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## CONVERGENCE AND REGIONAL MOBILITY IN THE EUROPEAN UNION

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### Abstract:

The paper begins with a conventional analysis of regional convergence in the European Union, during the period 1977-94. It can be observed that, although a certain convergence took place, it practically came to a halt over the last few years (1986-94). In any case, it clearly stands out that this convergence is “conditioned” and that, in the analysis of fixed effects, regions show quite different positions. The paper is then centred on studying the “mobility” which occurred within the European Union regional ranking during that period. Markov systems offer the possibility of analysing the principal changes in the positions of the regions and, in particular, of defining the transition towards a *stationary state*.

In addition to describing the shifts followed by regions, this paper also shows some common patterns which help to distinguish among the factors determining this mobility. The data base essentially comes from Eurostat official series, although other auxiliary sources have also been used in order to overcome some deficiencies of the Eurostat series.

**Key words:** convergence, regional mobility, Markov systems, fixed effects, stationary state.

## 1. Introduction

Over a number of decades, economic growth and its causes have been at the centre of economists' attention. In the open debate over recent years on the factors explaining growth and the validity of the dominant models, the explanation of national and, above all, regional inequalities has been the real *test* for new proposals and their derivations. In particular, debate is largely centered on the very controversial question of *convergence* or *divergence* between countries or regions with different levels of economic development, which has become the touchstone in evaluating the validity of new theses<sup>1</sup>.

Unfortunately, in spite of the already large number of existing analyses, empirical evidence does not offer conclusive results in favour of any of the two opposite postures. On one hand, analyses carried out under a neo-classical approach (Barro and Sala-i-Martin, 1991 and 1992 or Sala-i-Martin 1994 and 1996) underline the existence of convergence, generally qualified as *conditioned*, while others, critical of the foundations of the neo-classical model (Chatterji, 1993 or Quah, 1993 and 1996) point out a marked trend towards a *polarisation* pattern, in turn leading to a higher level of regional income dispersion.

In the European Union (UE), the problem of economic convergence, whether between countries or between regions, has had and still has a special interest, since it is closely linked with some of the basic principles on which European integration is based. In particular, regional convergence is central to the objective of achieving the highest possible level of *economic and social cohesion* stated in the new Union Treaty. However, reaching such an objective is not an easy task. On one hand, theoretical literature offers quite diverging explanatory models when trying to evaluate the effects of economic integration processes on the reduction or disappearance of existing regional

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<sup>1</sup> The neo-classical approach, whether in its version of *absolute or conditioned* convergence, stimulated from the beginning of the 90's by Barro and Sala-i-Martin, has been contested with alternative approaches ranging from the neo-classical reformulation of Romer and others (*endogenous growth*) to models of *new economic geography* (Krugman), the reformulation of Myrdalian cumulative causation, the theory of

disparities. On the other hand, the available empirical evidence does not offer conclusive results with regard to the validity of the proposed theories. Indeed, when the reality of European regions is taken as reference, as shown, among others, in Armstrong (1995), Cheshire and Carbonaro (1995), Rodríguez Pose (1997) or Cuadrado, Mancha and Garrido (1998), the processes of change now taking place show that *convergence and divergence* are simultaneously occurring: regions which present a higher growth and a more favourable trajectory do not always coincide with the most developed; likewise the ones which show slow growth are not necessarily the least developed and/or peripheral.

Current trends therefore indicate that we are faced with very complex processes in which the most notable pattern is the high level of *heterogeneity* present in the behaviour of the different regional economies, processes quite far from the classical centre-periphery concept and from other more or less conventional approaches. For this reason, the need to further analyse the factors or elements which are behind the existence of a higher degree of convergence or divergence becomes essential and demands more detailed analyses.

The first objective of this paper is to offer a global overview of the evolution of regional disparities in the EU, including both an analysis of the regional mobility which occurring within this process and an attempt to better understand the facts and detected trends which may point to some possible explanations.

The paper is structured in the following way. Following this introduction, the second section is centred on the description of the data base. The third section shows the results of the convergence analysis carried out using a conventional methodology. Section four studies the dynamics and mobility of European regions using a Markov chains methodology applied to the regions winning and those losing positions in the European ranking. Section five indicates some differences existing between winning and losing regions, with some tests enabling us to approach a causal analysis of these changes. Finally, the paper ends with some brief concluding remarks.

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social capital, or the approach of *milieux innovateurs*. An excellent survey of these theoretical positionings can be found in Armstrong (2000).

## 2. Data base: basic characteristics and problems

The only homogeneous statistical information available for the analysis of the socio-economic evolution of European Union regions can be found in the REGIO data base, provided by Eurostat for the period 1977-1994. However, this official series presents some gaps in particular years and regions of specific countries for some basic variables such as GDP, GVA or employment which were supplemented with other official statistical sources. These included, for instance, data from the Labour Force Survey or the regional Portraits elaborated by some countries. Finally, the data compilation by the *Recherche Economique Nord Sud* of the University of Cagliari (CRENoS) has been very useful to get a complete series of GDP, GVA and regional employment and to carry out empirical analyses.

In relation to some of the other variables, such as demographic density, urbanisation, patents, R+D, etc., the availability of statistical information has been much more limited, given the absence of long series. Since these variables were used mainly for test with the basic results, we consider that these limitations do not impede the explanation of the complex change processes occurring in European regions during the analysed period.

As is widely known, in relation to area, population and, in particular, level of government autonomy, European regions are very heterogeneous. It serves to remember, for instance, that although the average area of NUTS 1 regions is slightly superior to 33,700 km<sup>2</sup>, this fact hides important extremes: 215,000 km<sup>2</sup> for the Spanish region Centro versus 200 km<sup>2</sup> for Brussels (Belgium). In terms of population, similar disparities can be seen: in Île de France there are more than 10 million inhabitants versus 115,000 inhabitants in the Valle de Aosta. Comparing political-administrative governments is not an easy task either. In the European Union, federal states (Germany and Belgium) and regional states (Spain and Italy) coexist with more centralised states (the United Kingdom, Ireland and Luxembourg) and other states with some type of political-administrative regionalisation (France and Portugal).

These differences, together with the availability of data, represent important restrictions when adopting an homogeneous classification scheme. In order to overcome this problem, regions have been selected in accordance with the comparability of their levels of self-government – for decentralised states – while, for the remaining ones, the adopted criterion has been their similarity in area and population with the former. The classification thus obtained is as follows (see annex for a more detailed analysis)<sup>2</sup>:

1) NUTS 2 for Spain – except for Ceuta and Melilla - (17), Greece (13), France (22) – excluding overseas territories – and Italy (20)

2) NUTS 1 for Germany -except for the new *länder* - (11), the United Kingdom (11), the Netherlands (4), Belgium (3) and Portugal – excluding Madeira and Azores - (5).

