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"Assessing the role of productivity and productive structure in the regional convergence: A comparative analysis"

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Abstract:

The main objective of this paper is to show the existing links between productivity trends and changes in regional productive structure, showing that this relationship is also directly related to the apparent exhaustion of regional convergence in GDP per capita in the European Union (EU-15). Changes in regional productive structures have been an important source of the productivity convergence observed. A process of transferring labor from less productive industries to the most ones, particularly important in the poorest regions, seems to be rather exhausted and this might explain the standstill of convergence in GDP per capita. Nevertheless, figures show important differences by countries as well as some similarities between some of them, allowing us to differentiate three clusters of countries. Firstly, our analysis refers to the EU-15 NUTS-2 regions during the time period ranges from 1980 to 2006. Then, the Spanish case is characterized.

Key words: Convergence, Labor productivity, productive structures.
JEL: R11, R23, O40

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1. Introduction

One of the most outstanding points of recent debates on economic growth has been the controversial topic of convergence/divergence between countries and regions departing from different levels of development. Unfortunately, despite the large number of contributions to the topic, there is not a clear closing conclusion of such a debate. As usual, some disagreements come from the theoretical approaches adopted. But, it is also clear that empirical evidence does not offer conclusive results supporting any of the dominant positions. On the one hand, analyses carried out under neo-classical approaches[1] - both on countries and regions - underline the existence of a long term convergence, but generally considered of conditional type. On the other, critical approaches to the roots of the neo-classical model, or to some neglected methodological aspects of this focus[2], have pointed out the existence of trends towards divergence and/or polarization of regional disparities. And, finally, a good number of the most recent analysis conclude that there exist an evident 'heterogeneity' of regional and countries behaviors, where economic convergence and divergence are simultaneously present.

The problem of economic convergence between their country-members and regions has had, and goes on having, special attention in the European Union. The main reason of it is supported by one of the basic principles on which the process of European integration was founded. In fact, the aim of reaching a reduction of economic and social disparities between the EU countries and their regions is one of the objectives included into the actual Treaty of the Union.

The economic 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 (Eckey and Türk, 2007; Cuadrado, 2002). Not so surprisingly the results of such analysis show some coincidences but many discrepancies too. Some 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, the data sources used, and the delineation of regions. Quah (1992) underlined that regional growth is always a complex process, which displays instabilities and cyclical fluctuations, and all them may influence the results according to the period elected. On the

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[1] That is, like Barro and Sala-i-Martin, (1991, 1992), or Sala-i-Martin (1996). Some previous contributions from a neo-classical focus can also be quoted: Easterlin (1960), Borts (1960), Borts and Stein (1964) and Siebert (1969), among others.

[2] See, among others, Chatterji (1993), Chatterji and Dewhurst (1996) and Quah (1993, 1996).

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)[3].

Any case, a high number of empirical analyses on the EU regions have underlined the existence of weak tendencies towards convergence along the last two decades. The annual rate appears to be clearly below 2 pr 100 and the long term convergence speed is tending to diminish (Cuadrado, 2001; Lopez-Bazo, 2003; Martin, 2001, Fingleton, 2003). Not much general conclusions can be derived from the great number contributions made to the analysis of convergence in the EU. The majority of the studies carried on from mid-90s. up to date (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[4]. Some analyses have even concluded 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 paper aims to contribute to feed the debate focusing on the development of regional productivities, their relation with the evolution of productive structures and how can all this explain the low regional convergence in GDP per capita observed at the EU level. The main purpose isn't to discuss the theoretical aspects of convergence or divergence processes, but to adopt an approach we consider may help to better understanding the evolution of disparities in the EU-15. Thus, our focus is mainly empirical and our objective is to contribute to clarify what figures seem to show us about regional convergence, departing from the hypothesis 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) for the Spanish case, and more recently, by Cuadrado and Maroto (2008) for some European Southern countries. Both concluded that almost exhaustion of the process of convergence among regions might be explained due to the diminishing convergence in productivity levels.

In this paper our analysis is focused on the EU-15 regions during the period 1980-2006. It should have been interesting to take also into account the regions of the 'new' EU members (actually EU-27), but the statistical information covers only the period 1996 to

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[3]   As underlined by Fingleton (1999), regression analysis with administrative units can result on spatial autocorrelation
[4]   This is a fact recognized by the 4th Cohesion Report (European Commission, 2007)

2006, which is insufficient for our purposes. Then, the Spanish case is analyzed more deeply.

The paper is organized as follows. In section 2, the data source and the methodology used are described. Section 3 will synthesize the aggregate trends observed at the EU-15 as whole. Section 4 includes an analysis of differences and similarities by countries and their regions observed throughout a disaggregate analysis. According to similarities observed, three clusters of countries can be defined, excluding the cases of Luxemburg and Ireland. Section 5 analyzes the Spanish case. Finally, the main conclusions and some final comments will be summarised at Section 6.

2. Data sources and Methodology

The core aim of this paper, highlighted in the introduction, is to explore the regional convergence patterns within the European Union (EU-15) countries[5] 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*.

Then, we analyze in depth the Spanish case throughout the last five decades. The database used for this purpose comprises several time series regarding production, employment and productivity for 17 Spanish regions[6] and has been prepared mainly on the basis of two statistical sources. Firstly, data corresponding to the period between 1955 and 1987 was obtained from the statistical database[7] prepared jointly by the BBVA Foundation and FUNCAS (Foundation of Savings Banks). However, the previous database does not contain data from after the mid-1990's[8], and this is the reason why we have

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[5]   Handling with the huge amount of information of the data source described before, the final sample of the paper included data for EU-13[5] regions. In particular, 126 NUTS-2 regions[5]: 11 Belgian, 3 Danish, 13 Greek, 17 Spanish, 22 French, 21 Italian, 12 Dutch, 9 Austrian, 5 Portuguese, 5 Finnish and 8 Swedish; and 28 NUTS-1 regions: 16 German and 12 from United Kingdom (reasoning of this higher regional aggregation in both countries is the homogeneity of size with the NUTS-2 regions in the former countries). European reference in our analysis is the average of these fifteen countries.

