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MOBILITY AND REGIONAL INEQUALITY IN THE EUROPEAN UNION: IMPLICATIONS FOR ECONOMIC POLICY

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Abstract: The aim of this paper is to analyse the mobility of per capita income distribution in the European regions during the period 1977-1996. In doing so we will attempt highlight some aspects of the nature of interregional inequality. We also hope to draw inferences that might be applied by European regional policy makers. Our methodological approach involves calculating indices commonly used in the dynamic income distribution literature, such as those of Theil, Atkinson and Shorrocks. These indices are calculated at different levels, both temporal and geographical, in order to discover different regional behaviour patterns throughout the study period.

Key Words: Mobility, Inequality, Regional Development, European regions

JEL Codes: D63, R12

1. Introduction

Due to interest in regional growth within the European Union and in the issue of whether or not there exists neo-classical convergence between regions, the last decade has seen the publication of a number of studies aiming to analyse the dynamics of interregional inequality in Europe[1].

It is against this background that the present study was undertaken, in the hope of promoting a better understanding of existing disparities by analysing the mobility of per capita income distribution at regional level within the European Union between 1977 and 1996[2].

The aim is to contribute complementary data that will help to explain the nature of interregional inequality, in order to reveal some kind of inference that might be of use to the Community's regional policy-makers. The fact is that limited mobility may be indicative of a tendency for regions to consolidate a particular position. If this were the case, it would underline the need for an active policy to reduce regional disparities. If, however, findings suggest that differences in regional incomes are largely to blame for existing inequality, regional policy would need to put aside traditional convergence policies and focus first and foremost on alleviating the adverse effects of economic cycles.

The basis of our working method is to calculate various indices commonly used in studies of the dynamics of personal income distribution. However, since the unit of reference here is to be the region and not the individual, the additional dimension of population will be included in the analysis. Thus, most of the indices that are calculated will be weighted by the relative population[3].

Most of the empirical studies that explore the evolution of interregional inequality in the European Union are based on data taken from the Eurostat Regio databank. Eurostat contemplates four different hierarchically classified levels of geographical subdivisions, known as NUTS (Nomenclature of Units for Territorial Statistics). Thus there is NUTS-0 data (on countries), NUTS-1 (on standard regions), NUTS-2 (basic administrative units) and NUTS-3 (subdivisions of the former). In the case of some member countries, however, (United Kingdom or Denmark, for

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[1] See, for example, Dunford (1993), Sala-i-Martin (1994, 1996), Esteban (1994), Dewhurst and Mutis-Gaitan (1995), Armstrong (1995), Rodríguez-Pose (1997), Paci (1997) or López-Bazo et al. (1999), among others.

[2] The study of mobility in interpersonal income distribution has given rise to a vast amount of empirical literature in the last few years. See, to name but a few, Creedy et al. (1981), Atkinson et al. (1992), Hungerford (1993), Gustafsson (1994), Burkhauser and Poupoure (1996), Aaberge et al. (1996), Jenkins (1996) or Bigard et al. (1998). Within the Spanish context it is worth mentioning Pena (1996) and Cantó (2000).

[3] Save for a few exceptions, recent literature on convergence fails to take into account differences in the population of the regions included for analysis.

instance) this classification is extremely artificial since it is based on purely statistical criteria, that even fails to take into account each nation's particular administrative structure. This imposes a significant limitation, since convergence analysis should be based on regional areas that are uniform in geographical and social terms.

It is also important, as recommended by Paci (1997), to avoid *over-representing* the more developed regions of the European Union among the data. There is a danger of this occurring if, for example, only NUTS-2 are taken into account.

In view of all these factors, therefore, it was decided to take 110 regions (a complete list is included in the appendix): NUTS-0 for Ireland, Luxembourg and Denmark; NUTS-1 for Belgium (3 Régions), Germany (11 Länder), Holland (4 Landsdelen) and the United Kingdom (12 Standard Regions); NUTS-2 for France (22 Régions), Italy (20 Regioni), Spain (17 Comunidades Autónomas), Portugal (5 Comissaoes de Coordenaçao Regional) and Greece (13 Regiones de Desarrollo)4. Population and GNP data from 1977 to 1996 for all 110 regions was obtained from Crenos and Regio5.

This study is organised in five sections. The one that follows is a mobility study of per capita income distribution in the European context. Section three uses the findings to explore the evolution of regional mobility through time and how this relates to the existing level of inequality. Section four then examines the direction and level of impact of the changes that have taken place in the relative positions of the European regions over the observation period. Finally, section five presents the conclusions that may be drawn, together with a few closing remarks.