3) The whole country in the cases of Denmark, Ireland and Luxembourg.

After selecting a total of 109 European regions, the analyses described in the previous section was performed for a set of economic indicators for the period 1977-94. The principal variables used were the original GDP and GVA at market prices in current ecus, later on converted into 1985 constant ecus through the homogeneous application of a single deflator (European Union consumer price index based on 1985). Data related to population and employment have been used to transform these economic variables into per capita and per employee terms.

### **3. Convergence versus divergence: a conventional analysis**

Conventional analyses of regional convergence are useful for studying and interpreting the general trends observed. However, this type of approach hides some important aspects and elements for understanding the complexity of the change as important as that which has been taking place in the EU since the mid-seventies, and

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<sup>2</sup> The existing information does not permit us to widen the analysis to Austria, Sweden and Finland, given that REGIO only provides data for very recent years.

which can only be detected through more detailed analyses by country and by region, as is done in the following section.

In any case, the availability of time series data for a great number of regions (109), and for a long time period (1977-94), allows for the test of two well known convergence concepts in the literature on regional growth: *absolute beta* ( $\beta$ ) *convergence* (also called non conditioned beta) and *conditioned beta* ( $\beta$ ) *convergence*, both referring to per capita GDP and to productivity, although we do not here discuss their theoretical approaches, as they are well known<sup>3</sup>.

The basic results of these estimations can be synthesised into the following points:

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<sup>3</sup> The objective of the analysis of  $\beta$  *convergence* is to see if a situation of relative lag at a given time tends to decrease as time goes. That is to say, if regions starting in worse-off positions register higher growth rates than the most developed ones, as predicted by the neo-classical theory, a catching up effect must eventually take place enabling the former to approximate the levels of the latter. In formal terms, and using a panel of data for European regions during the 1977-1994 period, absolute convergence is tested in accordance with the following equation (expressed in logarithms):

$$\Delta y_{it} - \Delta \bar{y}_t = \beta(\bar{y}_{t-1} - y_{it-1}) + v_{it}$$

The first term of this equation shows the difference between the growth of GDP per inhabitant or productivity of a region  $i$  in relation to European average growth during the considered time period. This difference must positively depend that existing during the period  $t-1$  between the value of the level of European GDP per inhabitant and the value of region  $i$ .

The existence of panel data allows the estimation of *conditioned*  $\beta$  *convergence*, which implies testing the following equation:

$$\Delta y_{it} - \Delta \bar{y}_t = \alpha_i + \beta(\bar{y}_{t-1} - y_{it-1}) + v_{it}$$

As can be observed, a new parameter  $\alpha_i$  is included in this case, which captures, through the use of *regional dummy variables*, the existence of specific regional factors influential on the convergence of regions towards their own *stationary state*. This implies estimating a model with *fixed effects*. The econometric use of *panel data* allows the estimation of these regression coefficients. Namely, the use of the panel enables to test the hypotheses which underlie the analysis of absolute  $\beta$  convergence: the same speed of convergence for all the regions ( $\beta_i = \beta$ ) and/or the equality of regional parameters in a *long term stationary state* ( $\alpha_i = \alpha$ ). If  $\beta = 0$ , the differences between the various analysed regions would not be *stationary* and as a result productivity levels would widen between the most and the least advanced, even in the assumption that  $\alpha_i = \alpha$ . On the contrary, if the value of  $\beta$  ranges between 0 and 1 and, in addition,  $\alpha_i = \alpha$ , differences between developed regions and the remaining ones would shorten and tend to cancel themselves out, and all of them would move towards *the same stationary state*. However, if  $\alpha_i \neq \alpha$ , inter-regional disparities in productivity or GDP per inhabitant will tend to stabilise themselves and each region will shift towards its own *steady state*.

1. The analysis of *non conditioned  $\beta$  convergence* shows that convergence rate during the period 1977-94 is higher in the case of productivity than in GDP<sup>4</sup> per inhabitant, although they are quite close to the 2% estimated in various analyses. When comparing two sub-periods, the obtained results suggest that this convergence was fundamentally achieved between 1977 and 1986, dates after which it almost came to a halt (see table 1).
  
2. The analysis of *conditioned  $\beta$  convergence*, through the test of a model with regional *fixed effects*, provides different results. First, because the model is more consistent from a statistical point of view<sup>5</sup> and second, because the value of  $\beta$  is much higher (around 20% for both variables). However, to state that a *conditioned* convergence takes place in approximately 4 periods is equivalent to say that differences in per capita GDP and in productivity tend to stabilise themselves over that time<sup>6</sup>.
  
3. The existence of *conditioned* convergence indicates that an important number of regions show clearly different behaviours. Indeed, three types can be distinguished: i) regions with *positive*, and statistically significant, *fixed effects*, a sign that these regions possess elements which contribute to their dynamism; ii) regions with *negative*, and significant, *fixed effects*, a fact which indicates the presence of factors slowing down their convergence with the remaining regions; and finally iii) a third group where the estimated *fixed effects are not significantly different from zero*, or what is the same, where factors neither slowing down nor fomenting their convergence with the

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<sup>4</sup> As shown in the literature on regional growth, De la Fuente (1996) or Rodríguez Pose (1997), the parameters of the different estimations are very sensitive to the considered period and to units. Thus, for instance, the use of variables expressed in PPS instead of ECUs would somewhat modify the final results.

<sup>5</sup> In our estimation, the test on the existence of regional fixed effects does not allow us to accept the hypothesis according to which  $\alpha_i=0$ , thus implying that the most efficient estimator is the one derived from a model with these fixed effects.

<sup>6</sup> This implies estimating different *equilibria states* under the following form:  $\alpha_i / \beta$ ; or, what is the same, confirming the existence of regions which present positive *fixed effects* while others offer negative ones. This form of estimation has the advantage that it is not necessary to establish assumptions on the determining variables of the *steady state* of each of the regional economies being considered. However, it presents a fundamental inconvenience when interpreting the value of estimated *fixed effects*, since these constitute a “black box” which has to be deciphered through additional analyses (Cuadrado and García Greciano, 1995, Cuadrado, Mancha and Garrido, 1998) and which, in a way, represents the “ignorance” of the economist.

remaining regions are detected, which allows us to state that they are to be found around a line of *absolute convergence*, somehow representing the average situation (see map 1).