[6]   In particular, the 17 Spanish autonomous regions, except for Ceuta and Melilla: Andalusia, Aragon, Asturias, the Balearics, the Canary Islands, Cantabria, Castile-La Mancha, Castile-Leon, Catalonia, the Valencian Community, Extremadura, Galicia, Madrid, Murcia, Navarre, the Basque Country and La Rioja.

[7]   Due to the biennial nature of such series, we have opted to use the arithmetic average as an approach to the intermediate data.

[8]   FUNCAS has offered regional data referring to a new time series covering from 2000 to 2006. However, using this resulted in new problems of linkage with the previous series by BBVA-FUNCAS and, therefore, we preferred to use the regional accountancy database of the INE.

completed the analysis with data offered by the INE (Spanish National Statistics Institute) in the Spanish Regional Accountancy for the period 1987-2006.

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, next empirical sections include an empirical study of the convergence within the European Union countries, and particularly Spain, and whether some explaining factors have played a role or not during the recent decades. 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 has generally come to be referred to as *sigma convergence* (see Barro and Sala-i-Martín, 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[9]. To analyze the evolution of the level of regional inequality in the countries of the sample, we examine the evolution of the following inequality index:

$$\sigma_t = \left[\frac{\sum_{i=1}^{N} \left(\ln GDPpc_{it} - \ln GDPpc_t \right)^2}{N} \right]^{1/2} \qquad (1)$$

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 regions considered in each case. The results of this calculation are shown in section 3.

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[9] Other widely used dispersion indices are, for instance, the coefficient of variation and Williamson's index. It may also be of interest apply inequality indices, such as Theil's, Gini's, or Atkinson's (Cuadrado et al., 1999; Eckey and Türck, 2007).

What factors can account in those convergence or divergence tendencies? Firstly, some authors[10] 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. 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:

$$\ln GDPpc_t = \ln Lpc_t + \ln \Pi_t \qquad (3)$$

where *Lpc* is the number of jobs per capita and Π is gross value added per employment or job.

Finally, the value of labour productivity depends on one hand on within-industry productivities and, on the other hand, on productive structure[11]. The sigma convergence results obtained for the sectoral productivities 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 phenomenons 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:

$$ID = \frac{\sum_{i=1}^{N} \left[\left(PLA_{it} - PLA_t \right)^2 + \left(PLI_{it} - PLI_t \right)^2 + \left(PLC_{it} - PLC_t \right)^2 + \left(PLMS_{it} - PLMS_t \right)^2 + \left(PLNS_{it} - PLNS_t \right)^2 \right]}{N} \qquad (4)$$

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

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[10]   See Rodriguez Posse (1994, 1996), Dewhurst and Mutis-Gaitan (1995), Borrás-Alomar et al. (1994), Armstrong (1995), Cheshire and Carbonaro (1995), Quah (1996), Cuadrado and Maroto (2008), or Lopez Bazo et al. (1999), among others.

[11]   See, for instance, Salter (1960), Denison (1967), Chung and Denison (1976), Young (1995), Dalum *et al*. (1999), Caree (2003), Hölzl and Reinstaller (2007), Krüger (2008), Maroto y Cuadrado (2007), Dollar and Wolff (1988), van Ark (1995), Peneder (2003); Fagerberg (2000) or Timmer y Szirmai (2000).

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*).

3. Results: a global approach.

Is it possible to talk of regional convergence in Europe between 1980 and 2006? As an introductory approach, trends towards convergence in per capita income have been analysed taking into account figures of GDP per capita of the 156 regions (EU-15). Considering as 100 GDP per capita of the EU-15 in 1980 as well as the average growth between 1980 and 2006, regional behaviours show a rather high dispersion. As predicted by the neo-classical approach, a good number of regions located below 100 in 1980 have increased their GDP per capita above the EU average since then. But not all have been so successful, because almost 30 regions remained below the EU average increase. On the other hand, regions having a GDP per capita above the EU average in 1980 show also different behaviours. Many of them have increased their GDP p.c. less than the EU average, but some others locate above or close to it. The global result of this first approach is that data permits only to talk of a slight convergence, as shown by the adjustment curve, having an R^2 of 0,192. If some outliers are eliminated this value increases, but not substantially.

To clarify if the 156 NUTS-2 regions of the sample have shown or not regional convergence in the EU during the period 1980-2006, the evolution of σ-convergence of GDP p.c. has been analyze, considering the EU-15 as reference. As shown by Figure 1, results suggest that there is not regional convergence along the period 1980-2000, but of fluctuations around a rather stable path, although since then onwards the evolution of σ-convergence shows a weak path to slow down. As pointed out in section 2, GDP per person can be decomposed into the product of jobs per capital and labour productivity. Figure 1 shows the evolution of convergence in these two variables. Employment per capita displays a practically stable path all through the period 1980-2006, but labour productivity shows a slow but positive trend to converge, particularly from 1992 to 2000, when that convergence process stops.