2. Regional Mobility within the European Union

Over the last few years numerous studies, both theoretical and empirical, have taken a dynamic rather than the conventional static approach to exploring inequality. However, in spite of the enormous volume of literature that this issue has generated, authors have not yet reached any uniform criterion regarding how to define and quantify the notion of *mobility*. Most researchers overcome this problem by highlighting those aspects of the phenomenon that they believe to be most relevant to their objectives. Thus, for the purposes at hand, it was decided to define mobility in such general terms as changes in the ordering of individuals in a given distribution that is subject to

[4] The study does not cover the new German *Länder*, France's overseas departments (Guadaloupe, French Guayana, Martinique and Reunion), Portugal's islands in the Atlantic (the Azores and Madeira) or Spain's territories in North Africa (Ceuta and Melilla). Nor does it include the Dutch region of Groningen because of its heavy dependence on North Sea oil production.

[5] GDP is expressed in terms of purchasing power parity (PPP), thereby eliminating the effects of different price levels and enabling comparisons to be made in real value terms. The option of using ecus to express this variable was rejected because when comparing regions of different countries values in ecus would not have provided an adequate measure of the differences between them, because monetary parity would fail to reveal internal differences in purchasing power.

temporal alterations. Even in its simplest form, therefore, such as study requires at least two observations of distribution.

Let it now be assumed that there are *n* groups of individuals (which could be countries or regions, for example). Per capita income in group *i* will be designated the term x_i, with $x_i = M_i / N_i$, and M_i and N_i being the income and population respectively of group *i,* i=1,2,…,n.

For the sake of greater accuracy, we will proceed by identifying the strictly positive orthant in the n-dimensional Euclidean space (R^{n}_{++}), as the space of all per capita income distributions with population $n \geq 1$[6]. Consequently, $\mathrm{x} = (x_1, x_2, ..., x_n) \in \mathrm{R}^{n}_{++}$ represents the per capita income distribution in the n groups of individuals considered.

Let us now suppose that per capita income in group *i* (x_i) has altered over a given period of time, and has now become y_i. To use the terminology of Fields and Ok (2000), x is said to have been transformed into $\mathrm{y} = (y_1, y_2, ..., y_n) \in \mathrm{R}^{n}_{++}$, and the change in distribution is denoted as $\mathrm{x} \longrightarrow \mathrm{y}$.

Within this framework, it is possible in theory to define a mobility measure as any continuous function $M : \mathrm{R}^{2n}_{++} \longrightarrow \mathrm{R}$ with the interpretation that "$\mathrm{x} \longrightarrow \mathrm{y}$ exhibits more mobility than $\mathrm{z} \longrightarrow \mathrm{w}$, whenever $\mathrm{M(x,y)} \geq \mathrm{M(z,w)}$".

2.1. Measures of mobility based on the correlation coefficient

Let us begin this mobility analysis of the regional distribution of per capita income in the European Union by taking a close look at the information provided by the correlation coefficient, $r(\mathrm{x}, \mathrm{y})$.

The set of mobility measures based on the correlation coefficient can be formally defined as follows:

$$M(\mathrm{x}, \mathrm{y}) \equiv f(r(\varphi(\mathrm{x}), \varphi(\mathrm{y}))) \tag{1}$$

where $f : [-1,1] \longrightarrow \mathrm{R}$ y $\varphi : \mathrm{R}_{++} \longrightarrow \mathrm{R}$ are both continuous functions, the former of which is decreasing and the latter increasing[7].

A simple example of a measure of mobility based on the correlation coefficient would be:

$$M_r(\mathrm{x}, \mathrm{y}) = 1 - r(\mathrm{x}, \mathrm{y}) \tag{2}$$

Alternatively consider Hart's index (1976a, 1976b and 1983):

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[6] Some of the measures of inequality that will be used later on are not defined for non-positive incomes. Shorrocks (1980) and Cowell (1995), however, show that it is possible to analyse inequality in distributions with negative incomes.

