REGIONAL CONVERGENCE, POLARISATION AND MOBILITY IN THE EUROPEAN UNION, 1980-1996

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Abstract

This paper deals with three relevant questions for the European Union: the degrees of regional inequality, polarisation and mobility in the per capita regional income distributions between 1980 and 1996. Using different techniques, the paper shows that inter-regional inequality has slightly decreased, there is no apparent polarisation and the degree of mobility is relatively high. Despite this, the speed of all these three aspects has declined over time, which is interesting for polarisation but raises some worries about convergence and mobility for the future.

Key words

Inequality, convergence, polarisation, mobility, European regions.

JEL code

R11, R23

1. Introduction

Regional disparities in the European Union (EU) have been a subject of great interest and debate since, at least, the early seventies. In fact, the extent of these disparities was the main reason to establish the ERDF in 1975 and the European regional policy. Although most of the studies agree that regional disparities in the EU decreased during the sixties and seventies, it is also widely admitted that there has been little progress since then and that its actual degree is too high. Furthermore, there are some concerns that regional disparities in the EU may increase in the near future as a result of both the widening and deepening of the integration process.

Along with the new developments of the theory of economic growth questioning the relevance of automatic spatial convergence, the European integration process itself has encouraged the research on regional convergence. This paper, inserted in this fruitful tradition, tries to identify some of the most relevant features of the economic evolution of the European regions between 1980 and 1996. To accomplish this aim, the statistical information used comes from the REGIO and CRENoS databanks and refers to 141 European regions, both NUTS 2 and NUTS 1 (See appendix for the whole list of regions); the key variable of the analysis is per capita GDP expressed in purchasing power standards.

The remainder of the paper is organised as follows. Section 2 analyses the level and recent evolution of regional inequalities in the

EU. Section 3 examines the external shape of the European regional income distribution, while section 4 deals with its dynamics. A final section summarises the main conclusions.

2. Regional disparities in the EU

According to the latest Eurostat release (February 2002), averaging over the years 1997-1999 and taking into consideration purchasing power standards, per capita GDP of the richest region in the EU, Inner London, was 4.7 times higher than that in the poorest regions, Ipeiros, Reunion and Guayana. This is a fairly large number that roughly illustrates the actual extent of regional inequalities in the EU. Other official publications by the European Commission show that, during the last ten years, the extent of these disparities has not changed very much and that the mobility in the income distribution has been quite low; in fact the ranking of the ten (twenty five) most and least prosperous regions is, nowadays, roughly the same as a decade ago.

Although important, these conclusions need to be somehow qualified, because they are critically dependent on three factors: the period under study, the number of regions considered in the analysis and the statistic indicators used to measure inequality. It is then necessary to deal more in-depth with regional inequalities in the EU and this is done through the computation of some inequality indicators (Gini, Theil and Atkinson, with different degrees of poverty aversion). The results (Table 1) permit to highlight two main conclusions. The first, that the degree of inequality in the regional per

capita income (GDP) distribution in the EU shows a clear-cut reduction. Nevertheless, the strength of this reduction is too varied, the lowest rate realised by the Gini index (with a fall equal to 9.3%) and the highest rate corresponding to the Atkinson index A(2), with a fall equal to 26,5%. The second conclusion is that although there is an apparent similarity in the inequality reduction processes, as shown by all the indices (Figure 1), the evolution has not been uniform at all over time: in particular the highest volatility is associated to some Atkinson indices, mainly those displaying a higher poverty aversion, A(50) and A (100).

Spatial disparities in the EU are higher inside countries than among them. As the Theil index is additively decomposable, we have used it to show which part of the European regional inequality is due to the inequality among countries (external inequality) and which one comes from the inequalities inside countries (internal inequality). The results (Table 2) show that about three fourths of total inequality originates within each country and that just one fourth comes from the external inequality. These results support the idea of a European regional policy. At the same time, Table 2 shows that the decrease in the global inequality index has been achieved thanks to both the reduction of the internal and external inequalities. Nevertheless, this has been attained to a major extent due to the reduction of external inequality (the fall was of 41.3%) rather than that of internal inequality (the fall was 10.5%), which means that the convergence process was stronger among countries than among regions in each country. As a result of this evolution, internal inequalities have gained weight in the global inequality; to say in a different way, this implies that the richest regions of the poorest countries have been the main contributors to the decline of the European regional inequality.