**Table 1**  
**Estimation of  $\beta$ convergence in G.D.P. per capita and productivity**  
**Generalised Least Squares (GLS)**

	1977-1994		1977-1986		1986-1994	
<b>G.D.P. per capita</b>						
$\beta$ (probability)	0.01740 (0.0000)	0.18016 (0.0000)	0.01732 (0.0000)	0.21026 (0.0000)	0.00919 (0.0102)	0.3379 (0.0000)
Fixed Effects	No	Yes	No	Yes	No	Yes
R <sup>2</sup>	0.0218	0.1888	0.0224	0.2870	0.0059	0.2669
F-test (probability)	--	3.72 (0.0000)	--	3.21 (0.0000)	--	2.90 (0.0000)
DW	1.66	1.73	1.69	2.01	1.43	1.29
Observations	1853	1853 (17x109)	981	981 (9x109)	981	981 (9x109)
Years to half convergence	41	4	41	4	77	3
<b>Productivity</b>						
$\beta$ (probability)	0.03432 (0.0000)	0.2213 (0.0000)	0.03142 (0.0000)	0.29458 (0.0000)	0.01557 (0.0047)	0.37062 (0.0000)
Fixed Effects	No	Yes	No	Yes	No	Yes
R <sup>2</sup>	0.0399	0.1934	0.03862	0.3036	0.00467	0.2497
F-test (probability)	--	3.83 (0.0000)	--	3.48 (0.0000)	--	2.65 (0.0000)
DW	2,00	1,92	1,82	2,13	2,01	1,76
Observations	1853	1853 (17x109)	981	981 (9x109)	981	981 (9x109)
Years to half convergence	21	4	23	3	45	2

Source: Own elaboration

**Map 1 around here**

- Regions with *more negative fixed effects* generally coincide with the slower-growth European regions (mainly Spanish, Greek, Portuguese and Italian) and with others which suffered from the negative impact of the economic



crisis of the 70's and the 80's (as for instance some British and German ones) due to the strong weight of industry in their production structure. On the contrary, among those presenting *positive fixed effects*, various of these correspond to big metropolitan centres, such as Île de France, Lombardy, Bayern and Hamburg, among others.

The previous results allow therefore an interesting conclusion: during the period 1977 to 1994, a certain (although modest) process of *absolute convergence* took place between European regions but, behind it, are hidden certain regional *peculiarities* which the analysis of *conditioned  $\beta$  convergence* somehow confirms through the existence of some regions with *positive fixed effects* and others with *negative fixed effects*. Hence, it seems necessary to try and further study this differentiated behaviour among European regions beyond the conventional analysis.

#### **4. Dynamics and mobility of European regions**

##### **4.1. An principal feature: differentiated regional growth**

The individual behaviour of the selected regions shows that, in terms of economic growth, their evolution differs remarkably. The presence of this *heterogeneity* can be observed in the fact that, while some have hardly grown or have even come to a halt, others have reached performed well enough to be classified as clear *winners*.

What this fact - which can seem contradictory to the previously mentioned evolution of regional disparities over recent years, with neither a clear process toward convergence nor divergence - really means is that European regions are not trapped in a fixed or stable position within an European ranking (whether in terms of level or growth rate of GDP, per capita GDP or productivity of labour input). On the contrary, the evidence shows that notable shifts have taken place within this ranking.

However, instead of analysing at this point the characteristics of these dynamics, to which special attention will be dedicated in the following section, it seems more important to note that upwards and downwards shifts can be found *in any type of region*.

That is to say, we are faced with an heterogeneous panorama in which developed regions with favourable performances coexist with lagging regions behind but also showing positive dynamics while, at the same time, other developed regions do not show very favourable performances, being very similar to those of some areas situated at a low level of development.

The most positive achievements are most clearly seen in East Anglia, South West and East Midlands (United Kingdom), German regions in the South (Bayern and Baden-Wutenberg) and in those of the “Terza Italia” since the beginning of the 70’s. All of them registered GDP growth rates superior to those of other areas in their respective countries while, at the same time, they showed clear evidence of a renewed dynamism and capacity to attract new investments (Cuadrado, 1994). However, other areas with a lower level of development, such as the Spanish regions in the Mediterranean Arc (Cataluña, Comunidad Valenciana or Murcia) or the Ebro Axis (Aragón, Navarra and Rioja), as well as some Italian regions, also experienced a more dynamic behaviour than the rest, with growth rates above national and European averages.

At the opposite extreme, a high number of regions which can be classified within the “old industrialisation” group obtained growth rates clearly below European growth averages during the analysed period (Nord-Pas de Calais in France; Nordrhein Westfalia in Germany, South Yorkshire in the United Kingdom or Wallonne in Belgium are significant examples). However, although the problems faced by this type of region are similar such as economic crisis and industrial and/or mining reconversion, their capacity of restructuring and renovation has been quite different depending on particular cases.

In terms of GDP per inhabitant, results do not greatly differ from those previously analysed: a varied behaviour is still been although, on the whole, it is conditioned by the macroeconomic evolution of the respective country. However, it should be noted that the so-called regions Objective 1 (GDP per inhabitant below 75% of the Community average), hence the least developed, maintained throughout the 1986-1996 period a relatively good performance, growing at rates close or even superior to the EU average. Ireland, Abruzzi and Molise, East Macedonia, the Centre of Portugal

and Canarias, Comunidad Valenciana, Extremadura and Murcia are the most representative cases. The fact that some did not improve their position in the European ranking is due to the relatively high population growth they maintained throughout those years.

From a productivity point of view (GDP per employee), results are also clearly related to the previously mentioned points, although the highest productivity gains of the least developed regions can mainly be explained by their negative employment growth. As for those with a higher level of development, the panorama is more varied since some regions have gained productivity through an increase in unemployment while others have lost productivity but have maintained employment growth, as in the case of Dutch regions<sup>7</sup>.

Finally, these trends seem to indicate that, in relation to the halt of regional convergence, some quite significant changes are taking place in the positions held by the different European regions and that, in addition, the least developed regions have less possibilities of catching up with the most advanced ones. Indeed, the results indicate a process of *decreasing convergence* in terms of GDP per inhabitant and GDP per employee, taking place precisely because the final position of the most developed regions *worsens more* than the improvement occurring among the least developed (see figures 1 and 2).

#### **4.2. Mobility of European regions**

The evolutionary dynamics of European regions can be effectively captured through a Markov systems approach. This technique adequately captures the mobility of regions as have been underlined in some works (Quah,1993; Armstrong and Kevernode,1997). In analysing these shifts in ranking, it is possible to determine some of the factors separating the *winning* regions from the *losing* ones.

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<sup>7</sup> A detailed analysis on productivity can be found in Mancha (1999 and 2000) and in Cuadrado, Mancha and Garrido (2000).

While it is not necessary to go into a detailed description of this technique, it should be noted that it is a useful tool for studying convergence from a mobility perspective, given the assumption that income levels between regions follow a stochastic process (Quah, 1993).