[7] For the sake of simplicity in the notation: $\varphi(\mathrm{x}) \equiv (\varphi(x_1), \varphi(x_2), ..., \varphi(x_n))$ and, by analogy, $\varphi(\mathrm{y}) \equiv (\varphi(y_1), \varphi(y_2), ..., \varphi(y_n))$.

$$M_H(\mathrm{x},\mathrm{y}) = 1 - r(log(\mathrm{x}), log(\mathrm{y})) \quad (3)$$

However, both M_r and M_H present a serious drawback, in that they fail to capture the "origin independence" aspect of mobility (Fields and Ok, 2000). To illustrate this problem let us consider the following distributions at two given points of time:

$$\text{A: } x_A \equiv (1,3) \longrightarrow (3,1) \equiv y_A$$

$$\text{B: } x_B \equiv (1,3) \longrightarrow (2,2) \equiv y_B$$

According to M_r and M_H the less mobile distribution can be said to be B ($M_r(x_A,y_A) > M_r(x_B,y_B)$ and $M_H(x_A,y_A) > M_H(x_B,y_B)$). However, it could also be argued that distribution B is in a way more mobile than distribution A. In fact, in B there appears to be no dependence of the final state of one's income on the initial state, while in distribution A it is possible to observe perfect (negative) dependence between the two observations. If the aim were to focus on this facet of mobility, the measure to use might be the following:

$$M_{|H|}(\mathrm{x},\mathrm{y}) = 1 - |r(log(\mathrm{x}), log(\mathrm{y}))| \quad (4)$$

Table 1 shows the values calculated for the different proposals for measuring per capita income distribution in the regions of the European Union between 1977 and 1996, taking different time periods[8]. Population is also introduced as a further dimension of the analysis. This is achieved by weighting GNP pc by the relative population of the region in question.

As was to be expected, the data summarised in Table 1 shows that, the longer the study period the more mobility will be observed in the distribution. In fact, when study periods are extended from year-long intervals to periods of ten or twenty years, M_r scores increase by 9.975 and 23.4 times respectively. The same also applies to M_H and $M_{|H|}$ measures.

Table 1: Mobility measures based on the correlation coefficient[9].

	Time period				
Measures	1 year	2 years	4 years	10 years	20 years
$M_r(x,y)$	0.0040	0.0088	0.0116	0.0399	0.0936
$M_H(x,y)$	0.0045	0.0080	0.0126	0.0460	0.1010
$M_{\|H\|}(x,y)$	0.0045	0.0080	0.0126	0.0460	0.1010

Note: Results shown are the average for each time period.

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[8] A crucial step in any mobility analysis is the choice of the time period of analyis. This issue, and its implications are explored by Shorrocks (1978a) and Creedy (1992) among others.

[8] Given that r(x,y)>0, M_H and $M_{|H|}$ coincide in all the cases considered.

In any event, all the figures obtained are relatively close to zero (complete immobility). In spite of the simplicity of the measures employed, this result may be taken as an indication that the regional distribution of per capita income in the European Union exhibits very little mobility.

2.2. Shorrocks' rigidity index

In this section we will examine the family of indices proposed by Shorrocks (1978b). This is a set of measures initially conceived to calculate the degree to which incomes converge as the study period is prolonged, but which, as will later be shown, also serve as mobility measures.

Let us first of all consider a society made up of *n* identical individuals, each of whom receives a given income over the duration of *T* consecutive periods, such that y_i^t denotes the income received by individual *i*, *i*=1,2,…,n, in the period *t*, *t*=1,2,…,T. If

$$\mu^t = \frac{1}{n}\sum_{t=1}^{T} y_i^t \tag{5}$$

is the average income of the *n* individuals over the period *t,* the accumulated average income over the *T* periods considered will be given as:

$$\mu = \sum_{t=1}^{T} \mu^t \tag{6}$$

Finally, let Y be the n-dimensional vector of the income accumulated by the *n* individuals over the *T* periods. That is

$$Y = (Y_1, Y_2, ..., Y_n) \tag{7}$$

where

$$Y_i = \sum_{t=1}^{T} y_i^t \qquad (i=1,2,\ldots n) \tag{8}$$

Now we will denote by *I(Y)* the set of inequality measures that are convex functions of the relative incomes[10]. Therefore, given that the function is convex, it can be written as:

$$I(Y) = h\left(\frac{\sum_{t=1}^{T} Y^t}{\mu}\right) = h\left(\sum_{t=1}^{T} w_t \frac{Y^t}{\mu^t}\right) \leq \sum_{t=1}^{T} w_t h\left(\frac{Y^t}{\mu^t}\right) \tag{9}$$

where

$$w_t = \frac{\mu_t}{\mu} \tag{10}$$

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[10] In accordance with the notation used so far, a mesure of inequality is no more than a continuous function $I: R^n_{++} \longrightarrow R$ such that if distribution x exhibits a higher level of inequality than distribution y, it must be checked that $I(x) \geq I(y)$. Thus, being defined on the basis of the whole space of possible income distributions, it provides a complete ordering of all of them and makes it possible to calculate the magnitude of the observed differences. The minimum requirement to be made of any measure I is that it should be consistent with the Lorenz dominance criterion (absolute or relative).

