8</sup> Other widely used dispersion indices are, for instance, the coefficient of variation and Williamson's index. It may also be of interest apply inequality

To analyze the evolution of the level of regional inequality in the five countries of the sample (at the NUTS-2 level), we examine the evolution of the following inequality index:

$$\sigma = \left[ \sum \right] \quad (1)$$

where  $\ln GDPpc_{it}$  is the logarithm of the GDP per capita of region  $i$  at time  $t$ ;  $\ln GDPpc_t$  is the logarithm of the GDP per capita of the aggregate economy (country), and  $N$  is the number of NUTS-2 regions considered in each case. The results of this calculation are shown in section 4.3.

What factors can account in those convergence or divergence tendencies? Firstly, some authors<sup>9</sup> have pointed out the strong national stamp, represented by a high spatial autocorrelation in this kind of convergence models. Those regions which belong to the same country usually are clustered into specific zones in the figures. Not only because they started with similar development levels, but they have experienced similar growth rates too. The approach to suppress the possible national distortions which we have used in this paper consists on weighting both regional GDP per capita and growth rates, where weights are national indices:

$$\hat{X}_{it} = \frac{v}{X_t} \cdot \dots \quad (2)$$

where  $\hat{X}_{it}$  represents the variable  $X$  (GDP per capita or GDPpc growth rate) of region  $i$  in time  $t$ , nationally weighted;  $X_{it}$  represents the variable of region  $i$  in time  $t$ ,  $X_t$  is the variable of the aggregate country where region  $i$  is located, and  $X_{Et}$  is the variable of the average EURO zone.

Secondly, Cuadrado et al. (1999) emphasize the importance of the evolution of regional employment rates. They decompose GDP per capita into the product of jobs per capita and labour productivity. According to this breakdown and taking logarithms, we have:

$$\ln GDPpc_t = \dots + \Pi \quad (3)$$

where  $Lpc$  is the number of jobs per capita and  $\Pi$  is gross value added per employment or job.

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indices, such as Teil's, Gini's, or Atkinson's (Cuadrado et al., 1999; Eckey and Türck, 2007).

<sup>9</sup> See Rodriguez Pose, 1994 and 1996; Dewhurst and Mutis-Gaitan, 1995; Borrás-Alomar et al., 1994; Armstrong, 1995; Chesire and Carbonaro, 1995; Quah, 1996a; or Lopez Bazo et al., 1999, among others.

Finally, the value of labour productivity depends on one hand on within-sectoral productivities and, on the other hand, on productive structure<sup>10</sup>. The sigma convergence results obtained for the sectoral productivities are set out in figures in Annexe 2. These show that there is no trace of convergence in some economic sectors, although there is some evidence of convergence in total or aggregate productivity. The question therefore arises of how these two phenomena are compatible. One reason might be the varying weight of the *productive* sectors in the regions and its interplay with their average productivity levels. Second, if the shift of labour from low toward higher productivity sectors takes place to a greater degree in the poorer regions than in the richer ones, a process of sigma convergence may also occur in spite of there being no convergence in sectoral productivities. To examine if convergence in sectoral structure across regions may have been an important source of productivity convergence or not, we introduce an index of inequality in productive structure (ID) defined by:

$$ID = \frac{\sum_{i=1}^N \left[ \frac{PLA_{it}}{PLX_t} + \frac{PLI_{it}}{PLX_t} + \frac{PLC_{it}}{PLX_t} + \frac{PLMS_{it}}{PLX_t} + \frac{PLNS_{it}}{PLX_t} \right]}{N} \quad (4)$$

where  $PLA_{it}$ ,  $PLI_{it}$ ,  $PLC_{it}$ ,  $PLMS_{it}$  and  $PLNS_{it}$  denote the weight of agriculture, manufacturing and energy, construction, market and non market services, respectively, in total employment in region  $i$  at time  $t$ , and  $PLX_t$  are the corresponding sectoral weights at the national level. The value of the index would be zero if the productive structure were the same in the  $N$  regions. This index may be broken into the sum of the inequality indices of agriculture ( $IDA$ ), manufacturing and energy ( $IDI$ ), construction ( $IDC$ ), market ( $IDMS$ ) and non market services ( $IDNS$ ).

#### 4. RESULTS:

This section will search, as an introductory note, which trends towards convergence in terms of per capita income have been observed in the five European countries within the sample. In addition, those trends are decomposed into their two main components: convergence or divergence in terms of employment per capita and labour productivity. Afterwards, we will go in depth into the regional behaviour. Following the driving topic of the paper, the role of the 'national effect' will be tested in order to isolate regional from country issues. Finally, relationship between convergence on labour productivity and structural changes, in terms of productive structure, will be analyzed. According to these ideas our main results are highlighted in the following lines.

<sup>10</sup> See, among others, Dollar and Wolff (1988), van Ark (1995), Peneder (2003); Fagerberg (2000) or Timmer y Szirmai (2000).

The first aspect analyzed has been to check if the 78 NUTs regions of the five countries in the sample have shown convergence in terms of GDP per capita. To achieve this aim, the evolution of  $\sigma$ -convergence has been estimated for the period 1980-2006, considering the EURO zone as reference.

Table 1 shows the results obtained through this exercise. It suggests that it is not possible to talk about convergence but fluctuations around a rather stable path during the period 1980-1996, although from this last year to 2006 the evolution of the standard deviation of the logarithm shows a weak trend to slowdown. As it will be pointed out later, this last movement can mainly be explained by the evolution of the Spanish and Greek regions along the decade 1996-2006, which have progressed to converge unlike the trends shown by Portugal and Italy.

Table 1.  
**Dispersion of the logarithm of GDP per capita and its components:  
Employment per capita and labour productivity**  
(three year mobile averages)

	1980	1986	1991	1996	2001	2006
GDP per capita	0.4383	0.4592	0.4340	0.4394	0.4163	0.3750
Employment per capita	0.1599	0.1579	0.1635	0.1825	0.1888	0.1868
Labour productivity	0.4138	0.4098	0.3616	0.3449	0.3134	0.2978

Source: Own elaboration

As obvious, such aggregated analysis may hide rather aspects of interest. A way to progress to an in-depth understanding of such process is to decompose GDPpc into the product of jobs per capita and labour productivity, as it was described in section 3. Table 1 shows the results of carrying out this exercise and what it can be observed is that sigma convergence of both variables have experienced a different evolution. On the one hand, the logarithm of labour productivity shows a trend to converge, even not being too remarkable. But, on the other, jobs per capita show a divergence path from 1989 onwards, except a short fluctuation between 2001-2004, and the increase of dispersion of this variable explains really the slow convergence process in GDPpc previously observed. In other words, the decrease in terms of jobs per capita of the European regions analyzed has balanced the slow but positive trend to converge of labour productivity.