The principle variable selected for this approach is GDP per inhabitant during the period 1977-94. The first step consists of establishing five relative states or levels of income (UE=100). Secondly, the vector of probabilities is calculated at the beginning ( $P_t$ ) and at the end of the period of the sample. Transition matrices<sup>8</sup> have then been estimated in one step (M), tabulating which regions do not vary and which ones change from one state to another in the initial and final years of the samples used. From an initial situation (t), the probabilities of belonging to the different states of income in t+n can be defined in accordance with the following expression:

$$P_{t+n} = M^n * P_t$$

The equilibrium or *ergodic* solution is calculated when  $n \rightarrow \infty$ , thus obtaining a vector  $P^*$ , which shows the probability of resting at the different levels of income in the long term, independently from the initial situation. If the central values of  $P^*$  (corresponding to the average levels of income) are high, a convergence process is detected. If, on the contrary, the extreme levels are the highest, the distribution tends toward equilibrium values above or below average values.

The main results are shown in tables 2 and 3. In general, it can be said that inter-regional mobility in Europe tends toward convergence insofar as long term equilibrium distribution shows a probability superior to 80% of being situated at an income level between 90 and 110 (EU=100). However, it is necessary to emphasize the following remarks:

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<sup>8</sup> The transition matrix must fulfil a series of conditions so that the obtained results are stationary, thus allowing the obtention of a long term equilibrium solution. These conditions are homogeneity, irreducibility, recurrence and lack of periodicity. In this case, Markov chain presents a long-duration or ergodic distribution (Artís *et al.* 1995)

1. In accordance with the steps necessary to obtain the ergodic distribution, the convergence process is very slow<sup>9</sup>. Indeed, the scarce convergence detected for the whole period is mainly due to shifts which took place during the first sub-period (1977-1984). The equilibrium distribution obtained during the 1984-1994 period is not convergent, since the highest values of the probability are concentrated in the lowest income levels.

2. Mobility is much more important among regions with high levels of income than among those with income levels below the average. Nearly 43% of the regions which, in 1977, had an income level superior to 125, fell to levels ranging from 110 to 125. Only 16.7% of the regions which, in 1977, had an income level situated between 110 and 125, continued to maintain similar figures seventeen years later. In contrast with this situation, there are regions with levels inferior to 75% of European average income which show a relatively significant persistence (70.2% carry on having levels inferior to 75 in 1994), comparable only with the regions of average income (with a value of 78.6%).

3. Nevertheless, it should be noted that the mobility of regions has been relatively limited. Most of them only move from one state to a contiguous one<sup>10</sup> and it can not be said that dramatic changes have taken place in regional ranking, despite the fact that these are significant.

4. Results suggest that what has taken place is a clearly *decreasing convergence*. This is not mainly due to the improvement of regions which started from lower levels, but to the relative worsening of those which were significantly above European average. This fact is clearly discernible noting that the greater part of the catching-up process took place during a period of crisis in the European economy (1977-1984); while during the following phase, a period of improvement and higher average growth (1985-1994), the observed trend indicates divergence (table 2).

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<sup>9</sup> The number of steps necessary to obtain the vector of equilibrium probabilities is 50.

<sup>10</sup> Logically, since the intervals are quite large, it is not easy for a region to move forwards or backwards two states during a relatively short period of time (1977-1994). However, such examples exist.

**Table 2. One-Step Transition Matrices For European Regions**

**a) 1977-1994**

<b>1977</b>	<b>1994</b>	<b>&lt;75</b>	<b>75-90</b>	<b>90-110</b>	<b>110-125</b>	<b>&gt;125</b>	<b>Observ.</b>
	<b>&lt;75</b>	0,702	0,245	0,053	0,000	0,000	57
	<b>75-90</b>	0,000	0,000	1,000	0,000	0,000	5
	<b>90-110</b>	0,000	0,071	0,786	0,143	0,000	14
	<b>110-125</b>	0,000	0,000	0,833	0,167	0,000	12
	<b>&gt;125</b>	0,000	0,000	0,095	0,429	0,476	21
	<b>Initial Distribution</b>	0,523	0,046	0,128	0,110	0,193	
	<b>Final Distribution</b>	0,367	0,138	0,284	0,119	0,092	
	<b>Ergodic Distribution</b>	0,000	0,057	0,805	0,138	0,000	

**b) 1977-1984**

<b>1977</b>	<b>1984</b>	<b>&lt;75</b>	<b>75-90</b>	<b>90-110</b>	<b>110-125</b>	<b>&gt;125</b>	<b>Observ.</b>
	<b>&lt;75</b>	0,737	0,070	0,193	0,000	0,000	57
	<b>75-90</b>	0,000	0,000	0,600	0,400	0,000	5
	<b>90-110</b>	0,000	0,071	0,786	0,143	0,000	14
	<b>110-125</b>	0,000	0,083	0,667	0,250	0,000	12
	<b>&gt;125</b>	0,000	0,000	0,095	0,381	0,524	21
	<b>Initial Distribution</b>	0,52	0,05	0,13	0,11	0,19	
	<b>Final Distribution</b>	0,39	0,05	0,32	0,14	0,10	
	<b>Ergodic Distribution</b>	0,00	0,07	0,75	0,18	0,00	

**c) 1984-1994**

<b>1985</b>	<b>1994</b>	<b>&lt;75</b>	<b>75-90</b>	<b>90-110</b>	<b>110-125</b>	<b>&gt;125</b>	<b>Observ.</b>
	<b>&lt;75</b>	0,905	0,095	0,000	0,000	0,000	42
	<b>75-90</b>	0,333	0,500	0,167	0,000	0,000	6
	<b>90-110</b>	0,000	0,229	0,714	0,057	0,000	35
	<b>110-125</b>	0,000	0,000	0,266	0,667	0,067	15
	<b>&gt;125</b>	0,000	0,000	0,000	0,182	0,818	11
	<b>Initial Distribution</b>	0,39	0,05	0,32	0,14	0,10	
	<b>Final Distribution</b>	0,37	0,14	0,28	0,12	0,09	
	<b>Ergodic Distribution</b>	0,64	0,18	0,14	0,03	0,01	

Source: Own Elaboration

5. The degree of mobility during the 1977-1984 period *is much more intense* than during the following one. This is true not only because during the former period 32 regions move from one state to another in comparison with 24 during the latter, but also because of the *intensity* of these changes. There is a relatively high percentage of regions which move two levels during the first period (table 2.b) while during the second one (1984-1994) changes are of a lesser magnitude.

6. The strong growth of some laggings regions which have better adapted their production structure to new market conditions, together with the relative decline of many old industrial areas, are both factors which have encouraged convergence. The progresses made by Baleares, Madrid, Cataluña in Spain; Emilia-Romagna, Veneto or Trentino in Italy, or the South East in the United Kingdom, among others, illustrate upwards shifts. The opposite case is represented by regions such as Picardie or Lorraine in France, Niedersachsen or Rheinland-Pfalz in Germany, or Dutch regions (table 3)<sup>11</sup>. On the other hand, the relative stagnation of quite a few peripheral regions without special comparative advantages, together with the progressive concentration of the economic activity in big urban areas have encouraged divergence. The final result, as previously indicated, is a clear *slowing down of regional convergence in the EU almost since the beginning of the 80s*.