Expression (9) gives:

$$I(Y) \leq \sum_{t=1}^{T} w_t I(Y^t) \tag{11}$$

In other words, the index of inequality in the income accumulated over the *T* periods observed can be no greater than the weighted sum of the inequality indices for each period individually. Thus, Shorrocks' rigidity index is defined as:

$$R = \frac{I(Y)}{\sum_{t=1}^{T} w_t I(Y^t)} \leq 1 \tag{12}$$

Note that the above expression only applies to those inequality measures that are convex functions of the relative incomes. However, most of the commonly used indices (Gini's index, the variation coefficient, Theil's indices, Atkinson's family of indices,...) satisfy this property[11].

The R index gives the amount by which inequality decreases as the study period is prolonged. Thus, for example, if R=0.90, inequality of income over a period will be 90% of the average inequality of each of the separate subperiods. This is actually an index that measures the degree of stability in inequality when the income period is prolonged. Indeed, if R=1, inequality does not vary in relation to a prolongation of the period of reference. In other words, relative incomes show no variation whatever over time, thereby suggesting that the society in question is totally immobile. In a society with a certain degree of mobility, however, variations in relative income can be expected to be more frequent and more marked, which would mean a reduction in the value of R (R=0 would signify perfect mobility). R can therefore be considered to be a measure of mobility[12].

In the case in hand, however, the aim is to work with groups of individuals (henceforth, regions). Given, therefore, that the unit of reference is not the individual, it will be necessary to consider the specific features of regional mobility. One such feature is that, as time goes on, each region registers variations in per capita income and in population. As a result, the evolution of the various measures of inequality over time reflects variations both in per capita income and in the population of each region. If, however, mobility is taken to be the capacity of regions to alter their relative positions in terms of development levels, analysis must focus exclusively on variations in per capita income, irrespective of the impact of changes in population.

For a better understanding of this idea, let us consider the following example. Let us for a moment imagine that we have several years' data regarding the regional distribution of per capita income in a certain country with two different regions. Let us assume that per capita incomes

[11] The most important exception is the variance of the income logarithm.

[12] Strictly speaking, according to the definition given above, the measure of mobility in the case of R would be: $M_R = 1-R$.

remain unaltered for the whole period, but that each year a varying portion of the population migrates from one region to the other. In such a situation, Shorrocks' rigidity index would vary throughout the period as a result of alteration in the inequality indices from one period to the next. According to the definition of mobility at present being applied, however, per capita income distribution in the country in question would have to be said to be completely immobile.

To over come this problem, therefore, the strategy used was that proposed by Esteban (1994). For this, it must be assumed henceforth that the distribution of regional per capita income throughout the *T* periods is known, such that x_i^t denotes per capita income in region *i,* i=1,2,…,n, during the period *t,* t=1,2,…,T. The relative population of the n regions is likewise known. Specifically, p_i^t represents the fraction of the population of *i*, during the period *t*, with respect to the total population of the n regions during that period. Henceforth let us assume that the population remains constant with respect to its size in the period *T*. That is, $p_i^t = p_i^T$.

The per capita income of the *n* regions in the period *t* should then be given by:

$$\mu^t = \sum_{i=1}^{n} p_i^t x_i^t \tag{13}$$

Let X be the n-dimensional vector of the per capita income throughout the *T* periods. That is:

$$X = \left(X_1, X_2, ..., X_n\right) \tag{14}$$

where

$$X_i = \sum_{t=1}^{T} x_i^t \qquad (i=1,2,\ldots,n) \tag{15}$$

Henceforth we can define Shorrocks' rigidity index adapted to the peculiarities of regional mobility as:

$$R' = \frac{I\left(X, P^T\right)}{\sum_{t=1}^{T} \frac{\mu^t}{\mu} I\left(X^t, P^T\right)} \tag{16}$$

where

$$\mu = \sum_{i=1}^{n} P^T X_i \tag{17}$$

and *I* is the inequality index[13].

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[13] The corresponding mobility measure will obviously be $M_{R'}=1-R'$. In the previous example, $R'=1$, therefore $M_{R'}=0$ (immobility).