According to some theoretical arguments, the convergence process of labor productivity should be mainly due to the introduction of technological and organizational changes by the less developed economies. However, other mechanisms may help labor productivity to converge, as changes of the productive structures and their movements to converge which has been also part of our analysis. But, before entering this point, it seems interesting to study the regional convergence within each country considered here, and if the global behavior of the countries is related to regional performances. This is also

an element to be taken into account to explain the higher or lower regional convergence.

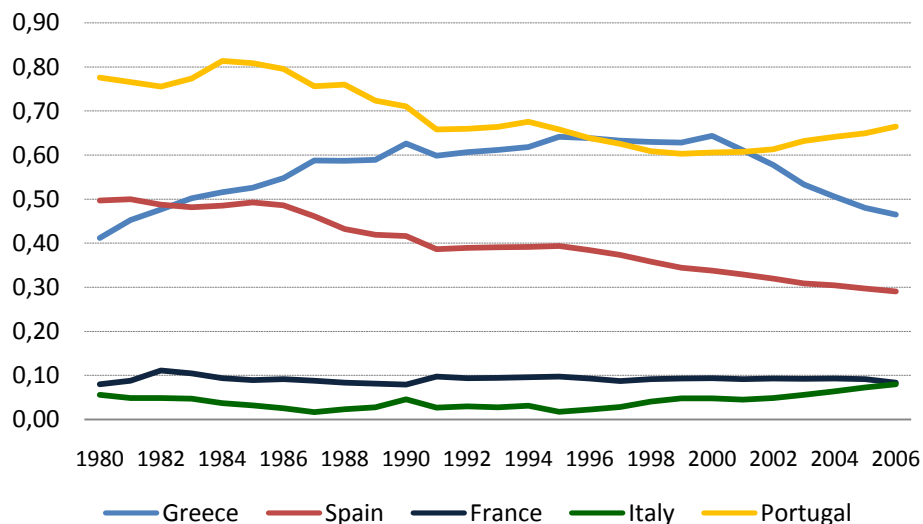
#### 4.1 National distortions and heterogeneity in the regional behaviour

According to the latest Reports on Economic and Social Cohesion by the European Commission (2004b and 2007), disparities in GDP per head among the Members of the European Union have been notably narrowed during the recent years. Nevertheless, empirical patterns observed in the sample countries here tested have not been homogeneous, as it can be concluded with the figure 1 below. Specific convergence or non convergence paths can be observed within these five particular countries.

First, Spain has experienced a sigma convergence towards the income average of the EURO zone countries during the whole period 1980-2006. In 1980, the Spanish GDP per head was around 9315 Euros (representing the 61 per 100 of the EURO zone GDPpc), while it raised to 17540 Euros in 2006 (75 per 100) due to an annual average growth rate by 1,35 per 100 (EURO zone GDP per capita only grew by 0,33 per 100 during those years). On the other hand, Portugal followed a clear convergence path until the end of the 1990s. However, Portuguese economy has enduringly grown below the rest of the European Union countries, without observing any recovering symptoms. In 2000, its GDP per capita represented the 55 per 100 of the EURO zone average (11969 Euros), in contrast to the 46 per 100 at the beginning of the 1980s. In 2006, the Portuguese income per head only was the 51 per 100 of the EURO zone average. The opposite behaviour has been observed in Greece. This economy experienced a divergence until the end of the 1990s. While in 1980 the Greek GDP per capita was 10136 Euros (66 per 100 of the EURO zone average), in 2000 was barely 11530 Euros (53 per 100). Since then, its growth has been more intense, which has raised its income per capita to reach the 63 per 100 of the EURO zone average.

On the other hand, the convergence observed, in general terms, in these three economies it is not translated to the other two States in the sample. Both Italy and France stood in 1980 at high income per capita levels (16756 Euros in France – an 8 per 100 above the EURO zone average – and 14470 Euros in Italy, merely a 5 per 100 below that average). The consequence of this advantaged position at the beginning, and their annual growth rates clearly lower than the ones observed in the Cohesion countries (0,39 and 0,18 per 100 from 1980 to 2006), has been a similar ranking of these two countries related to the EURO zone average. Concretely, in 2006 the French GDPpc was 25017 Euros (9 per 100 above the average), while the Italian one was 21301 Euros (92 per 100 of the EURO zone mean).

Figure 1.  
**Dispersion of the logarithm of GDPpc by countries**  
 (related to EURO zone, 1980-2006)



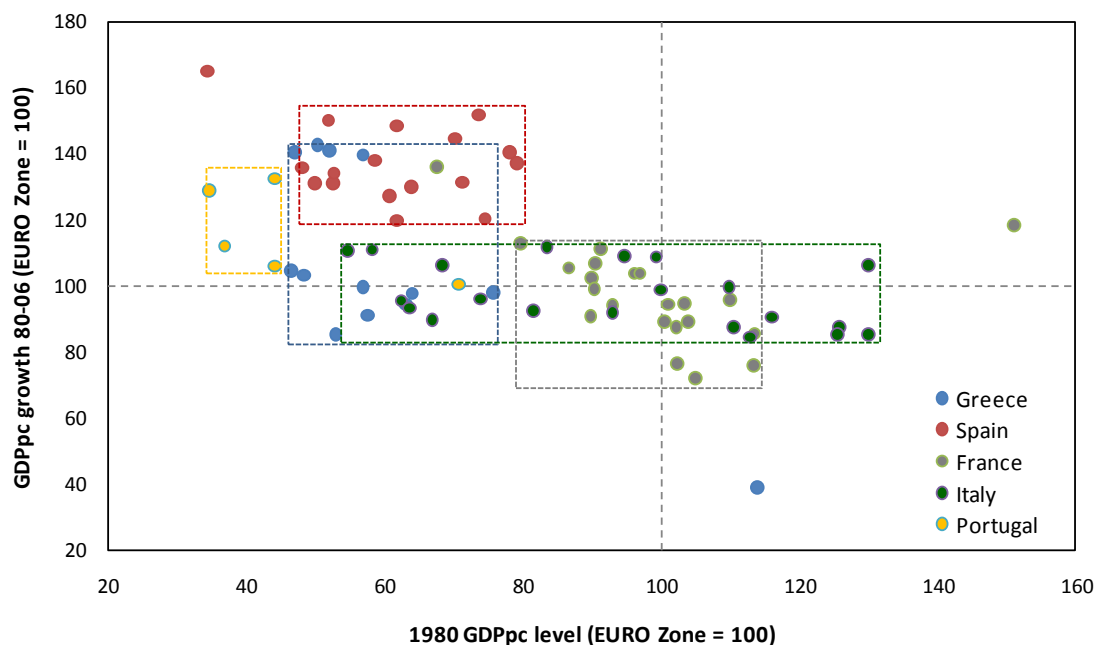
Source: Own elaboration

However, these results, which could support some evidence on convergence in some European countries (here analyzed), do not hide some spatial autocorrelation matters which might bias our conclusions. One plausible reason, as Quah observed in 1996, is that regions under analysis are often considered such as islands, forgetting the effects on the economic growth of their belonging to a specific country and their physical contiguity to other regions. But the existence of strong state distortions or the links between regional and national behaviors are well known. A core block of the literature on disparities in Europe has extensively analyzed those stylized facts.