Even though the general trend of European regional inequality is a decreasing one, Figure 1 also shows the existence of some cyclical movements around it. Are these ups and downs someway linked to the evolution of GDP in the EU? A well known hypothesis maintains that spatial inequalities go hand in hand with the rate of growth of economic activity: inequalities increase during expansions and decrease during contractions or periods of stagnating activity. Has this been happening in the EU? To give a simple answer to this question we have regressed the degree of regional inequality (as measured by the Theil index) on the growth of GDP in the EU. The results obtained

$$Theil_t = 0{,}03276 + 0{,}00042\ \Delta PIB_{t,\,t-1} \qquad R^2 = 0{,}35$$
$$(30{,}5) \qquad (2{,}8) \qquad \text{(t statistics in brackets)}$$

show that the hypothesis of a positive nexus between both elements cannot be rejected. Thus, as much as the economic cycle can be smoothed in the EU, a reduction of cyclical movements in the general tendency of reduction of the European regional inequality can also be expected.

Taking into account that in the EU coexist very different regional situations, we have also studied how the convergence process has taken place. For this, we have considered seven groups of regions according to their per capita GDP in 1980, being the EU average equal to 100: $1<50\%$; $50\geq 2>75\%$; $75\geq 3>90\%$; $90\geq 4>110\%$; $110\geq 5>130\%$; $130\geq 6>150\%$; $7\geq 150\%$[1]. The results obtained for the Theil index (Figure 2) show that, except for group 4, regional inequality has increased. As a consequence, the fall in the overall

regional inequality has its roots in the fall of inter-group inequality. Furthermore, according to Garcia Greciano (1997) we have calculated the inter-groups inequality as the difference between the overall and intra-group inequalities, the latter computed as the simple average of the inequality in the seven groups previously mentioned. The results (see Figure 2 again) show that the bulk of overall inequality (between 81 and 94%) is due to inter-groups inequality.

Finally, another interesting point that emerges when dealing with regional inequalities in per capita GDP is whether there is any association between this variable and the degree of regional concentration of GDP. This is a relevant point since it is not the same for the reduction in the overall inequality index to come, for instance, from loosing population the poorest regions than from a relative lower rate of economic growth in the richest regions.

In the EU, leaving aside some particular situations (i.e. Darmstadt and Luxemburg on the positive side and Asturias on the negative one), convergence or reduction of overall regional inequality has not implied relevant shifts in the regional distribution of output and population. The Gini-Hirschman[2] concentration index shows (Table 3) that changes have been very modest (0.20% for output and 0.29% for population) and that the indices have also been very stable over time: the coefficient of variation for both variables is very low. This means that, contrary to what happened in previous years, European regional convergence in the eighties and the first half of the nineties has not taken place at the expense of depopulation of the least developed regions.

3. Per capita income distribution in the EU. Is there any polarisation?

Conventional inequality indicators (Gini, Theil, Atkinson) mainly capture the spread of an income distribution, underlying only the deviations from the global average and ignoring whether, or not, there is clustering around different local poles. On the contrary, polarisation places more emphasis on clustering, so as to compare the homogeneity of a group with the overall heterogeneity of a given population.

A simple way to deal with the potential existence of regional polarisation in the EU is through the estimation of density functions for the regional distribution of per capita GDP. Figure 3 plots simple and weighted density functions for four selected years estimated using a gaussian kernel with bandwidth selected as in Silverman (1986). A straightforward visual inspection of these functions shows that our main and previous conclusion –decreasing inequality or convergence in regional per capita income across the EU- is also supported in this analysis. First of all, the ratio between the extreme values of the distribution has declined over time; that is, the spread of relative incomes has decreased. Secondly, the external shape of the distribution for the relative incomes shows a clear unimodality situation when dealing with simple density functions. On the contrary, when dealing with weighted density functions, an incipient bimodality, or polarisation in two groups, can be observed: the first group refers to regions with a per capita GDP similar to the mean (which, once again, implies convergence) while the second group is made up of regions with very high relative income levels. Thirdly, density functions are lightly skewed to the right, although, in general terms, the degree of skewness has declined over time. And finally,

given that the probabilistic mass has been shifting little by little to the right, not only the convergence conclusion is supported once again but also the fact that this convergence is moving towards the European average. Thus, contrary to the conclusion by Boldrin and Canova (2001), we obtain that the distributions collapse towards their central value.

4. Mobility within the European regions

Density functions, as those shown in Figure 3, offer an appealing description of some interesting characteristics of the relative income distribution of the European regions at different times. Unfortunately, they do not offer any insight about the intra-distribution dynamics or, using Quah words, "*churning-like behavior when individual economies transit from one part of the distribution to another*" (Quah, 1996). Taking into consideration that, from a policy-oriented point of view, mobility in the per capita income ranking of the European regions is important, we are interested in finding out how many of these European regions have changed their position in the ranking over time. In the case of many regions changing their position, it is said that there exists mobility; otherwise, it is said there is persistence in the distribution.