Figure 1. **Sigma convergence in EU-15 regions, 1980-2006**
GDP per capita, employment per capita and labour productivity
(3 years-mobile average)
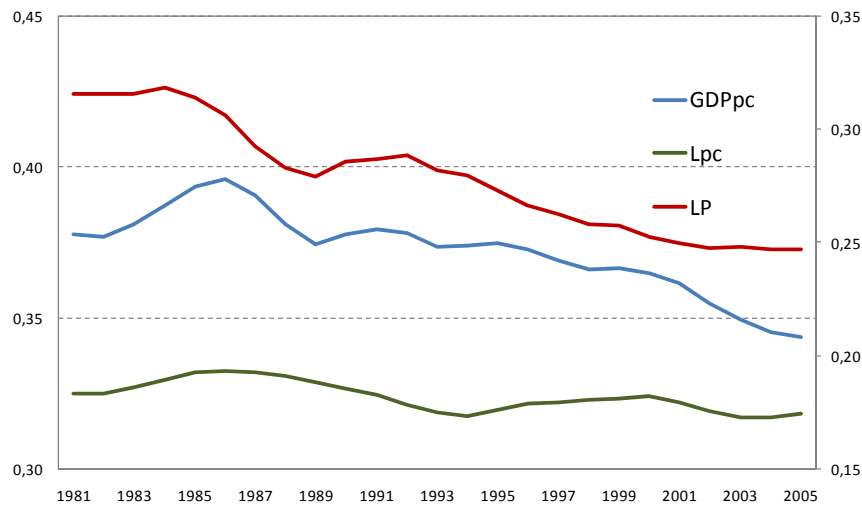
Source: Own elaboration. Data from *Cambridge Econometrics*

Apparently, the evolution of labour productivity seems to be the factor explaining the weak but positive process of regional convergence observed in the EU-15. But, two observations must be pointed out before carrying on the results of our analysis. The first is that trends shown by Figure 1 refer to the EU-15 regions on the whole and this might be hiding some differences at regional level. As some analysis have underlined, one of the main characteristics of the EU is the *heterogeneity* of behaviors which can be observed by countries and, above all, by regions (Cuadrado *et al.*, 2002). At section 4 we will come back to some of these differences. The second remark is that, according to some theoretical arguments as well as empirical analysis, convergence process of labour productivity should be driven by to the introduction (or imitation) of technological and organizational changes by the less developed economies. Nevertheless, there are other mechanisms that may generate convergence in labour productivity. Undoubtedly, changes of the productive structures and the evolution of sectoral labour productivity may act as key factors for convergence in productivity.

Both last aspects have been analysed. Firstly, we have studied if convergence in sectoral structures across regions may have been or not a source of productivity convergence. In doing so, an index of inequality in productive structures (*ID*) defined in section 2 has been estimated. Figure 2 (left side) shows the aggregate result of such calculation. It shows that, after a period of convergence, the process of narrowing differences in productive structures appears to be practically exhausted since mid-90s. On the other hand, as shown by Figure 2 (right side), some small differences do exist by

sectors: the agriculture still shows a possibility of diminishing inequalities and construction has slightly increased its disparities, but the rest of sectors show stable paths at a very low level of differences.

Figure 2. **Convergence in productive structure within EU-15 regions, 1980-2006**
(3 years-mobile average)

Total index	Sectoral indexes
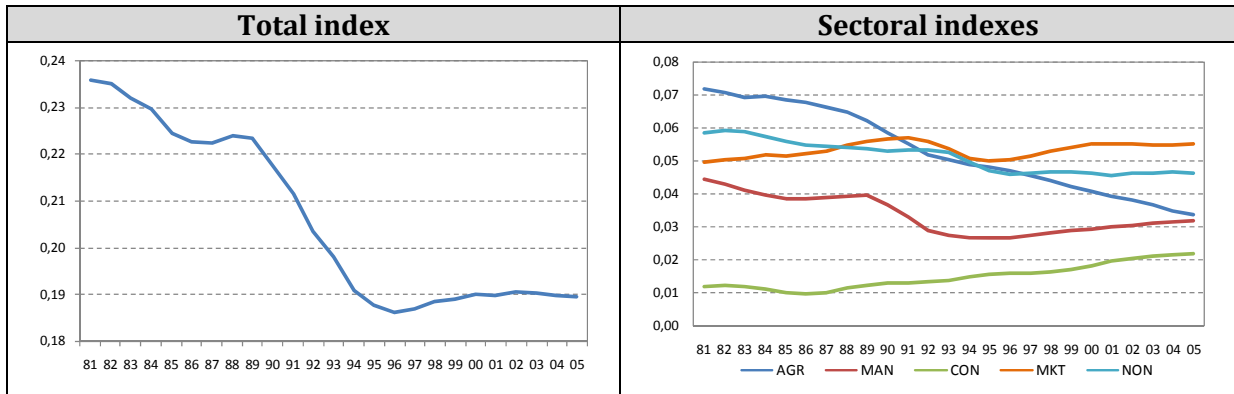
Source: Own elaboration. Data from *Cambridge Econometrics*

Finally, dispersion of sectoral productivities has also been calculated. Figure 3 shows that productivity within agriculture and non-market services have experienced a process of clear convergence, which has been compensated by the evolution within manufacturing industries from mid-90s. and by construction since 2000. Market services do not show significant changes around a low dispersion value along the whole period. The aggregate result is, as we have previously underlined, a process of slight convergence in terms of overall productivity, which practically fades away from late 90s. to 2006.