One first look at the relationship between the initial GDP per capita and its growth rate seems to support the convergence hypothesis. Figure 2 shows the regional GDP per head on the horizontal axis, and the annual average growth rate of the regional GDPpc during 1980-2006 on the vertical one. This figure is similar to that by Barro and Sala-i-Martin's (1991) and other neoclassical models and authors which have followed that. Those regions with lowest GDP per head levels at the beginning of the period grow, in general terms, by growth rates above that in those regions with a highest GDP per capita. The observed growth patterns in regions, such as the North and the Valley of Tajo in Portugal, Extremadura in Spain, or Molise in Italy, is sensitively higher than the more developed regions one.



Figure 2.  
Relationship between regional GDP per capita in 1980 and GDP per capita growth between 1980 and 2006

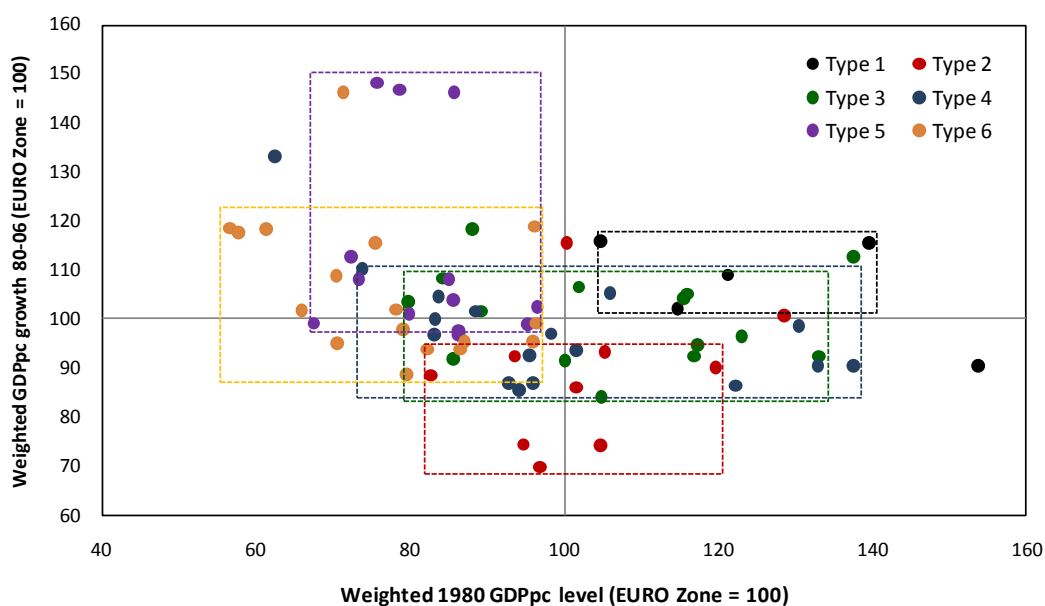


Source: Own elaboration

The empirical evidence shown in figure 2 could close the convergence debate, but, on the contrary, a strong 'national stamp' can be observed in that graph. Results reflect a significant spatial autocorrelation. The consequence of this 'national stamp' is that regions belonging to the same country can be clustered in some specific areas of the plot. For instance, Portuguese regions are clustered at the top left because they took off very low GDPpc levels in 1980 but have experienced, with the only exception of Lisbon region, annual growth rates clearly above the EURO zone average ones. Close the Portuguese regions, although with higher development levels in 1980, can be located the Spanish regions. From the most dynamic region (Extremadura) to the least one (Asturias) every Spanish communities have grown by rates notably above the EURO zone average. Greek regions are clustered at the same quarter of the figure (although it can be observed a surprisingly growth in the Egeo islands). France, which presented the highest GDP per capital levels at the beginning of the 1980s., have generally grown below the average. Only the regions of Ile de France and Corse have broken this 'national' path. Finally, despite the high dispersion in the GDPpc levels among the Italian regions in 1980, all these 21 regions are ranged only in sixteen points of growth (from the indices 111 of Sicilia, Calabria or Marche, to the indices 85 of regions such as Piamonte, Valle d'Aosta or Emilia-Romagna).

The methodological approach chosen here to suppress those plausible 'national or state' distortions on the convergence was previously described into section 3. Weighting the growth and GDP per capita items by a national coefficient allows us to compare regional disparities within countries, without forgetting the international perspective. Results according to these nationally weighted indices are shown in figure 3.

Figure 3.  
**Relationship between regional GDP per capita in 1980 and GDP per capita growth between 1980 and 2006**  
 (weighted model)



Source: Own elaboration

A contrasting landscape is observed in that figure 3, related to that figure using indices without nationally weighting (figure 4). It is obvious that some delayed regions, such as Extremadura, the Centre of Portugal, or Calabria, seem to grow clearly faster than the average yet. But regions with the highest GDP per head levels at the beginning of the 1980s. have also grown by similar rates. For instance, some regions, such as Ile de France or Lazio. The consequence is that 'country' clusters observed in figure 4 have been changed into 'socioeconomic region' clusters. The linking criterion within these latest clusters is the ability of the regions belonging to them to face the present-day social and economic restructurations, independently from the economic behaviour of the country where specific region was located.

Summing up, a dual territorial<sup>11</sup> model can be concluded (Leborgne and Lipietz, 1992). Those regions which could take advantages within this

<sup>11</sup> See Rodríguez Pose (1999) for more details on these regional taxonomies.

structure would be those located into typologies 1 (*Capital Cities and Financial Centres*), 3 (*Intermediate Dynamic Regions*) and 5 (*Peripheral Dynamic Regions*). On the other hand, regions characterized into typologies 2 (*Recessing Manufacturing Regions*), 4 (*Intermediate Less Dynamic Regions*) and 6 (*Peripheral Less Dynamic Regions*) seem to be the 'losers'. Those six regional taxonomies are characterized, among other issues, by their differences on productive structure and productivity behaviour. We try to deep into those two plausible explanatory factors in the next section.