## 5. An outline on some explanatory factors

The objective of this section is to show some common characteristics of the *winning* and the *losing* regions which can permit to find some explanatory factors of the regional mobility we have previously pointed out. These characteristics and/or factors will need a deeper causal analysis in the future and so the results from this section have to be considered as provisional.

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<sup>11</sup> Table 3 presents a ranking of the regions which have moved both upwards (*winners*) and downwards (*losers*) during the complete period and the two sub-periods considered. (↑) It indicates upward movements (↓) it indicates downward movements. When the intensity of the changes is higher, it is indicated by a double arrow.

**Table 3.- Winning and Losing Regions**

1977-94					
WINNERS			LOSERS		
	1977	1994		1977	1994
NAVARRA	71,89	75,24	CORSE	96,48	82,94
MADRID	64,91	78,79	PICARDIE	121,61	99,30
CATALUÑA	65,92	77,02	CENTRE	117,11	108,26
BALEARES	68,95	81,61	BOURGOGNE	111,37	102,98
LOMBARDIA	97,81	115,22	LORRAINE	119,84	102,34
EMILIA-RAMAGNA	90,57	112,50	FRANCHE-COMTE	123,67	106,65
VENETO	74,68	103,86	AQUITAINE	114,65	104,20
UMBRÍA	71,35	87,21	PROVENCE-ALPES-COTE D'AZUR	123,58	104,35
MARCHE	68,86	91,34	CHAMPAGNE-ARDENNE	130,56	114,57
ABRUZZO	58,65	79,46	HAUTE-NORMANDIE	130,12	109,77
TRENTINO-ALTO ADIGE	79,22	108,93	ALSACE	125,39	119,58
FRIULI-VENEZIA GIULIA	80,56	105,44	VLAAMS GEWEST	134,95	117,32
TOSCANA	79,21	96,72	REGION WALLONE	112,88	92,24
LAZIO	78,74	105,33	OOST-NEDERLAND	122,95	98,84
NORTH	71,91	76,83	ZUID-NEDERLAND	121,90	107,07
YORKSHIRE AND HUMBERSIDE	72,38	78,74	WEST-NEDERLAND	149,13	119,99
EAST MIDLANDS	73,62	83,53	NOORD-NEDERLAND	273,46	108,86
EAST ANGLIA	74,24	90,25	BERLIN	161,80	120,21
SOUTH WEST (UK)	70,81	85,49	NIEDERSACHSEN	128,30	122,47
WEST MIDLANDS	74,38	80,93	RHEINLAND-PFALZ	132,27	116,14
SOUTH EAST (UK)	88,35	105,33	SAARLAND	128,02	123,33
NORTH WEST (UK)	74,16	79,52	SCHLESWIG-HOLSTEIN	132,55	123,23
SCOTLAND	74,67	88,02			
IRELAND	52,81	76,48			

PERIOD 1977-84		PERIOD 1984-94	
WINNERS	LOSERS	WINNERS	LOSERS
↑ BALEARES	↓ CORSE	↑ NAVARRA	↓ WALES
↑ ABRUZZO		↑ MADRID	↓ NORTHERN IRELAND
↑ WALES	↓ PICARDIE	↑ CATALUNA	
↑ NORTHERN IRELAND	↓ CENTRE	↑ IRELAND	↓ UMBRIA
↑↑ VENETO	↓ BOURGOGNE		↓ NORTH
↑↑ UMBRÍA	↓ LORRAINE	↑ REGION WALLONNE	↓ YORKSHIRE AND HUMB.
↑↑ MARCHE	↓ FRANCHE-COMTE		↓ EAST MIDLANDS
↑↑ NORTH	↓ PROVENCE-ALPES	↑ VLAAMS GEWEST	↓ SOUTH WEST (UK)
↑↑ YORKSHIRE AND HUM.	↓ OOST-NEDERLAND	↑ SCHLESWIG-HOLSTEIN	↓ WEST MIDLANDS
↑↑ EAST MIDLANDS	↓ ZUID-NEDERLAND		↓ NORTH WEST (UK)
↑↑ EAST ANGLIA	↓↓ REGION WALLONNE	↑ LUXEMBOURG	↓ SCOTLAND
↑↑ SOUTH WEST (UK)			
↑↑ WEST MIDLANDS	↓↓ SCHLESWIG-HOLST.		↓ HAUTE-NORMANDIE
↑↑ NORTH WEST (UK)	↓ VLAAMS GEWEST		↓ AQUITAINE
↑↑ SCOTLAND	↓ NIEDERSACHSEN		↓ TRENTINO-ALTO ADIGE
	↓ RHEINLAND-PFALZ		↓ SOUTH EAST (UK)
↑ FRIULI-VENEZIA GIULIA	↓ SAARLAND		
↑ TOSCANA	↓ CHAMPAGNE-ARDENNE		↓ BERLIN
↑ LAZIO	↓ HAUTE-NORMANDIE		↓ NOORD-NEDERLAND
↑↑ TRENTINO	↓ ALSACE		
↑↑ SOUTH EAST (UK)	↓ LUXEMBOURG		
	↓ WEST-NEDERLAND		
↑ LOMBARDIA			
↑ EMILIA-ROMAGNA			

Source: Own elaboration.



To explore these possible factors we have chosen some variables which “a priori” should have had some influence on regional GDP per capita evolution. The variables selected were:

- Population: Demographic densities by regions during the period have been one of the variables selected as a way to capture population growth (which is also included as a variable). Internal migrations figures in each country have also been considered. And, finally, percentages of homes in urban areas have been used as a proxy urbanization indicator.
- Production: GDP growth rates have been chosen to capture differences in productive regional trends.
- Human capital and R+D: Three human capital variables have been taken as they are defined at the Sixth Periodical Report (European Commission, 1999). They show population percentages by educational levels (high, medium and low). Additionally, a variable that measures regional R+D effort has also been used (average 1993-94).
- Production structure: The importance of productive structure to determine income levels is clear as it has great influence on productivity evolution. Then, percentages of agricultural, industrial and services employment and their growth rates have been taken as variables. Unemployment rates have also been used as a contrast variable because it is a regional economic evolution's result .
- Productivity: Average growth rates of total labour productivity during the analysed period (1977-1994) have been selected as indicator.

Once collected this variables set (necessarily incomplete) the next step has been to develop an statistical contrast among average differences through an ANOVA analysis, taking into account the regions which have experienced changes in their previous GDP per capita state level. Three alternative analysis have been done according to factor's definition:

- i) Taking three groups of regions: Regions that move upward; regions that moved downward and regions not having experienced changes.
- ii) Taking regions that move upward and the rest of them.
- iii) Taking regions that move downward and the rest of them.