Figure 3. **Convergence in EU-15 regions, 1980-2006**
Sectoral productivity
(3 year-mobile average)
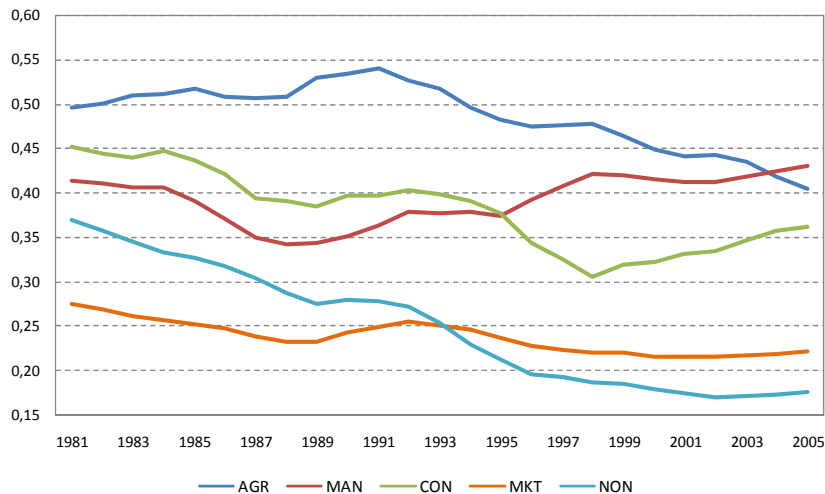
It is necessary to highlight that significant differences exist when the focus deeps into the different countries of the EU-15, questioning what is happening inside them in terms of convergence in all aspects previously analysed: GDP per capita, employment per person, labour productivity, and changes in productive structure. Results show clearly that the regional evolution of European countries has not been homogeneous, as it could be expected. Two comments can be drawn. First, it is obvious that regional disparities were, and still are, very high in some countries (Portugal, Greece, Spain and Ireland, even being this a special case) but rather irrelevant in some other (i.e.: Belgium, The Netherlands or Finland). Secondly, patterns are quite different by countries. Some countries have diminished their regional differences, other have experienced a process of divergence (even not being too much important), and other have remained stable.

Previous results, and other similar regarding employment, labour productivity and productive structure, have leaded us to explore the existence of some common patterns by countries in the following lines.

4. Results: Country clusters.

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.

Both theoretical and applied studies focusing European economies agree at defining one key characteristic: internal panoramic of European Union is not homogeneous. This fact seems to be relevant in our case too. Clear heterogeneities between regions and countries arise when GDP per capita, employment per person, labor productivity and even changes in productive structure are analyzed. As we introduced in the previous section, common patterns in terms of regional convergence might be underlined although when disaggregating into countries behaviors differ significantly.

However, some coincidences come up when individual countries are analyzed. This fact have urged us to group EU-15 countries into three different clusters or typologies according to the evolution of convergence in GDP per capita, productivity and productive structure. Concretely, it is likely to talk about 'divergence', 'stable' and 'convergence' countries in the EU-15. These three groups present different patterns between them, as we will show in this section (see also Annexe), and the countries belonging to each one seem to behave – with some exceptions that we will take into account – similarly. Table 1 shows the summary outline of these three clusters, characterizing those countries included within each group.

Table 1. **Regional convergence in EU-15 countries.**
The role of productivity and productive structure

	Countries	GDP per capita	Employment per capita	Labour productivity	Productive structure
Divergence countries	Denmark Finland Sweden United Kingdom Netherlands	Divergence (although show low interregional differences)	Narrowing differences (positive effect)	Divergence	Stable and Low ID
Stable countries	France Belgium Austria Germany	Stable path	Narrowing differences (positive effect)	Convergence	Decreasing and low ID
Convergence countries	Spain Italy Greece Portugal	Convergence	Widening differences (negative effect)	Convergence	Decreasing but high ID

Source: Own elaboration.

Firstly, some Northern countries, such as Nordic (Denmark, Finland and Sweden), the Netherlands or the United Kingdom, can be labelled as '*divergence'* countries in terms of GDP per capita. Some central countries, such as France, Belgium, Austria and Germany, belong to the second cluster: the '*stable'* economies because they maintain practically the same interregional differences than at the beginning of the 80s. Finally, Spain, Italy, Greece and Portugal have been clustered into 'convergence' group because they have experienced – especially those last two – significant convergence paths during the period here analyzed. Subsequently, we will describe the different behaviours within these three groups in terms of convergence and the role which have played issues as productivity and productive structure.

a) *Convergence* countries*:*

The process of sigma convergence in terms of GDP per capita across the regions within this final group has trended to stabilization after 1980, after a strong convergence period until the late 70s. 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 two countries stand below 0.19 at the end of 2006.

What factors can account for this general trend? In general terms, we observe a certain divergence in jobs per capita since 1980 onwards. This fact is one of the main causes of the interruption of the convergence process in GDP per capita previously pointed out.. On the other hand, we find that sigma convergence in labour productivity levels continues throughout the 80s. and the first 90s. However, that convergence process slowdowned since mid-90s. Productivity varies markedly across countries in the cluster, underlying the disparities in GDP per head noted above. It is highest in the 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 EU-15 average, through still below. 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 (Cuadrado and Maroto, 2008).

From the analysis of this group of countries we can draw two conclusions. 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.

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 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. 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.

b) *Divergence* economies.

Most Northern European countries have shown sigma divergence in terms of GDP per person across their regions. These economies are economically mature and took off high levels of development at the beginning of the 80s. Additionally, countries belonging to this cluster present low interregional differences of income per capita. These characteristics have translated into an increasing of the sigma coefficient since 1980, widening their differences related the EU-15 GDP per capita average level (sigma coefficients range between 0.15 and 0.20 for the United Kingdom, the Netherlands and Sweden, while even stand above 0.20 for Denmark and Finland).