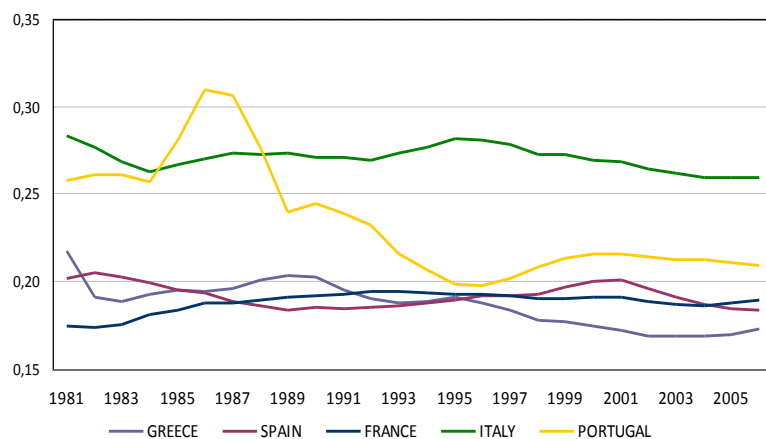
#### 4.2. Regional convergence in productivity and productive structure

This section contributes to the open discussion on the convergence process in Europe supplying empirical evidence that a disaggregate analysis at the sectoral level may alter some of the conclusions drawn in the literature both about the existence of convergence. In addition, it provides some alternative explanations (complementary to those introduced in the section before) about the mechanisms that have generated it.

The process of sigma convergence in terms of GDP per capita across the regions within the five European countries of the sample is shown in the figure 4. That process has trended to stabilization after 1980, after a strong convergence period until the late 1970s. The differences between NUTS-2 regions within the countries in the sample have not narrowed significantly and the level of inequality remains essentially constant. Only Portugal and Greece seem to follow a certain convergence path since 1980 onwards. One second interesting fact is the existence of differences of regional inequality within these countries. While the inequality index (measured by the sigma coefficient) in Italy stands above 0.25, in Portugal is around 0.20 and in the other three countries stand below 0.19 at the end of 2006.

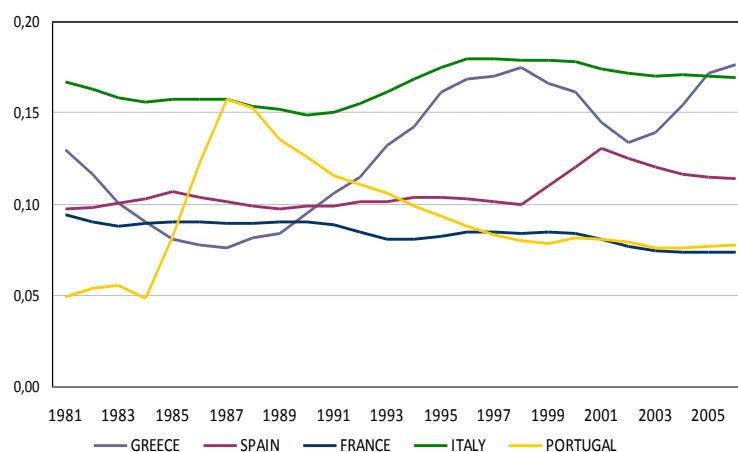
What factors can account for this general trend? In section 3 we emphasized the importance of the evolution of regional employment per capita and labour productivity. Let's take in-depth these two explanatory factors in the following lines. Figures 5 and 6 are sigma convergence plots in the two components of GDP per capita. In general terms, we observe a certain divergence in jobs per capita since 1980 onwards, with the only exception of France, where a stable path is observed when employment per capita is analyzed. The increase of the dispersion of this variable in the other four countries is one of the main causes of the interruption of the convergence process in GDP per capita commented before.

Figure 4.  
Dispersion of the logarithm of regional GDP per capita, 1980-2006



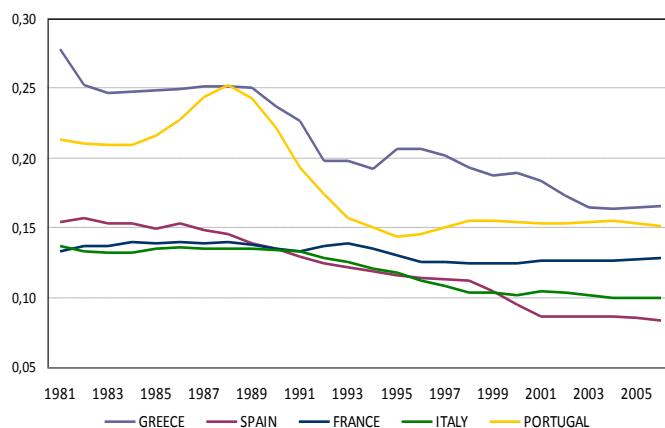
Source: Own elaboration

Figure 5.  
Dispersion of the logarithm of regional employment per capita, 1980-2006



Source: Own elaboration. Data: Cambridge Econometrics

Figure 6.  
Dispersion of the logarithm of regional labour productivity, 1980-2006



Source: Own elaboration. Data: Cambridge Econometrics

On the other hand, we find that sigma convergence in labour productivity levels continues throughout the 1980s. and the first 1990s. On the contrary, that convergence process slowdowned since mid-1990s. This fact reflects one focused phenomenon which has been observed in the European countries during the last decade: the gap in productivity between the European countries and the United States<sup>12</sup>. The data leaves no room for doubt regarding the poor, even negative, evolution of the European average shown by all the indicators since the middle of the 90s. Thus, during the 1995-2006 period, productivity per employee in the European Union increased by 1,04 per 100, at some distance from the 1,95 per 100 yearly growth of the US economy for the same period.