The Sixth Periodic Report on the Social and Economic Situation and Development of Regions in the European Union (European Commission, 1999) analyses this question and, considering that the Spearman's rank correlation coefficient between the rankings in 1986 and 1996 was 0.91, concludes that "*there has been little change in the*

ranking of particular regions and the order in terms of GDP per head was much the same in 1996 as ten years earlier". Is this a right conclusion? No doubt it is when dealing with the context of the Sixth Report; however, our context, with 141 regions and a larger period of analysis (1980-1996), presents a much more attractive profile.

A standard methodology currently used to trace the movements within a distribution is based on the estimation of transition probability matrices. This is so because Markov chains –in which these transition matrices are based- provide useful representations of dynamic processes like the one we are dealing with. Thus, if we denote by F_0 and F_t the initial and final distributions, the link between them can be written as $F_t = M^t * F_0$, where M^t represents the transition probability matrix. What this expression describes is simply the time evolution of F_0, by mapping F_0 into F_t. Operator M^t is approximated by discretizing our set of values (of regional per capita income) into intervals. Due to the lack of sound theoretical methods proposed to obtain a (more or less) appropriate partition of the distribution (i.e. the minimum variance criterion of Cochran (1966)) we have somewhat arbitrarily partitioned our distribution into the same 7 classes or states used when computing groups inequalities[3].

According to this grouping, the transition probability matrix obtained –computing it in one-step- is displayed in Table 4. In particular, for the whole sample period (80-96) the main features are the following:

1. Persistence is important however not too high. Although, on average, 58.9% of the regions have remained in their initial state, the

figure goes up to 80% for the regions in state 2 and down to 48,2% for the regions in state 5.

2. The mobility degree has been quite high: 41.1% of the regions have moved from one state to another. This mobility has been a little bit higher in descending than in ascending terms. This suggests a decreasing convergence, as shown in section 2.

3. Provinces changing the class they were in simply move to a contiguous one. This means, according to Jone's terminology, that there are neither growth miracles nor growth disasters: this is quite standard result even when the matrix is computed in one-step. To be precise, there are just three "miracles" (Ireland, jumping from class 2 to class 4, Utrecht from 3 to 5 and Luxembourg from 5 to 7) and two "disasters" (Drenthe and Picardie, both moving from class 5 to class 3).

4. The visual inspection of the density functions for the initial and final years of the sample confirms convergence towards the average: the number of regions with an income per capita similar to the mean (those in class 4) increases from 29.8% in 1980 to 34% in 1996.

5. And finally, another important result that can be seen in the table is that the ergodic distribution is unimodal, with a maximum in the fourth class: this implies convergence in the long run (and convergence to the average) instead of polarisation. Nevertheless, the long run regional income distribution is also skewed to the right: 38.5% of the European regions will be in the third class and another 43% will be in the fourth.

Taking into consideration that the transition matrix has been estimated in only one step, we have no clear idea as to how mobility has evolved over time. In order to see this evolution, it is necessary to

estimate transition matrices step by step and then calculate a mobility index, i.e. Shorrocks' index which is given by the expression

$$M(A) = [m - tr(A)]/(m-1)$$

where A is the transition matrix, *tr(A)* is its trace and *m* the number of elements in the distribution. When applying this expression to our distribution (m=141 regions) the results, shown in Figure 4, are:

1.- Between 1980-81 and 1995-96 the degree of mobility fell by 25%;
2.- The degree of mobility is very low every two consecutive years;
3.- The reduction in the mobility degree has not been uniform over time but very volatile, except between 1989-90 and 1993-94.

These results, although interesting, should only be considered as an approximation to the actual mobility since, in order to obtain them, only the elements of the principal diagonal of the A (step by step) matrices have been considered. Nevertheless, these results suggest that, although not negligible, the interregional mobility degree in the EU has been declining over time. Furthermore, although there have been some advances in the process of regional convergence in the EU this has coexisted with a decline on the probability of a region to move to another income class.

5.- Conclusions

Per capita regional income disparities in the EU are very large (about twice the level of USA). Despite of that, this paper has obtained some results that mitigate their seriousness. First of all, it has been shown

that regional disparities (when computed by different inequality indices) have been declining, although to a decreasing rate. Secondly, there are no clear signs of polarisation in two or more local poles. Thirdly, the mobility degree in the regional income distributions is quite high (more than 41% of the European regions have experienced a change in their income classes between 1980 and 1996). Overall, the degree of mobility year to year is not only much lower but has also declined, although following a very volatile pace. In other words, regional income disparities in the EU in 1996 are less serious than in 1980. Nevertheless, the reduction in both the speed of convergence and the mobility within regional per capita GDP distribution raise some concerns for the foreseeable future.

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1 This partition is more illustrative of the European situation than the conventional one which considers only five intervals, <75, 75-90, 90-110, 110-125 y >125.

2 The Gini-Hirschman index is given by the expression

$$C_i = \left[\sum_i (X_i / X)^2\right]^{1/2}$$

where X represents the variable under consideration (GDP and population in our case) and the sub-index i denotes the European regions.