Table 4 shows in a very synthetic form the results in i), where can be seen the F-Snedecor contrast on differences of means and each group of region's average in the variables previously sketched. Results of our analysis ii) and iii) are not included in this paper but some of them will be used in our next comments.

The first finding is related with GDP and population growth results. As could be expected, population changes are one of the main explanatory factors of the differences observed. Mainly in the second period (1984-1994). Demographic changes have been an important factor to explain why some regions have shift their states. This fact is quite clear analysing population growth rates and comparing each group averages. On the other hand, migrations (measured as migratory balance; 1 = positive, 0 = negative) show that more dynamic regions are the ones which have attracted more population<sup>12</sup>.

With respect to GDP growth, the results show that the process has been almost always the opposite than the precedent one. Economic growth has been higher in the regions that have moved upward in GDP per capita. This is a logical result, of course, but it is important to note that GDP growth is a particularly relevant explanatory factor in the first period. In the second one, differences in GDP growth are not significant among groups.

Taking the two precedent results together, it can be set up that regions moving downward have done it in two different ways: GDP growth clearly under the rest of the regions (specially in the crisis period 1977-84) and higher population growth in the period 1984-94. This fact indicates that when relative variables are analysed (GDP per capita or productivity), different movements of the elements which underlie these ratios

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<sup>12</sup> It must be noted that migrations flows were internal in each country and quite reduced.

(production, population and employment) are not being considered and they can play a different role by groups of regions.

**Table 4: ANOVA analysis results for European regions**

Variable <sup>1</sup>	Average values				
	F	Prob.	Not-change (63)	Upward (24)	Downward (22)
Population growth 1977-1984	1.655	0.196	3,3%	2,1%	2,09%
Population growth 1984 -94	2.749	0.069	3,3%	2,3%	7,9%
Population growth 1977-1994	1.937	0.149	6,7%	4,6%	9,9%
Migrations (0=negative; 1=positive)	5.225	0.007	0,41	0,78	0,64
GDP growth 1977-84	46.877	0.000	0,2%	3,3%	-2,1%
GDP growth 1984-94	1.547	0.218	2,2%	1,2%	2,1%
GDP growth 1977-1994	19.445	0.000	2,1%	4,0%	0,01%
Low Level of Education	13.777	0.000	53,88	52,16	35,09
Mid Level of Education	13.513	0.000	30,14	31,08	45,77
High Level of Education	2.105	0.127	15,96	16,62	19,18
R+D	2.483	0.089	1,01	1,41	1,47
Unemployment rate in 1994 <sup>2</sup>	6.291	0.003	14,76	10,29	10,39
% Agriculture Employ. 1977 <sup>3</sup>	18.863	0.000	23,68	9,32	7,58
% Agriculture Employ. 1994	14.579	0.000	16,40	5,81	5,00
Agriculture employment growth	0.145	0.865	-31,5	-32,67	-34,63
% Industrial employment 1977	6.041	0.003	32,40	38,53	37,37
% Industrial employment 1994	2.778	0.067	27,81	31,32	30,67
Industrial employment growth	2.784	0.066	-12,49	-18,50	-16,83
% Services employment 1977	3.297	0.041	43,83	52,10	44,14
% Services employment 1994	3.145	0.047	55,74	62,85	52,26
Services employment growth	11.929	0.000	29,38	21,21	12,97
Productivity growth 1977-1994	20.437	0.000	1,48	1,82	-0,44
Employment growth 1977-1994	2.807	0.065	0,10	0,30	0,61

1. Density variables and urbanization are not statistically significant
2. Only 96 regions with available data have been considered.
3. Corcega is excluded.

Source: Own Elaboration

Variables showing regional educational level and research effort can also help to explain the differences between *winning* and *losing* regions. Results obtained seem to be

paradoxical because regions that move downward are the ones with the lowest population percentage with low educational level and the highest population percentage with high educational levels. Anyway, this result is consistent taking into account that a high number of regions that have lost positions could be qualified as developed (or relatively developed) or old-industrialized regions.

This characteristic is also reflected when regional productive structure is analysed. Regions that move downward have lower employment percentages in industrial and service sectors. But, in fact, industrial and service growth are variables that can explain the differences observed. Winning regions have experienced higher employment services growth in service industries than the rest and the opposite with respect to industrial employment.

These results show not only the importance of the productive structure analysis to explain these differences but also the basic role of productivity evolution<sup>13</sup>. Regional productivity differences are very strong for the three groups. F-Snedecor test shows clear results: *winning* regions show productivity growth rates higher than the rest, meanwhile *losing* regions have a negative growth rate.

Productivity is one of the variables that has more influence in the long term evolution of regional income. The appropriate in-depth analysis cannot be developed here but it is possible to point out some common behaviour patterns for *winner* regions as well as for *losers* ones.

The 24 *winning* regions show productivity gains basically due to restructuring processes (employment growth under the average). Most of these regions show productivity growth rates higher than the average but lower growth rates in term of employment. On the contrary, half of the 22 regions that move downward (*losers*) are in a clear situation of economic decline with productivity and employment under the European average.

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<sup>13</sup> Productivity evolution and trends of the European regions has been analysed in: Cuadrado, Mancha and Garrido (2000).

These results suggest the need to analyse productivity gains taking into account production and employment figures as well as the contribution of each one of the productive sectors. Production growth in services explains productivity growth better than other sectors growth (see table 5). This means that terciarization in economies helps to explain productivity progress and so income per capita. This result seems much more clear when you let the services growth parameter be different for *winning*, *losing* and *not changed* regions<sup>14</sup>. *Winning* regions present a higher parameter than *losers* (with an null contribution of services to productivity growth).

**Table 5. Productivity growth**

	<b>Value</b>	<b>Probability</b>
<b>C</b>	-0.416	0.2039
<b>GVA growth Agriculture</b>	-0.059	0.1315
<b>GVA growth Industry</b>	0.2593	0.0003
<b>GVA growth Services</b>	0.5793	0.0000
<i>Winners</i>	0.4533	0.0001
<i>Losers</i>	0.0323	0.8464
<i>Rest of regions</i>	0.5359	0.0000
<b>Adjusted R<sup>2</sup></b>	0.7243	
<b>F-Snedecor</b>	70.620	0.000

Source: Own Elaboration

On the other hand, employment behaviour helps also to explain productivity growth. The well-known *Kaldor's third law* has been tested on both services and industry (Table 6) and three main findings can be underlined:

- i) Industry is not a key sector to explain productivity behaviour. Services are the most significant sector. In fact, the impact of services production (0.90) is clearly higher than industrial production (0.43) and the adjusted R<sup>2</sup> is better in the case of services than in industry.
- ii) *Wald test* shows statistical significative differences (on 90% level) in GVA growth of services by groups of regions but not in the industrial sector. *Winning* regions show a parameter higher (0.88) than the *losing* regions (0.64).