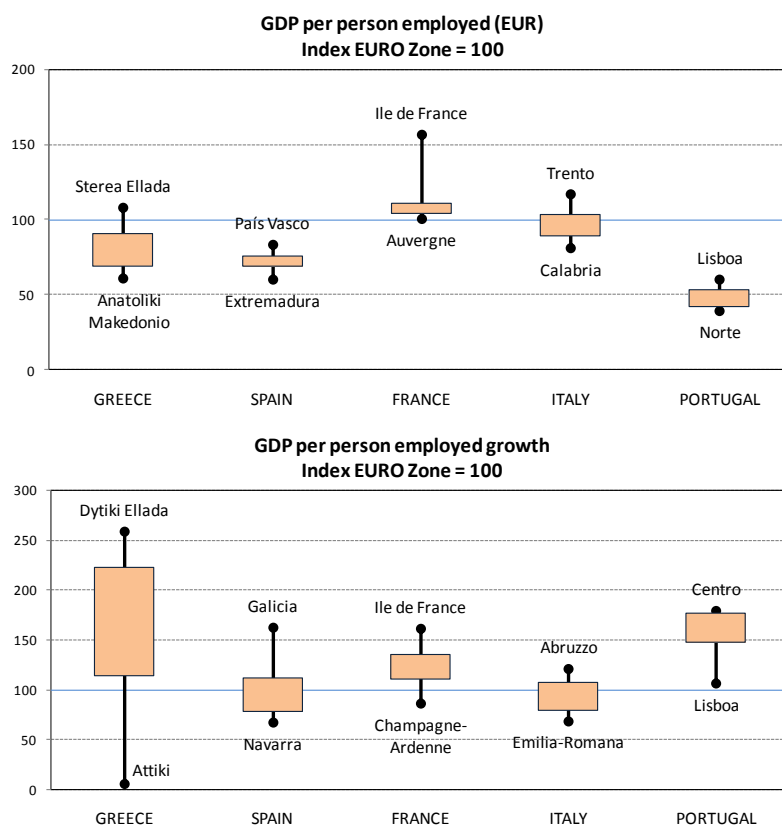
Productivity varies markedly across countries in the sample, underlying the disparities in GDP per head noted above. It is highest in French and northern Italian regions, while in most regions of Spain, Greece, Portugal and the South of Italy (the Cohesion countries), it is much closer to the EURO zone average, through still below (see figure 7). At the same time, there is some evidence of a certain catching up over recent years (notably after 1995), especially in regions where productivity levels are lowest. Between 1980 and 2006, therefore, labour productivity, measured in terms of GDP per person employed, grew by more than 2 per 100 in most Greek<sup>13</sup> and Portuguese regions; while in most of the more developed regions, it rose by less than 1,3 per

<sup>12</sup> See, among others, European Commission (2004a), Timmer et al. (2007), O'Mahony and van Ark (2003), OECD (2005), or Maroto and Rubalcaba (2007 and 2008).

<sup>13</sup> In addition, while the regions within the other four countries experienced a slowdown in their productivity growth rates after 1995 (following the general trend in countries belonging to the EU), Greek ones showed a higher productivity growth since then.

100 a year, in some cases, much less. In some cases, the regions concerned have among the highest levels of income per capita in their respective countries (Lombardia and Valle d'Aosta in Italy, or Madrid and Cataluña in Spain).

Figure 7.  
Productivity in sample countries and regional extremes. 2006



Source: Own elaboration

A number of authors have argued that such a convergence process is likely to be driven by the imitation of technological and organizational guidelines on the part of the less developed regions at a lower cost than that associated with invention or innovation processes. There are, however, other mechanisms that may generate convergence in labour productivity. In particular, we will see in the following lines that it is possible to explain labour productivity convergence through productive structure convergence.

As has already been shown, labour productivity in terms of total GDP showed a clear and sustained convergence process in the analyzed regions until mid 1990s. (see figure 6). The value of total productivity, however, depends on one hand on industrial productivities and, on the other hand, on productive structure. The sigma convergence results

obtained for the industrial productivities are set out in figure A2.1 in Annexe 2. With regard to the agricultural sector, no common trend occurs among these five countries. While Portugal experiences a clear trend toward divergence, the rest of countries show slight convergence paths. The reasons may be varied<sup>14</sup>. Insofar as the manufacturing sector is concerned, the sigma convergence process takes place quite uniformly in Southern countries (Spain, Portugal, Italy and Greece), but no in France, where a slight divergence sets out. Nevertheless, the convergence process when occurs is less intense than in previous decades.

Something similar happens with the construction and the services sectors, where unappreciated advances toward convergence are observed since 1980 in most of the countries in the sample. Only Portuguese and Greek regions may have followed some convergence processes. Broadly speaking, productivity convergence processes seem to have ceased to operate at the beginning of the 1980s. The wide dispersion of productivity observed during the 1960s. and 1970s. decades gradually narrowed and reached a stable trend since 1980. Although it may be expected that some productivity differences across regions may persist indefinitely. Only those regions which took off from lowest levels of productivity (Portuguese, Greek and some Spanish and Italian regions) have shown some sigma convergence during the last twenty five years.

We can draw two conclusions from this analysis. First, there is a slight process of sigma convergence in terms of aggregate productivity. At the industrial level, however, convergence is observed only in a few regions within the sample. Secondly, the prospects for further reductions in productivity disparities in the economic sectors are not very plausible because these are fairly small already (with the exception of the agricultural sector, which peculiar characteristics already explained allow wider disparities yet). Our analysis suggests that convergence observed for total productivity can be explained largely in terms of changes in employment structure. That hypothesis is verified in the following lines.

Table 2.  
**Inequality index of employment structure**

	1981	1986	1991	1996	2001	2006
Greece	0,4253	0,4144	0,4069	0,3784	0,3424	0,3171
Spain	0,2927	0,2787	0,2468	0,2259	0,2201	0,2065
France	0,2217	0,2041	0,1872	0,1769	0,1720	0,1606
Italy	0,3095	0,2849	0,2691	0,2524	0,2293	0,2195
Portugal	0,3984	0,3887	0,3358	0,3193	0,2969	0,2921
SAMPLE	0,2390	0,2319	0,1975	0,1770	0,1781	0,1734

Source: Own elaboration

<sup>14</sup> Strong random components stemming from weather conditions, and individual specificities of each region, as regards the type of agricultural production, among others.

In the previous lines raises the question of how the absence of convergence in most industrial productivities is compatible with a slight convergence in aggregate productivity. Reasoning for this fact includes but are not limited to the following two factors. Firstly, the varying weight of the productive industries in the regions and its interplay with their average productivity levels. Secondly, if the shift of labour from low productive sectors toward more dynamic ones takes place to a greater degree in the delayed regions than in the more developed ones, a process of sigma convergence might also occur in spite of there being no convergence in industrial productivities.