What factors can explain this clear divergence with respect the European average? Firstly, it is observed a slight divergence in employment per capita for the whole period analyzed. However, this factor seems not to play an important role since the narrowing of differences is chiefly unappreciated. In Finland, it pressures even against divergence patterns as the dispersion of the logarithm of jobs per capita has increased until mid-90s. Then, one of the main issues explaining the above mentioned divergence in terms of GDP per capita is the productivity. If we observe the evolution of the regional disparities of overall productivity within the Northern countries (see figures in Annexe), an evident sigma divergence come into sight. Both levels and average growth rates of overall productivity have been above the ones in the EU-15, especially in Denmark or the Netherlands. Moreover, sectoral productivities also present a slight divergence pattern.

If we examine the employment structure in 'divergence' countries, the reduction of disparities in productive structure does not play a role. Regional disparities are significantly low during the whole period and the evolution of these has moved around a stable path since 1980. The only exception is Finland where the employment structure is still less uniform. This behaviour leaves no room for changes in productive structure as explaining factor of the overall productivity above mentioned. The principal issue which has urged the regional divergence in terms of productivity in Northern countries has been intrasectorial factors, such as better organizational regimes, higher capitalization rates or the presence of a more skilled labour force, among others.

c) **Stable** economies.

Final cluster is that grouping some central continental European countries (Belgium, Austria, France and Germany). These countries have shown a stable path in terms of GDP per capita convergence/divergence during the recent decades. However, this is the cluster less homogeneous and different specific behaviours are evident when data are analyzed.

The process of sigma convergence in terms of GDP per capita across the regions within the four countries of the cluster has trended to stabilization since 1980. The differences between regions within these economies have maintained and the level of inequality remains essentially constant. Only Austria seems to follow a certain convergence path. Another point to highlight is the differences of regional disparity within these countries. While the sigma coefficient in France or Austria stands below 0.20 in 2006, in Belgium is above 0.30. The German case deserves special attention. It has been included within this last cluster because the figures show an even pattern during the 80s. and since mid-90s. However, a structural break can be observed since 1990, widening interregional differences of income per capita after the inclusion of Eastern German regions. After a period of taming, when it was observed a clear increasing of sigma coefficient, evolution of convergence in terms of GDP per capita returned to a stabilization path.

In terms of employment, 'stable' countries show neither convergence nor divergence, with the only exception of Austria yet again (where a slight convergence of employment per capita it is observed). Nevertheless, the inequality differences of

employment distribution within these countries are significantly manifest again. The steady evolution of dispersion of employment per capita has run parallel to the one for overall productivity. All these countries have experienced no convergence in terms of labour productivity from 1980 to nowadays. The only exception could be Germany, due to its integration process implemented at the beginning of the 90s. and previously commented.

We can draw a conclusion from this analysis. There is not convergence in terms of overall productivity. At the industrial level, moreover, convergence is only observed for a few regions within the cluster. Additionally, the prospects for further reductions in productivity disparities are not very reasonable because these are fairly small already, mainly in Austria. Finally, which is the role of changes in productive structure in these central countries? If the *ID* is observed, it seems to be evident that structural changes do not really play a role. Discrepancies of the total *ID* in these countries has moved around a steady level during the whole period analyzed. Moreover, these indexes are quite low. Then, future convergence of labour productivity (and convergence of income per capita) only would be achievable if intrasectorial advances are put into practice.

5. Results: The Spanish case.

The present section analyses what occurred regarding productivity and regional production structures in Spain[12] during the period 1955-2006, i.e. over a whole five decades. A significant reason to embark upon this analysis arose when an attempt was made to approach the evolution of the income per capita of the Spanish regions. As we relate the income per capita of each region (autonomous region) in the starting year (1955) to the growth of this variable throughout the aforementioned five decades, the Spanish case shows quite an acceptable interregional economic convergence between 1955 and 2006. This is due to the fact that many of the most underdeveloped regions in 1955 (Extremadura, Castile-La Mancha, Galicia or Murcia, for example) grew more rapidly than the most advanced regions in the same year (the Basque Country, Madrid and Catalonia). However, if such a broad period is divided into two sub-periods (1955-1987 and 1986-2006), the results obtained show a clear difference. During the first period, the behaviour pattern effectively responds to a more rapid growth of the most underdeveloped regions with respect to those considered the most advanced in 1955

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[12]   See Cuadrado and Maroto (2009) for an extension of the analysis of the Spanish case.

(with a R² of 0.77). On the contrary, in the second subperiod, the process of regional convergence clearly slows down, thus data shows a much more disperse spectrum (R² of 0.33) from the end of the 1980's and the beginning of 1990's. All this has slowed down the convergence process and has even opened up a stage of slight divergence in terms of income per head.

The result of the estimation of σ-convergence in terms of regional income per capita for the period between 1955 and 2006 is the trend line shown in Figure 4, where the values of σ-convergence of labour productivity and employment per capita referring to the group of Spanish regions have also been included.