3 The computing of stochastic kernels solves these problems by using a continuous approach instead of a discrete one. The main drawback of this approach is that its interpretation is not as direct and clear as in the discrete approach, because it does not offer quantitative information about the degree of mobility.

Figure 1.- REGIONAL INEQUALITY IN THE E.U. (1980=100)

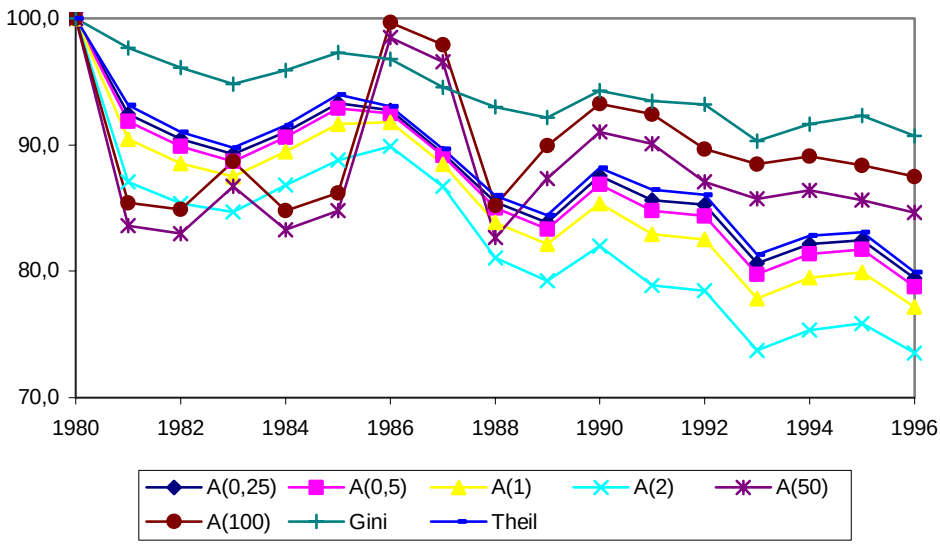
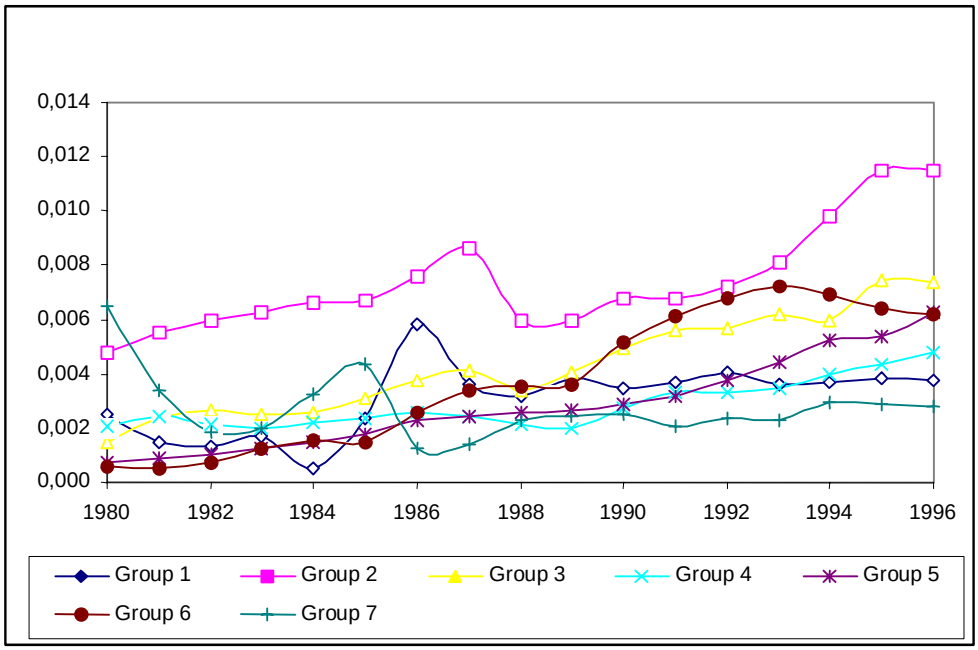