To examine the extent to which employment structure has become more homogeneous across sample regions, we use the index of inequality in productive structure (*ID*) defined in section 3. That index is represented in table 2. We observe that, in terms of employed people, the productive structure in the regions within the five analyzed countries has become progressively more uniform. However, the reason for this lies in the greater loss of weight of agriculture in poorer regions. Convergence in productive structure in the rest of sectors, although observed, is significantly less pronounced<sup>15</sup>. This behaviour may help to explain slower sigma convergence in aggregate productivity and, therefore, slower sigma convergence in GDP per capital levels in the period of 1980 to 2006 than in previous years, as well as convergence in productive structure.

## 5. FINAL REMARKS:

**E**conomic convergence or non-convergence between countries and regions continues to attract analytical attention in Europe. The aim of this paper has been to show at what extent regional convergence processes in terms of income per capita might be run out during the latest years. At least in some advanced economic areas, such as the countries belonging to the European Monetary Union analyzed here. One of the plausible sources of this fact is that labour productivity differences tend to be decreasing in time when regions converge on productive structures.

Results here presented for the regions of the five countries in the sample (France, Italy, Spain, Portugal and Greece) seem to agree with this topical hypothesis. However, some discrepancies appear among those countries. Generally speaking, regional GDP per head experienced a slow convergence path from 1980 onwards. While labour productivity seems to experience some convergence, although by an unhurried rhythm, it is not observed such a convergence on employment per

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<sup>15</sup> See figure A2.2 in Annexe 2 for more details of the evolution of industrial indices of inequality in productive structure.



capita. These two phenomenons might have caused this scarce convergence observed in terms of income per head.

As a second objective the paper examined two important facts that can contribute to explaining the actual trends. The first is named the '*national effect*', where regions of each country have economic behaviour strongly linked to the national economy as a whole. The second is the differential behaviour in terms of labour productivity and productive structure in many European countries.

First, empirical results show that regional behaviours are influenced by the economic patterns of the countries where those regions are located. It might explain some of the differences highlighted among the analyzed countries. Nevertheless, examination of the data allows us to confirm that the main source of the observed scarce convergence in labour productivity is the convergence of regional industrial structures. In other words, as other authors have stated in the latest times, we find no evidence that processes of technological diffusion from rich to poor regions continue at work. Transfers of labour from agriculture and less dynamic sectors to other more productive ones, which allowed underlined productivity developments and a clear convergence in terms of this indicator in the past, has practically run out. The apparent exhaustion of this process, due among other reasons to the rapid increase in the unemployment rate, has been accompanied by the cessation of regional convergence in income per capita.

Nevertheless, our results do not close the debate on convergence among European countries. As it was said in the introduction, our aim was try to feed it. Thus, some likely research ways seem to appear at this point. The observed evidence might be valid only for the chosen countries and regions. Other countries, especially those known as New Member States or Eastern European countries may enjoy significative convergence trends, since their productive structure are quite far from the ones within the Western European economies yet.

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## ANNEXE

Annexe 1.  
European Regions (NUTS-2) in the sample. Main economic indicators, 2006

Regions		GDP (2000m euros)	Population (000s)	GDPpc (euros)	Employment (000s)	Labour Productivity (euros per job)	GDPPc growth 80-06 (annual,%)	Employment growth 80-06 (annual,%)	Productivity growth 80-06 (annual,%)	
Greece	GR11	Anatoliki Makedonia, Thraki	6764	596	11343	209	32413	0,42	0,41	1,45
	GR12	Kentriki Makedonia	27298	1902	14351	661	41286	0,28	0,71	1,53
	GR13	Dytiki Makedonia	4258	307	13856	88	48196	0,19	-0,01	1,79
	GR14	Thessalia	9677	759	12747	262	36968	0,31	-0,21	2,13
	GR21	Ipeiros	4085	378	10794	117	34827	0,44	-0,64	3,04
	GR22	Ionia Nisia	3039	216	14050	70	43394	1,37	0,14	3,17
	GR23	Dytiki Ellada	8197	762	10763	226	36338	-0,06	-1,57	3,45
	GR24	Stereia Ellada	11361	661	17183	200	56887	-1,25	0,42	1,06
	GR25	Peloponnisos	8390	681	12312	212	39536	0,11	-0,05	2,06
	GR3	Attiki	62150	3663	16966	1737	35782	0,27	1,84	0,09
	GR41	Voreio Aigaio	3052	196	15556	64	47877	1,39	-0,28	2,98
	GR42	Notio Aigaio	5134	305	16820	102	50167	1,36	1,19	2,53
	GR43	Kriti	9228	608	15186	234	39351	1,42	1,13	2,35
Spain	ES11	Galicia	38608	2714	14227	1107	34884	1,13	0,03	2,05
	ES12	Principado de Asturias	16520	1060	15584	422	39185	0,85	0,17	1,52
	ES13	Cantabria	9625	557	17270	250	38552	1,10	1,07	1,48
	ES21	Pais Vasco	47290	2105	22464	1071	44145	1,37	1,28	1,10
	ES22	Comunidad Foral de Navarra	13085	588	22259	327	39998	1,28	2,07	0,90
	ES23	La Rioja	5666	301	18813	149	37941	0,86	1,62	1,05
	ES24	Aragón	23732	1266	18753	628	37795	1,59	1,46	1,43
	ES3	Comunidad de Madrid	136619	5944	22985	3126	43705	1,68	2,77	0,98
	ES41	Castilla y León	41241	2482	16613	1114	37013	1,32	0,73	1,50
	ES42	Castilla-la Mancha	25762	1898	13574	778	33108	1,13	1,55	1,23
	ES43	Extremadura	12715	1075	11824	398	31959	2,02	1,01	2,18
	ES51	Cataluña	144399	6899	20932	3501	41250	1,49	1,99	1,20
	ES52	Comunidad Valenciana	73921	4605	16053	2027	36470	1,03	2,06	1,00
	ES53	Illes Balears	18719	970	19306	469	39949	1,15	2,88	0,97
	ES61	Andalucía	105953	7812	13563	2904	36480	1,26	1,92	1,24
ES62	Región de Murcia	19391	1334	14536	545	35574	1,22	2,34	1,30	
ES7	Canarias (ES)	30887	1945	15884	811	38080	1,64	2,49	1,62	
France	FR1	Île de France	448211	11322	39586	5428	82581	0,80	0,38	2,16
	FR21	Champagne-Ardenne	29791	1332	22363	524	56849	-0,30	-0,22	1,16
	FR22	Picardie	37894	1884	20116	667	56838	-0,40	-0,02	1,23
	FR23	Haute-Normandie	41159	1804	22814	699	58890	0,19	0,04	1,82
	FR24	Centre	55992	2498	22419	985	56817	0,04	0,14	1,60
	FR25	Basse-Normandie	30194	1448	20848	564	53533	0,17	0,02	1,77
	FR26	Bourgogne	34970	1617	21630	640	54657	0,04	-0,16	1,54
	FR3	Nord-Pas-de-Calais	79146	4020	19687	1445	54779	0,09	0,11	1,38
	FR41	Lorraine	47168	2321	20318	845	55798	-0,28	-0,17	1,17
	FR42	Alsace	43438	1810	23999	732	59331	-0,04	0,53	1,31
FR43	Franche-Comté	24795	1141	21739	450	55107	0,00	-0,02	1,51	