Figure 4. **Sigma-convergence at a regional level in Spain Income, productivity and employment per capita, 1955-2006**
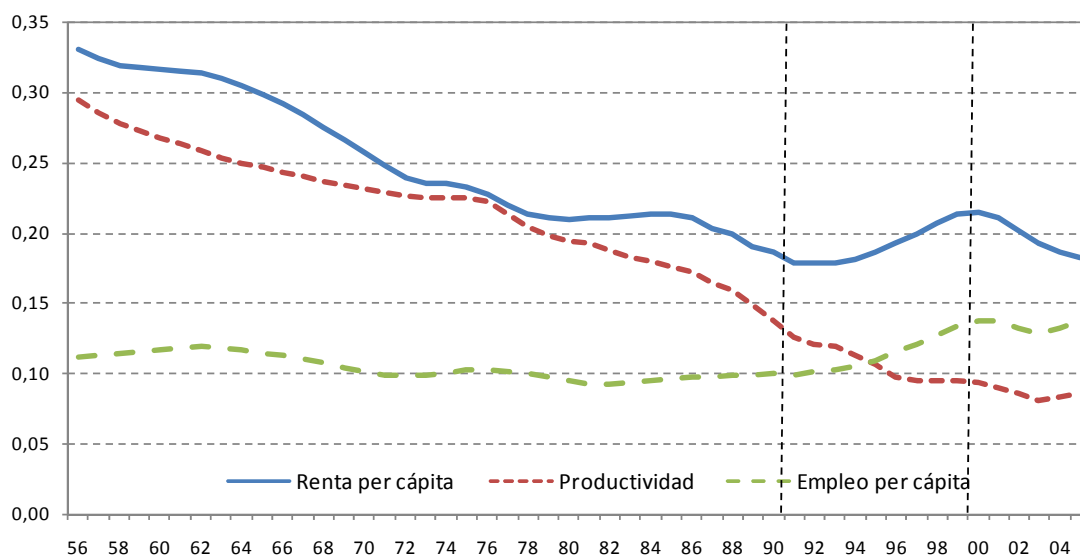
Source: Own elaboration from INE and BBVA-Funcas

The evolution of regional differences regarding income per capita in Spain allows us to differentiate two broad periods: from 1955 to 1978/79 and from 1978/79 to present date. During the first of these periods it is well known that quite a rapid process of convergence occurred where the differences in income per capita by autonomous regions were significantly reduced. Several studies[13] ascribe this process to the migratory flows registered in Spain during such period, which resulted in the movement of large population contingents from the less-developed regions to the most dynamic in the country and to other European countries, significantly modifying the denominator of

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[13] See for example: Alcaide (1988); Cuadrado-Roura, (1988); Mas *et al.* (1995); Cuadrado-Roura and García-Greciano (1995) and Cuadrado *et al.* (1998).

income per capita of many regions.[14] However, a factor that undoubtedly contributed to reducing regional disparities in terms of income per capita was the evolution of the aggregate productivity by regions, which also registers a notable process of convergence between 1955 and 1978/79, almost in parallel with that observed regarding income per capita.

This trend, however, ceased from 1979/80. The values of σ- convergence of regional levels of income per capita draw a fluctuating trajectory from that date on, linking stages of stagnation, convergence and divergence. Thus, between 1979 and 1986/87, convergence sharply comes to a halt, which coincides with the impact of the international economic crisis in the Spanish economy, with very low or even negative growth rates in the whole country and almost all the autonomous communities. After another brief period of convergence between 1991 and 2000, regional levels of income per capita diverge, and these converge again slightly from 2000 to 2006.

The explanation of these movements undoubtedly includes various factors. However, the decomposition of income per capita in productivity and employment per head offers some indication of what is underlying the movements registered during the period 1979-2006. As observed in Figure 4, convergence regarding productivity by regions has followed an advancing trajectory, although in the last years (1996-2006) this has virtually come to a standstill as the values are so reduced and therefore it is difficult to imagine new advances taking place – at least at an aggregate level – in terms of regional convergence in productivity. In parallel with the aforementioned, an opposite movement is registered in employment per capita, which had already been registering a slight trend towards regional divergence since the first years of the 1980's. This trend then becomes more intense and the values of its σ-convergence increase significantly from the year 1991, and subsequently, it stabilizes in the last years of the decade, although at a comparatively high level. This behaviour of employment per capita has influenced the evolution of regional convergence regarding income per head.

The changes concerning the estimations of regional convergence regarding income and employment per capita in the last years (2000-2006) could be due to different reasons, and a future analysis will be significant when data referring to a broader time span is available. However, we believe that such changes are mostly due to the different

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14   Some estimations ascribe around 50% of the reduction of interregional differences regarding income per capita to this factor.

variations experienced by population and employment in the diverse autonomous regions in the aforementioned period, which are, in turn, due to the immigration flows in Spain which have a different impact at a regional level.

As demonstrated in this work, productivity per worker has undergone a clear and sustained process of regional convergence in Spain from 1955 to the mid-1990's. However, this process seems to have slowed down from that latter date onwards. The value of aggregate productivity of an economy depends, in turn, on two factors: on the one hand, the internal productivities of each economic sector comprising such economy and, on the other hand, how economic resources are distributed among these sectors. If productivity is higher in industry or services than in agriculture, for example, a transfer of resources from the primary sector to other sectors could explain a convergence in aggregate productivity, which would not be necessarily so at an individual level in productive sectors.

Figure 5. **Sigma-convergence at a regional level in Spain**
Productivity by large sectors, 1955-2006
(three-year mobile averages)
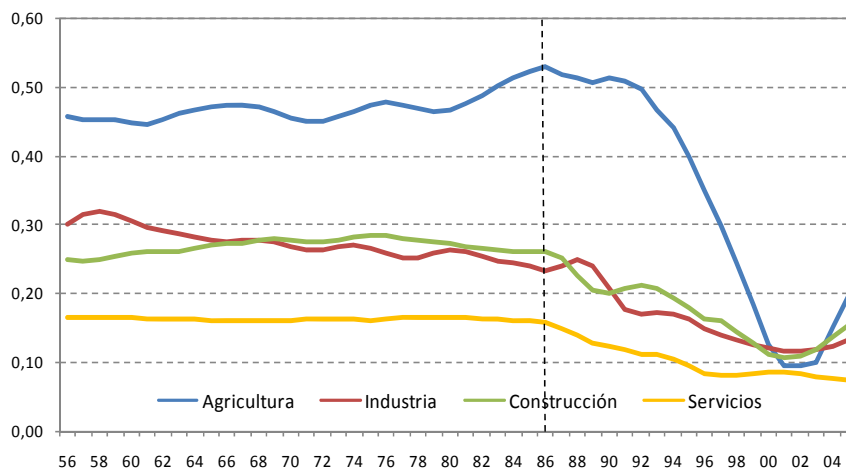
Source: Own elaboration from the INE and BBVA-Funcas.