Figure 2.- DECOMPOSITION OF REGIONAL INEQUALITY IN THE E.U. (Theil Index)

a) Groups, inequality



b) Intra-group, inter-group and total inequality

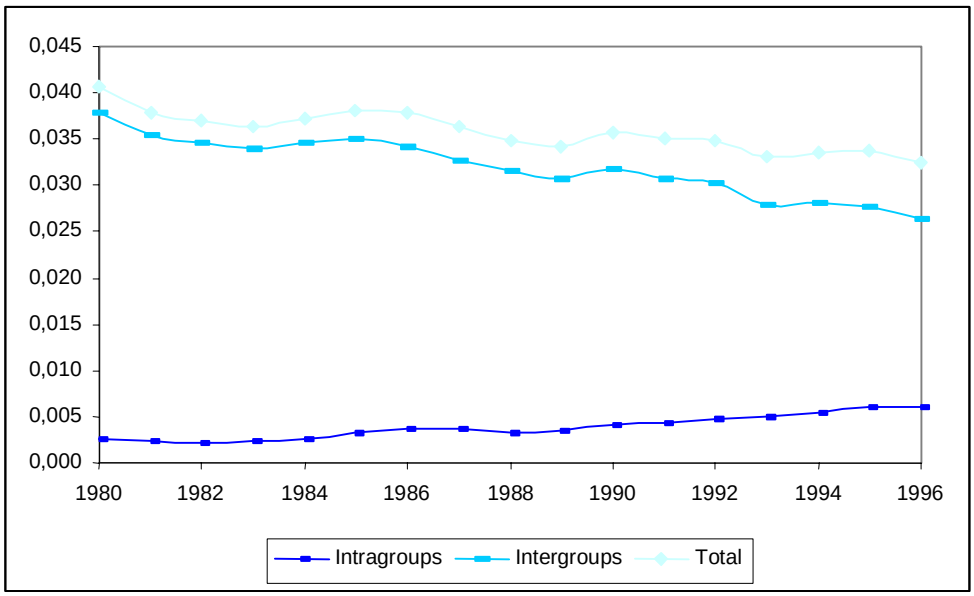
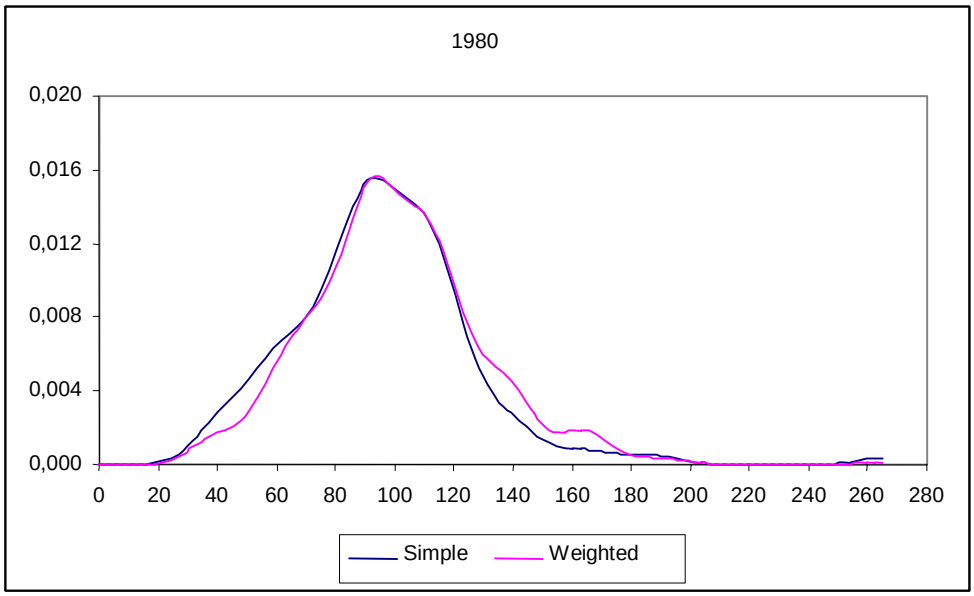
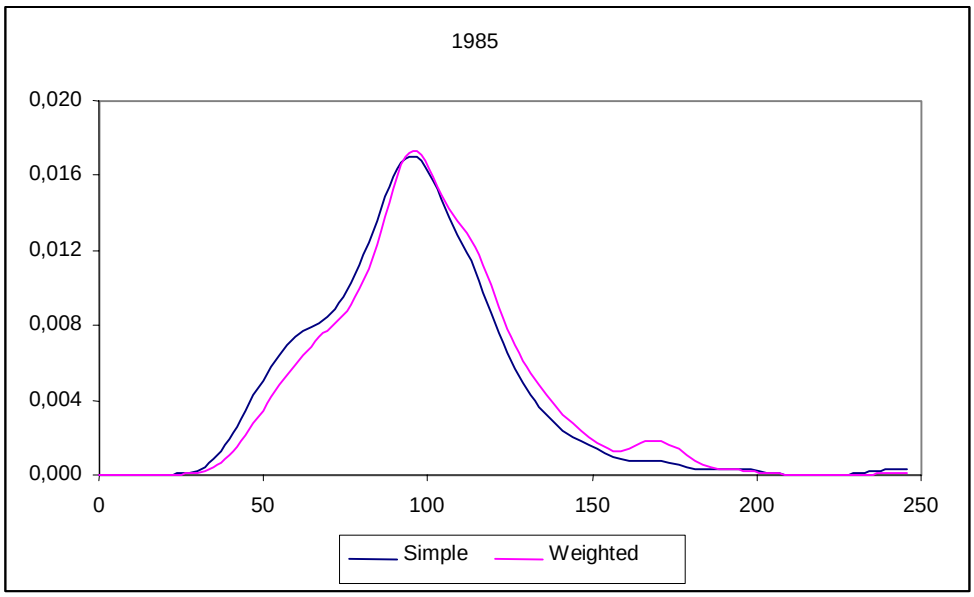
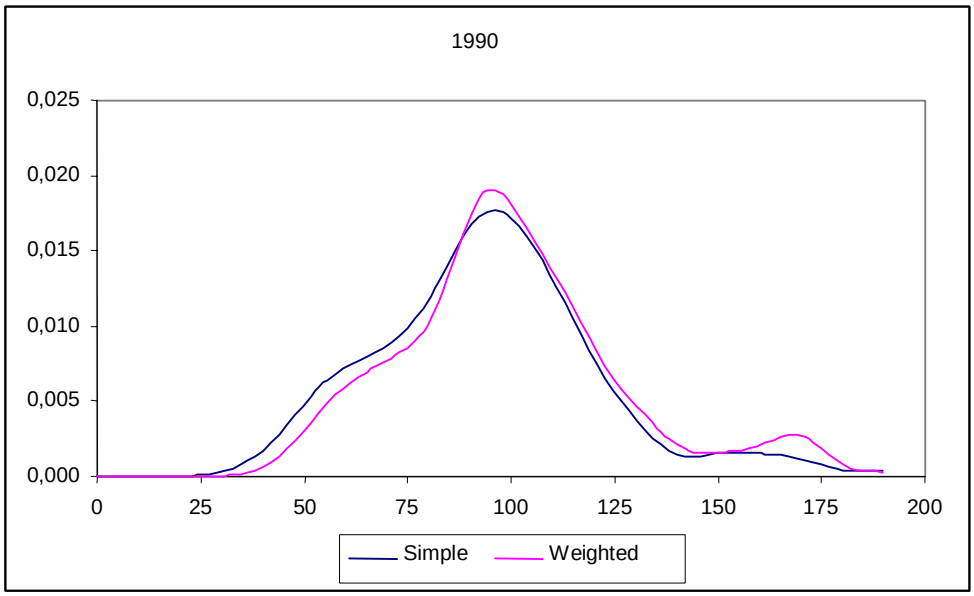