<sup>14</sup> This difference has also been done on industrie but *Wald test* indicates that parameter are the same.

- iii) Restructuring processes in employment have a clear impact on productivity. Employment increase out of services sector has a negative impact on the evolution of productivity. Thus, structural change can be underlined as one of the engines of productivity growth .

**Table 6. Growth in productivity. Kaldor's Third Law**

	<b>Value</b>	<b>Probability</b>
<b>C</b>	1.66	0.000
<b>GVA growth Industry</b>	0.4342	0.000
<i>Winners</i>	0.4169	0.000
<i>Losers</i>	0.6239	0.000
<i>Rest of regions</i>	0.3832	0.000
<b>Non-industrial employment growth</b>	-0.4632	0.000
<b>Adjusted R<sup>2</sup></b>	0.7927	
<b>F-Snedecor</b>	136.16	0.000
<b>C</b>	-2.17	0.000
<b>GVA growth Services</b>	0.9007	0.000
<i>Winners</i>	0.8887	0.000
<i>Losers</i>	0.6423	0.000
<i>Rest of regions</i>	0.8542	0.000
<b>Non-services employment growth</b>	-0.5753	0.000
<b>Adjusted R<sup>2</sup></b>	0.8337	
<b>F-Snedecor</b>	178.19	0.000

Source: Own Elaboration

## **6. Final remarks**

Our main conclusions can be summarized as follows:

1. Reduction of regional disparities in terms of GDP per capita and productivity has been a slowing process between 1977 and 1994 in the EU. It is also characterised by a clear *heterogeneity* of regional behaviours.
2. Actually, regional convergence in the EU is a clearly *conditioned* process. Reduction of incomes per capita disparities has been stopped in the last years.

3. Mobility of European regions is a complementary characteristic to the precedent. An important number of regions show increases in their relative income levels while others experiment opposite processes.
4. These movements have been more intensive between 1977 y 1984 than in the following years. This has mainly affected to the regions with income levels over the average. This means that convergence process happened in these years is much more due to the approximation to the average of the developed regions than to higher advances of the lagged ones. In short, regional convergence in the EU can be characterized as a *decreasing* process.
5. Nevertheless, inside regions with lower levels important movements have happened. These changes are clear, although they are not so big for letting a great number of them overcome the 75% of the EU income per capita average, a threshold to be qualified as ‘Objective 1’ region by the European Regional Policy.
6. Demographic variables, evolution of production and regional productive structure play the most important role to explain the mobility remarked.
7. Consequently, winning regions show production growth rates higher than the rest, but with lower population growth. Opposite characteristics show regions which are moving downward.
8. Finally, results on productive structure show that a great part of the gains experienced by some regions were due to restructuring processes they have had to face. Generally, this has led to a clear terciarization of their economies.

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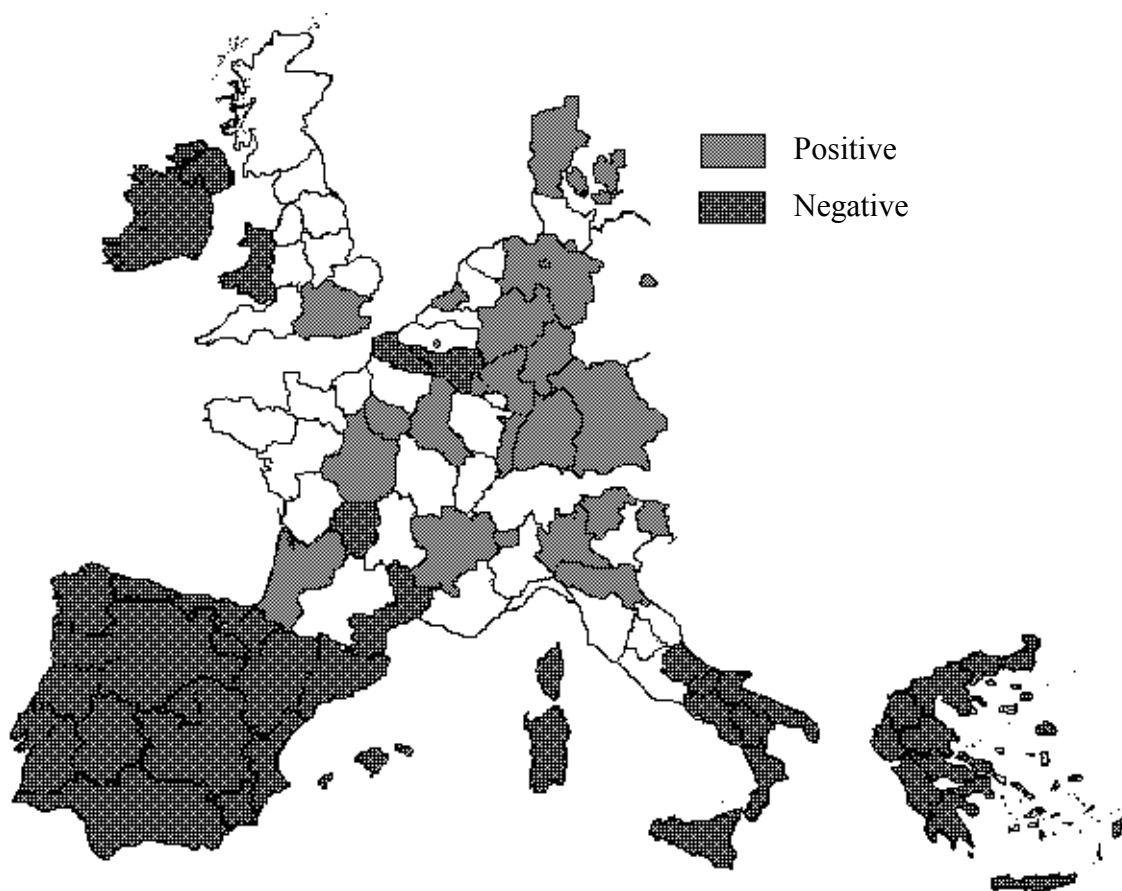
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## ANNEX: Regional Codes