Figure 5 shows the results of sigma-convergence regarding productivity by the four large economic sectors analyzed in this paper. As already mentioned, appreciable differences are observed within two periods of time. Until the final years of the 1980's decade, interregional differences in terms of productivities remained stable, although with only minor differences among the sectors. In the agricultural sector, not only convergence

in its internal productivity, but also a slight divergent tendency is observed[15]. The opposite process is observed in the industrial sector, where Figure 5 illustrates a slight process of sigma-convergence between 1955 and the end of the 1990's. Then finally, regarding the other two sectors (construction and services), no convergence or divergence process is registered during that same period, with the interregional productivity differences remaining in these activities.

Therefore, despite the convergence process regarding aggregate productivity registered between 1955 and the end of the 1980's in Spain, this process was not based on the convergence in within-industry productivities, whose differences remained virtually stable in that mentioned period. On the contrary, and as we will examine in more depth further on, the most important factor in the convergence of aggregate productivity involved the changes in productive structure. However, from this time, a convergence process in within productivities is observed (principally in the primary sector). This reduction in interregional differences at a sectoral level could be mainly due to the poor performance of Spanish productivity, as previously mentioned. Additionally, another two notable factors played an essential role in this process: Spain joining the European Union and the effects of cohesion policies regarding productivity in the less-developed regions. On the other hand, the significant processes of population and employment absorption in certain regions, which originated from migratory flows in recent years, could also explain such behaviour.[16] And the last factor affecting this process is the apparent weakening role of structural change since the end of the 1990's (see Figure 6) regarding productive convergence.

Until the end of the 1980's, a clear tendency towards regional convergence was seen in Spain regarding aggregate productivity, despite the fact that such convergence was not observed within industries. Thus, the issue would be how to combine the existence and lack of such aggregate convergence in within-industrial terms. Regardless of the existence of other possible explanatory factors, the previous phenomenon could be caused by the following: on the one hand, variations in the weight of each sector within each of the regions and its interrelationship with the aggregate productivity levels[17], and secondly,

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15   The reasons explaining this are based on its strong random behaviour, which is linked to its dependence on weather conditions, which characterizes these types of activities creating differences in regional productivity.

16   Due, on the one hand, to the direct influence of the employment variable on productivity (defined as GDP per worker) in Spain and, on the other hand, to the changes registered in statistical sources from the year 2000, which resulted in the emergence of population and employment.

17   For example, if the services sector has a higher weight in rich regions, which are also characterized by a higher productivity, and if the growth of productivity in such a sector is lower than in other sectors, a

if the shift of employment from the primary sector to more productive sectors occurs to a larger extent in the less-developed regions, processes of sigma-convergence could arise regarding aggregate productivity, even if these do not exist in sectoral productivities.

Figure 6. **Index of productive inequality at a regional level in Spain, 1955-2006**
(three-year mobile averages)
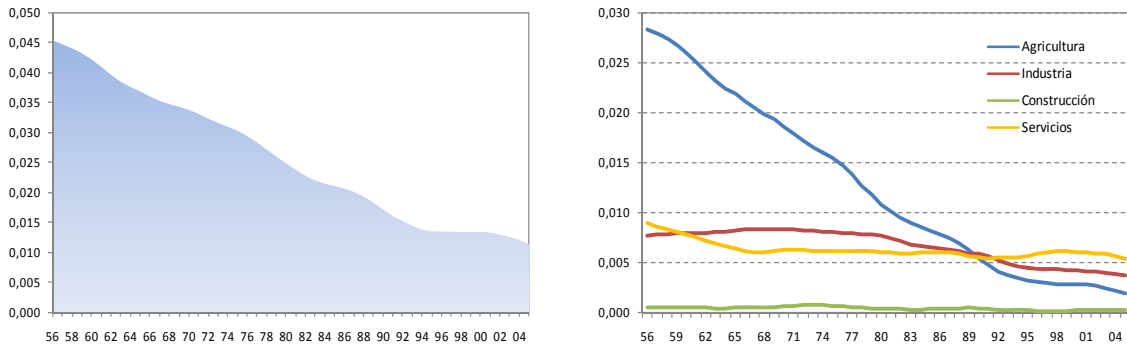
Source: Own elaboration from BBVA-Funcas

The aforementioned approach suggests that convergence in productive structures across the Spanish regions could have been an important source of productivity convergence, at least until the end of the 1980's, when such capacity seems to have ceased. In order to analyze this hypothesis, we use the productive inequality index[18] described in the second section. Figure 6 shows the results of such indicator. The left-hand figure shows that, in terms of employment, the productive structure of Spanish regions becomes progressively more homogeneous until the end of the 1980's decade. The right-hand figure shows, however, that the reason for this convergence is mainly based on the notable loss of weight of the primary sector in the poorest regions. In line with what has been already stated, this fact helps us to explain sigma-convergence in terms of total

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[18]

similar growth of sectoral productivities in the different regions would be compatible with a higher growth of total productivity in the less-developed regions. This would result in a convergence process in aggregate productivity (Cuadrado *et al*., 1999; Cuadrado and Maroto, 2006; Maroto, 2008).