Regional convergence in productivity and productive structure. Application to European Southern countries

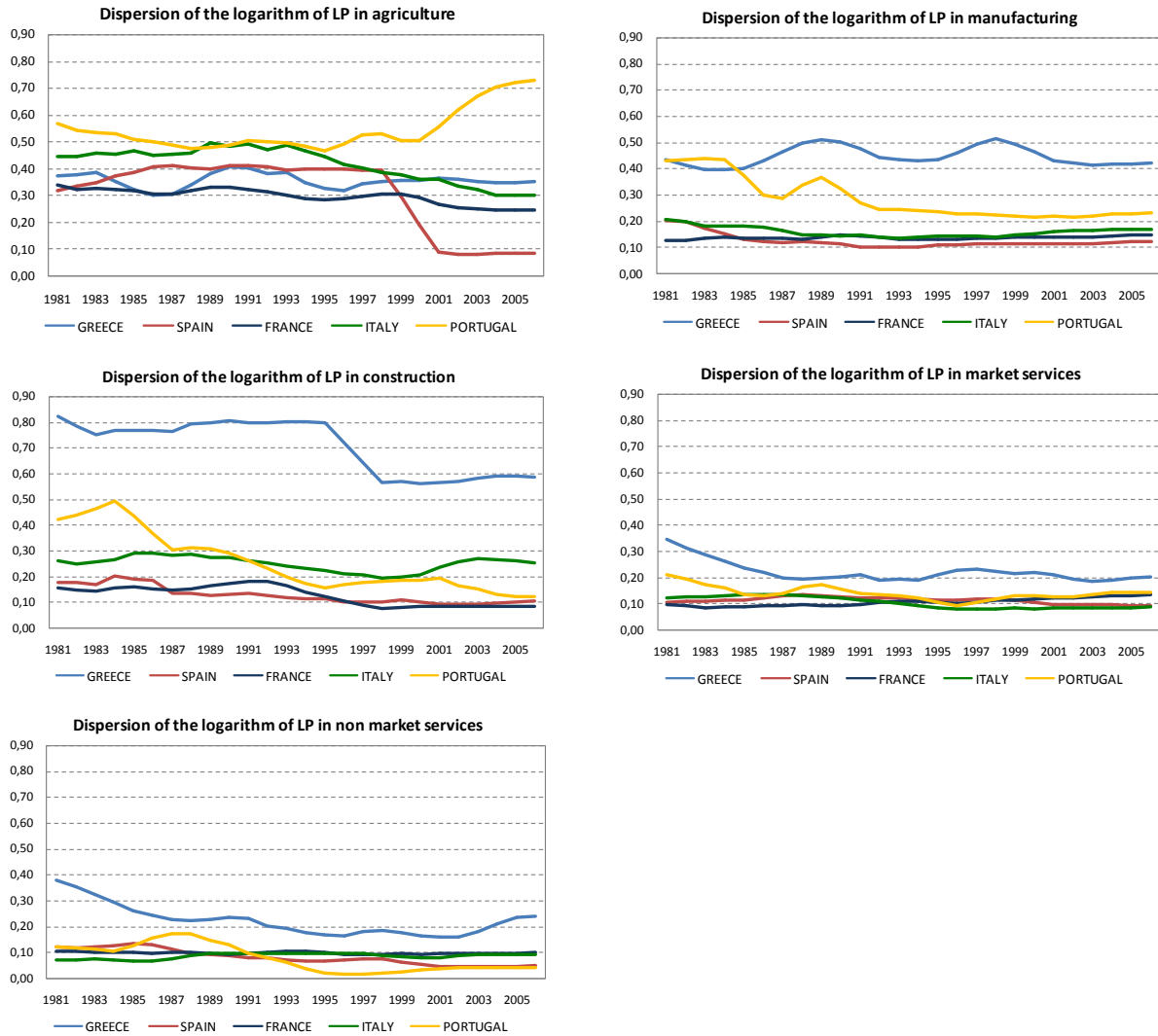
Italy	FR51	Pays de la Loire	78596	3389	23190	1401	56112	0,44	0,58	1,79
	FR52	Bretagne	66597	3037	21929	1217	54723	0,50	0,60	1,66
	FR53	Poitou-Charentes	35871	1691	21212	654	54871	0,38	0,00	1,98
	FR61	Aquitaine	70789	3058	23148	1191	59456	0,44	0,57	1,73
	FR62	Midi-Pyrénées	61723	2709	22783	1090	56601	0,61	0,87	1,62
	FR63	Limousin	14952	710	21061	281	53302	0,48	-0,40	2,04
	FR71	Rhône-Alpes	148709	5966	24924	2463	60387	0,21	0,75	1,47
	FR72	Auvergne	27582	1317	20946	519	53112	0,30	-0,41	1,97
	FR81	Languedoc-Roussillon	50559	2500	20223	878	57553	0,65	1,38	1,65
	FR82	Provence-Alpes-Côte d'Azur	112114	4798	23367	1803	62183	0,19	0,78	1,53
	FR83	Corse	5486	271	20218	101	54448	1,26	1,13	1,99
	ITC1	Piemonte	102950	4250	24225	1945	52931	-0,06	0,13	0,96
	ITC2	Valle d'Aosta/Vallée d'Aoste	3411	123	27785	60	56777	-0,05	0,52	1,13
ITC3	Liguria	37185	1553	23941	682	54517	0,56	-0,10	1,43	
ITC4	Lombardia	253441	9261	27365	4501	56311	0,00	0,46	1,06	
ITD1	Provincia Autonoma Bolzano-Bozen	15285	476	32079	248	61649	0,49	0,91	1,35	
ITD2	Provincia Autonoma Trento	12831	495	25942	223	57427	0,09	0,88	1,06	
ITD3	Veneto	112371	4659	24118	2150	52261	0,00	0,19	1,46	
ITD4	Friuli-Venezia Giulia	30928	1195	25890	558	55388	0,31	0,42	1,12	
ITD5	Emilia-Romagna	110196	4088	26953	2071	53202	-0,06	0,51	0,93	
ITE1	Toscana	84151	3548	23717	1664	50565	0,31	0,63	1,02	
ITE2	Umbria	17652	847	20834	365	48390	0,11	0,52	1,16	
ITE3	Marche	32428	1509	21486	672	48243	0,62	1,09	1,20	
ITE4	Lazio	130410	5220	24982	2458	53062	0,56	0,83	1,28	
ITF1	Abruzzo	23838	1289	18499	510	46723	0,13	0,14	1,63	
ITF2	Molise	5401	320	16861	115	47019	0,49	0,15	1,60	
ITF3	Campania	83700	5773	14498	1868	44802	0,22	0,37	1,49	
ITF4	Puglia	58596	4045	14487	1360	43087	0,16	0,16	1,56	
ITF5	Basilicata	8667	595	14559	189	45769	0,05	-0,11	1,40	
ITF6	Calabria	27888	2006	13902	654	42675	0,60	0,48	1,39	
ITG1	Sicilia	74056	4987	14850	1539	48109	0,62	0,65	1,41	
ITG2	Sardegna	27895	1638	17031	589	47342	0,23	0,68	1,04	
Portugal	PT11	Norte	35721	3746	9536	1700	21012	0,65	0,43	1,97
	PT16	Centro (PT)	24437	2380	10266	1095	22308	1,07	0,19	2,40
	PT17	Lisboa	47676	2784	17123	1495	31888	0,35	0,87	1,43
	PT18	Alentejo	8449	765	11042	328	25722	0,49	-0,46	2,22
	PT15	Algarve	5470	418	13086	195	28060	1,18	1,45	2,37
GREECE			162633	11036	14736	4182	38886	0,23	0,66	1,34
SPAIN			766314	43690	17540	19685	38929	1,35	1,75	1,31
FRANCE			1545738	60645	25488	24576	62897	0,39	0,38	1,74
ITALY			1253282	57879	21654	24423	51316	0,18	0,44	1,21
PORTUGAL			121754	10094	12062	4814	25291	0,63	0,44	1,93
EURO ZONE			7338694	312839	23458	139335	52670	0,33	0,94	1,33