be	BELGIQUE-BELGIE	es	ESPAÑA	ie	IRELAND	uk	UNITED KINGDOM
be1	BRUXELLES-BRUSSEL	es11	GALICIA	it	ITALIA	uk1	NORTH
be2	VLAAMS GEWEST	es12	ASTURIAS			uk2	YORKSHIRE AND HUMBERSIDE
be3	REGION WALLONNE	es13	CANTABRIA	it11	PIEMONTE	uk3	EAST MIDLANDS
		es21	PAIS VASCO	it12	VALLE D'AOSTA	uk4	EAST ANGLIA
dk	<b>DANMARK</b>	es22	NAVARRA	it13	LIGURIA	uk5	SOUTH EAST
		es23	RIOJA	it2	LOMBARDIA	uk6	SOUTH WEST
de	<b>DEUTSCHLAND</b>	es24	ARAGON	it31	TRENTINO-ALTO ADIGE	uk7	WEST MIDLANDS
		es3	MADRID	it32	VENETO	uk8	NORTH WEST
de1	BADEN-WUERTTEMBERG	es41	CASTILLA-LEON	it33	FRIULI-VENEZIA GIULIA	uk9	WALES
de2	BAYERN	es42	CASTILLA-LA MANCHA	it4	EMILIA-ROMAGNA	uk10	SCOTLAND
de3	BERLIN	es43	EXTREMADURA	it51	TOSCANA	uk11	NORTHERN IRELAND
de5	BREMEN	es51	CATALUNA	it52	UMBRIA		
de6	HAMBURG	es52	COMUNIDAD VALENCIANA	it53	MARCHE		
de7	HESSEN	es53	BALEARES	it6	LAZIO		
de9	NIEDERSACHSEN	es61	ANDALUCIA	it7	CAMPANIA		
dea	NORDRHEIN-WESTFALEN	es62	MURCIA	it81	ABRUZZI		
deb	RHEINLAND-PFALZ	es7	CANARIAS	it82	MOLISE		
dec	SAARLAND			it91	PUGLIA		
def	SCHLESWIG-HOLSTEIN	fr	<b>FRANCE</b>	it92	BASILICATA		
				it93	CALABRIA		
gr	<b>ELLADA</b>	fr1	ÎLE DE FRANCE	ita	SICILIA		
		fr21	CHAMPAGNE-ARDENNE	itb	SARDEGNA		
gr11	ANATOLIKI MAKEDONIA, THRAKI	fr22	PICARDIE				
gr12	KENTRIKI MAKEDONIA	fr23	HAUTE-NORMANDIE	lu	<b>LUXEMBOURG</b>		
gr13	DYTIKI MAKEDONIA	fr24	CENTRE				
gr14	THESALIA	fr25	BASSE-NORMANDIE	nl	<b>NEDERLAND</b>		
gr21	IPEIROS	fr26	BOURGOGNE				
gr22	IONIA NISISA	fr3	NORD-PAS-DE-CALAIS	nl1	NOORD-NEDERLAND		
gr23	DYTIKI ELLADA	fr41	LORRAINE	nl2	OOST-NEDERLAND		
gr24	STERREA ELLADA	fr42	ALSACE	n3	WEST-NEDERLAND		
gr25	PELOPONNISOS	fr43	FRANCHE-COMTE	nl4	ZUID-NEDERLAND		
gr3	ATTIKI	fr51	PAYS DE LA LOIRE				
gr41	VOREIO AGAIO	fr52	BRETAGNE	pt	<b>PORTUGAL</b>		
gr42	NOTIO AGAIO	fr53	POITOU-CHARENTES				
gr43	KRITI	fr61	AQUITAINE	pt11	NORTE		
		fr62	MIDI-PYRENEES	pt12	CENTRO (P)		
		fr63	LIMOUSIN	pt13	LISBOA E VALE DO TEJO		
		fr71	RHONE-ALPES	pt14	ALENTEJO		
		fr72	AUVERGNE	pt15	ALGARVE		
		fr81	LANGUEDOC-ROUSSILLON				
		fr82	PROVENCE-ALPES-COTE D'AZUR				
		fr83	CORSE				

Source : REGIO.

### Map 1. Fixed Effects on GDP per inhabitant



**Figure 1.- Level of regional GDP per inhabitant in 1977 and its relative growth**

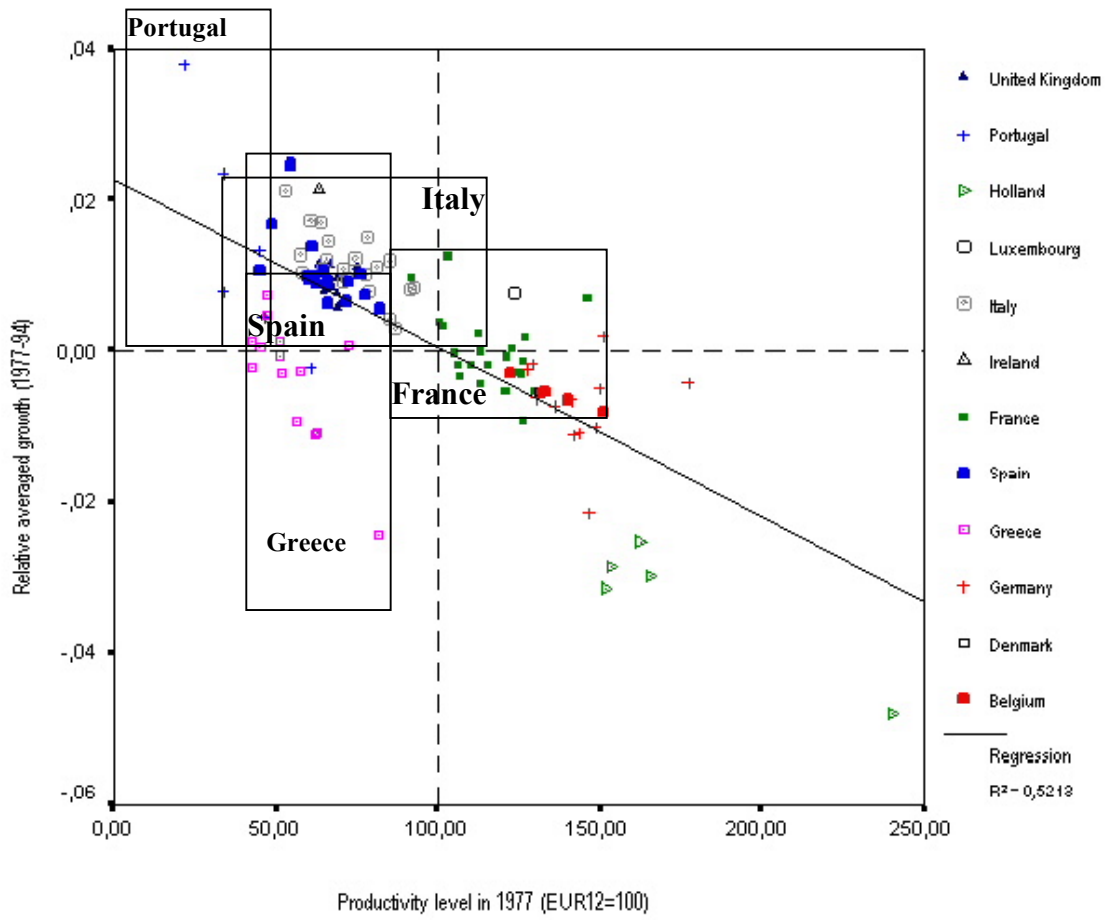


Figure 2.- Productivity levels: 1977 and 1994