Figure 3.- DENSITY FUNCTIONS






1990
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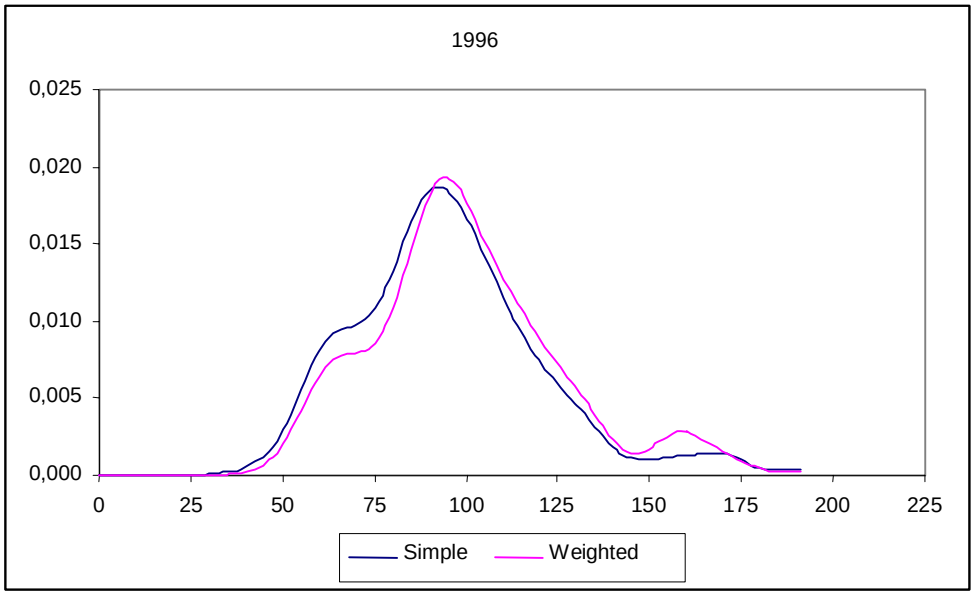
175
200
Simple
Weighted