Source: European Regional Database, Cambridge Econometrics



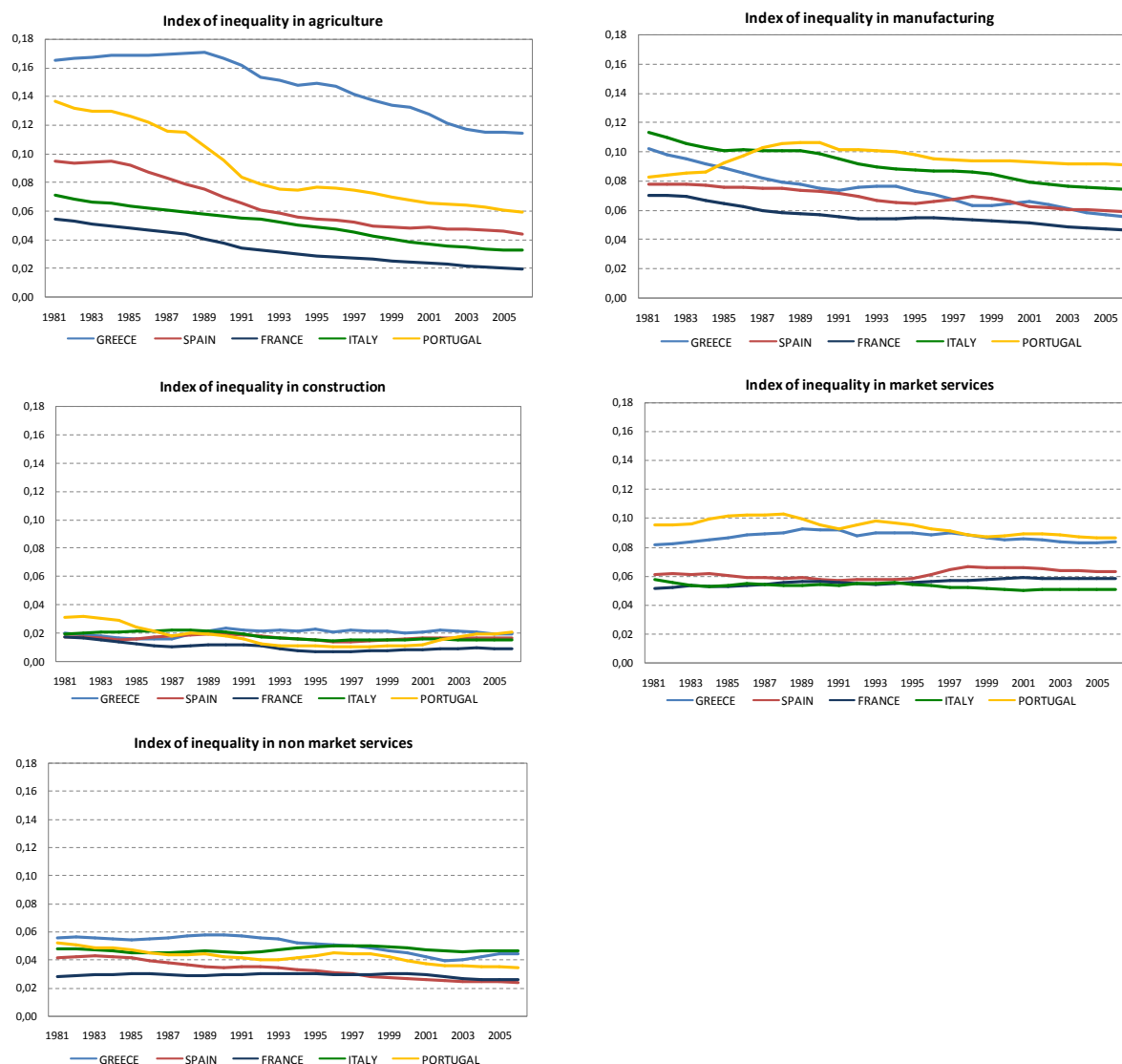
Annexe 2.  
**Complementary figures. Sigma convergence of sectoral productivities and sectoral indices of inequality of productive structure**

Figure A2.1.  
**Dispersion of the logarithm of regional labour productivity, 1980-2006**



Source: Own elaboration

Figure A2.2.  
Sectoral inequality indices of employment structure, 1980-2006



Source: Own elaboration

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