A similar analysis has been carried out on the basis of the specialisation index of each Spanish region, defined with the following expression:

$$ IE_{ij} = \frac{E_{ij} / \sum_i E_{ij}}{\sum_j E_{ij} / \sum_i \sum_j E_{ij}} = \frac{E_{ij} / \sum_j E_{ij}}{\sum_i E_{ij} / \sum_i \sum_j E_{ij}} $$

where E_{ij} is employment of sector i (with $i = 1,…,4$) in the region j (with $j = 1,…,17$).

The results obtained using this specialisation index corroborate the conclusions reached in the case of sigma-convergence in productive structure. A convergence process is observed in regional productive specialisation, as the less-specialised regions in 1955 were those relatively increasing their specialisation to the largest extent between that year and 2006 (see Annex 1).

productivity and, therefore, of income per capita from the mid-1950's to the end of the 1980's.

However, after the 1990's, convergence in productive structure slowed down considerably, as the minor interregional differences in industry and services, which were low from the 1950's, and the virtually non-nexistent differences in the construction sector registered a reduction in the primary sector as from this date. The result is that the differences in recent years have remained quite low (around 0.005), and therefore the margin of possible future positive effects seems to be scarcely probable.

6. Final remarks

Economic convergence or non-convergence between countries and regions keeps on attracting analytical attention in Europe. The aim of this paper has been to show at what extent regional convergence processes in terms of GDP per capita might be run out during recent years. At least in those advanced economies belonging to the European Union. 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 seem to agree with this topical hypothesis. However, some discrepancies appear among countries. Section 3 has presented a first approach to global convergence. Data permits only to talk of a slight convergence among European regions, as predicted by neoclassical models. Moreover, if sigma-convergence is estimated, we have concluded that there is not regional convergence along the period 1980-2000, but of fluctuations around a rather stable path, although since then onwards the evolution shows a weak path to slow down. Apparently, the evolution of labour productivity seems to be the factor explaining the weak but positive process of regional convergence observed in the EU-15. Data on productive inequality show that, after a period of convergence, the process of narrowing differences in productive structures appears to be practically exhausted since mid-90s

The cluster panoramic introduced in the section 4 draws two main conclusions. First, convergence/divergence patterns observed within the EU-15 is likely hiding different regional behaviours within each particular country. Three typologies have been differenced within EU-15: i) convergence economies or Southern countries (Italy, Spain,

and particularly, Greece and Portugal); ii) divergence economies or Northern countries (Nordic, the Netherlands and the United Kingdom); and, iii) stable economies or Central countries (Germany, Austria, Belgium and France). Results agree with the hypothesis about that structural changes help convergence on labour productivity, and this latter urges convergence on income per capita. Nonetheless, this is not common to all EU-15 countries, but only to those less mature. Moreover, the narrowing of productive structures is already very significative and its influence on the regional convergence in European economies seems to be worn out nowadays.

The observed evidence might be valid only for the EU-15 countries and regions. Other European countries, especially those known as New Member States or Eastern countries, may enjoy significative convergence trends, since their productive structure are quite far from the ones within the Western European economies yet. Moreover, these comments should not hide the intranational differences between regions within the same country. We have grouped European countries into three typologies, taking into account a plausible 'national' behaviour or stamp. However, if this national effect would be suppressed, clear differences between regions within the same country will arise[19].

Additionally, σ-convergence in terms of income per capita of Spanish autonomous communities leads us to differentiate between two sub-periods. In the first of these sub-periods (from 1955 to 1978-79), regional disparities regarding income per capita registered a rapid convergence, where the migratory flows occurring in Spain over this period had an unquestionable influence. However, convergence in regional productivity per worker also contributed significantly, which relates to the remarkable approach registered in the sectoral composition of the productive bases of Spanish regions. This result coincides with that obtained some years ago by Cuadrado *et al*. (1999). The second sub-period (1979–2006) shows quite a different evolution of σ-convergence in regional incomes to that of the previous stage. During the first years, convergence ceased completely. Regional convergence in productivity remained until the mid-1990's although towards the end at a very low level and almost coming to a standstill until the year 2006. Secondly, a process of divergence in employment per capita was registered, which undoubtedly influenced income-related convergence and even divergence variations. And finally, data regarding population and employment in the period 2000-06 also played a

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[19]   See, Rodriguez-Posse (1994, 1996), Dewhurst and Mutis-Gaitan (1995), Armstrong (1995), Chesire and Carbonaro (1995), Quah (1996), López-Bazo *et al*. (1999) or Cuadrado and Maroto (2008), among others.

significant role in the recent evolution of regional disparities due to the increases registered by both variables being distributed very unevenly in the regions

The fact that the convergence of productivity by regions has come to a halt in recent years is clearly related to the disappearance of a factor boosting such convergence for many years: the approaching process of regional productive structures by sectors. It is obvious that, in this way, no new boosts to regional convergence are registered, both regarding productivity and income per capita. On the contrary, although regional divergence of employment per capita was not very remarkable, it contributed to the slowing down of convergence in income per capita and even promoted a divergence process between 1993 and 2000.

Finally, our results do not close the debate on convergence among European countries. As we said in the introduction, our aim was try to feed it. Thus, some likely research paths seem to appear at this point. First, some trends shown refer to the EU-15 regions on the whole or to aggregate countries. But, this is hiding some differences at regional level because one of the main characteristics of the EU is the *heterogeneity* of behaviours which can be observed by regions. Secondly, the loss of weight of structural changes on convergence of labour productivity during recent years might highlight the role of intrasectorial improvements in productivity and the active contribution of some specific sectors or activities to the overall productivity dynamism.

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