1996
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Simple
Weighted

Figure 4.- EVOLUTION OF THE MOBILITY DEGREE

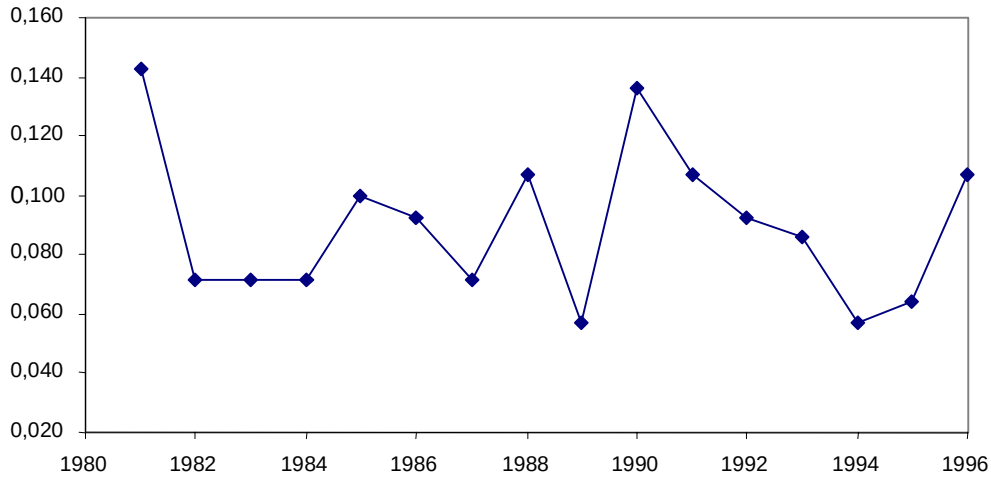

Table 1.- REGIONAL INEQUALITY IN THE E.U.

	A(0,25)	A(0,5)	A(1)	A(2)	A(50)	A(100)	Gini	Theil
1980	0,0100	0,0202	0,0410	0,0851	0,5923	0,6117	0,1549	0,0406
1981	0,0093	0,0185	0,0371	0,0741	0,4953	0,5224	0,1513	0,0378
1982	0,0091	0,0181	0,0363	0,0726	0,4914	0,5194	0,1489	0,0370
1983	0,0090	0,0179	0,0358	0,0720	0,5134	0,5424	0,1468	0,0364
1984	0,0091	0,0183	0,0367	0,0739	0,4933	0,5186	0,1486	0,0372
1985	0,0094	0,0187	0,0375	0,0755	0,5022	0,5274	0,1507	0,0382
1986	0,0093	0,0187	0,0376	0,0765	0,5835	0,6097	0,1499	0,0378
1987	0,0090	0,0180	0,0362	0,0738	0,5719	0,5989	0,1465	0,0364
1988	0,0086	0,0172	0,0344	0,0690	0,4896	0,5212	0,1441	0,0349
1989	0,0084	0,0168	0,0337	0,0674	0,5173	0,5501	0,1427	0,0343
1990	0,0088	0,0175	0,0350	0,0697	0,5392	0,5703	0,1461	0,0358
1991	0,0086	0,0171	0,0340	0,0671	0,5337	0,5653	0,1447	0,0351
1992	0,0086	0,0170	0,0338	0,0667	0,5156	0,5485	0,1444	0,0349
1993	0,0081	0,0161	0,0319	0,0627	0,5077	0,5411	0,1398	0,0330
1994	0,0082	0,0164	0,0326	0,0641	0,5118	0,5449	0,1420	0,0336
1995	0,0083	0,0165	0,0327	0,0645	0,5072	0,5406	0,1430	0,0337
1996	0,0080	0,0159	0,0316	0,0625	0,5014	0,5352	0,1405	0,0325
% change	20,5	21,2	22,8	26,5	15,3	12,5	9,3	20,1

Table 2.- THEIL INDEX DECOMPOSITION

	IndEX	Inequality			
		External	External(%)	Internal	Internal(%)
1980	0,0406	0,0126	31,1	0,0280	68,9
1981	0,0378	0,0121	31,9	0,0258	68,1
1982	0,0370	0,0117	31,6	0,0253	68,5
1983	0,0364	0,0109	30,0	0,0255	70,0
1984	0,0372	0,0113	30,4	0,0259	69,6
1985	0,0382	0,0112	29,4	0,0269	70,6
1986	0,0378	0,0108	28,6	0,0270	71,4
1987	0,0364	0,0098	26,9	0,0266	73,1
1988	0,0349	0,0098	28,0	0,0251	72,0
1989	0,0343	0,0096	27,9	0,0247	72,1
1990	0,0358	0,0106	29,5	0,0252	70,5
1991	0,0351	0,0104	29,7	0,0247	70,3
1992	0,0349	0,0100	28,6	0,0250	71,4
1993	0,0330	0,0084	25,3	0,0247	74,7
1994	0,0336	0,0089	26,3	0,0248	73,7
1995	0,0337	0,0089	26,5	0,0248	73,5
1996	0,0325	0,0074	22,9	0,0250	77,1

Table 3
G.D.P. AND POPULATION REGIONAL CONCENTRATION
(Gini-Hirschman Index)

	PIB	Población
1980	11,95	10,99
1981	11,96	11,00
1982	12,04	11,01
1983	12,05	11,01
1984	12,01	11,01
1985	12,06	11,02
1986	12,10	11,02
1987	12,15	11,02
1988	12,12	11,03
1989	12,13	11,04
1990	12,11	11,03
1991	12,08	11,03
1992	12,05	11,02
1993	12,03	11,02
1994	12,01	11,02
1995	11,97	11,02
1996	11,98	11,02
Coeficient of variation	0,0051	0,0011
% change	0,20	0,29

Table 4.- TRANSITION MATRIX
(1980-1996)

Classes	1	2	3	4	5	6	7
1	**0,1429**	0,8571	0,0000	0,0000	0,0000	0,0000	0,0000
2	0,0000	**0,8000**	0,1600	0,0400	0,0000	0,0000	0,0000
3	0,0000	0,1111	**0,5185**	0,3333	0,0370	0,0000	0,0000
4	0,0000	0,0000	0,2857	**0,6429**	0,0714	0,0000	0,0000
5	0,0000	0,0000	0,0741	0,4074	**0,4815**	0,0000	0,0370
6	0,0000	0,0000	0,0000	0,0000	0,1250	**0,6250**	0,2500
7	0,0000	0,0000	0,0000	0,0000	0,0000	0,4000	**0,6000**
Initial distrib.	0,0496	0,1773	0,1915	0,2979	0,1915	0,0567	0,0355
Final distrib.	0,0071	0,2057	0,2270	0,3404	0,1277	0,0496	0,0426
Ergodic distrib.	0,0000	0,0484	0,3835	0,4300	0,0932	0,0276	0,017

ANNEX
LIST OF REGIONS

Bélgium
Bruxelles-Brussels
Antwerpen
Limburg (B)
Oost-Vlaanderen
Vlaams Brabant
West-Vlaanderen
Brabant Wallon
Hainaut
Liège
Luxembourg (B)
Namur
Denmark
Germany
Stuttgart
Karlsruhe
Freiburg
Tübingen
Oberbayern
Niederbayern
Oberpfalz
Oberfranken
Mittelfranken
Unterfranken
Schwaben
Bremen
Hamburg
Darmstadt
Gießen
Kassel
Braunschweig
Hannover
Lüneburg
Weser-Ems
Düsseldorf
Köln
Münster
Detmold
Arnsberg
Koblenz
Trier
Rheinhessen-Pfalz
Saarland
Schleswig-Holstein
Greece
Anatoliki Makedonia, Thraki
Kentriki Makedonia
Dytiki Makedonia
Thessalia
Ipeiros
Ionia Nisia
Dytiki Ellada
Sterea Ellada
Peloponnisos
Attiki
Voreio Aigaio
Notio Aigaio
Kriti
Spain
Galicia
Principado de Asturias
Cantabria
Pais Vasco
Comunidad Foral de Navarra
La Rioja
Aragón
Comunidad de Madrid
Castilla y León
Castilla-la Mancha
Extremadura
Cataluña
Comunidad Valenciana
Baleares
Andalucia
Murcia
Canarias (ES)
France
Île de France
Champagne-Ardenne
Picardie
Haute-Normandie
Centre
Basse-Normandie
Bourgogne
Nord - Pas-de-Calais
Lorraine
Alsace
Franche-Comté
Pays de la Loire
Bretagne
Poitou-Charentes
Aquitaine
Midi-Pyrénées
Limousin
Rhône-Alpes
Auvergne
Languedoc-Roussillon
Provence-Alpes-Côte d'Azur
Corse
Ireland
Italy
Piemonte
Valle d'Aosta
Liguria
Lombardia
Trentino-Alto Adige
Veneto
Friuli-Venezia Giulia
Emilia-Romagna
Toscana
Umbria
Marche
Lazio
Abruzzo
Molise
Campania
Puglia
Basilicata
Calabria
Sicilia
Sardegna
Luxembourg
Netherlands
Groningen
Friesland
Drenthe
Utrecht
Noord-Holland
Zuid-Holland
Zeeland
Noord-Brabant
Limburg (NL)
Portugal
Norte
Centro (P)
Lisboa e Vale do Tejo
Alentejo
Algarve
United Kingdom
North East
North West (including
Merseyside)
Yorkshire and The Humber
East Midlands
West Midlands
Eastern
South East
South West
Wales
Scotland
Northern Ireland