[15] Atkinson's index is given by:

$$A(\alpha)_t = 1 - \left\{ \sum_{i=1}^{n} p_i^t \left(\frac{x_i^t}{\mu^t} \right)^{1-\alpha} \right\}^{\frac{1}{1-\alpha}}$$

Table 2 shows Shorrocks' rigidity index for regional income per capita in the European Union from 1977 to 1996, taking various periods of analysis (m=1,2,…,20). Also, R′ was calculated using various inequality measures (one of the Theil's indices, the variation coefficient and Atkinson's index with varying degrees of aversion to inequality), all of which are convex functions of relative incomes[14].

The results thus obtained show that whatever measure of inequality is used the rigidity indices take values close to 1 (total immobility). This suggests that, according to R′, regional distribution of GNPpc in the European Union is fairly rigid.

Table 2: Rigidity indices.

	Inequality indices				
	CV	*T(1)*	*A(O,5)*	*A(1,25)*	*A(2)*
m=1	1,0000	1,0000	1,0000	1,0000	1,0000
m=2	0,9993	0,9986	0,9986	0,9986	0,9986
m=3	0,9987	0,9971	0,9970	0,9969	0,9968
m=4	0,9975	0,9946	0,9945	0,9943	0,9942
m=5	0,9965	0,9922	0,9919	0,9915	0,9910
m=6	0,9956	0,9905	0,9901	0,9896	0,9890
m=7	0,9949	0,9891	0,9888	0,9883	0,9878
m=8	0,9945	0,9883	0,9880	0,9874	0,9868
m=9	0,9941	0,9873	0,9869	0,9861	0,9853
m=10	0,9938	0,9864	0,9859	0,9850	0,9840
m=11	0,9931	0,9850	0,9845	0,9835	0,9824
m=12	0,9926	0,9828	0,9834	0,9824	0,9812
m=13	0,9920	0,9828	0,9823	0,9813	0,9801
m=14	0,9913	0,9815	0,9809	0,9799	0,9788
m=15	0,9896	0,9784	0,9779	0,9771	0,9761
m=16	0,9885	0,9763	0,9758	0,9751	0,9742
m=17	0,9874	0,9741	0,9737	0,9729	0,9719
m=18	0,9864	0,9721	0,9716	0,9706	0,9694
m=19	0,9855	0,9701	0,9694	0,9682	0,9668
m=20	0,9844	0,9677	0,9669	0,9655	0,9640

However, on close examination of the data provided by Table 2 it is confirmed that the results obtained differ slightly according to which inequality index was used. Thus, the rigidity index shows less mobility when the variation coefficient is used. This measure of inequality is

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where $\alpha > 0$ is the aversion to inequality parameter. Taking the limit of this expression when α tends to one, this gives Theil's index:

$$T(1)_t = \frac{1}{\mu^t}\sum_{i=1}^{T} p_i^t x_i^t \log\left(\frac{x_i^t}{\mu^t}\right)$$

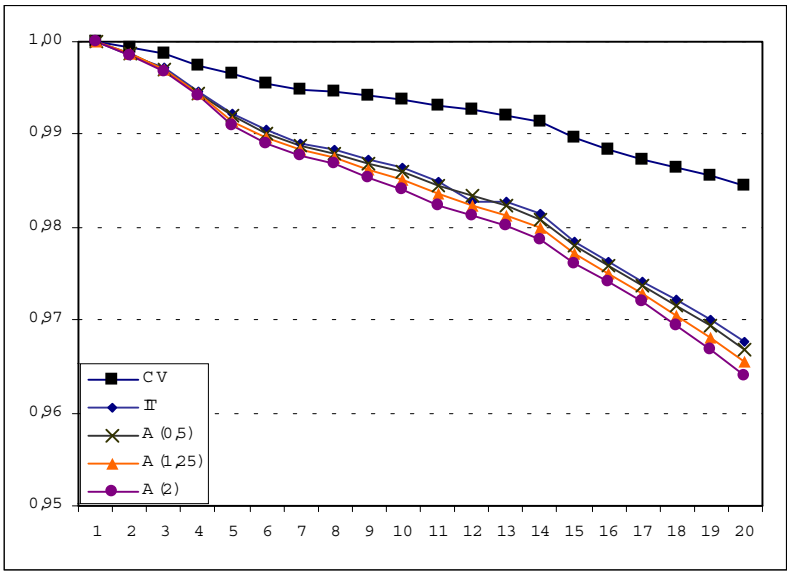
The variation coefficient, meanwhile, is obtained by dividing the standard deviation by the average:

$$CV_t = \frac{\sigma^t}{\mu^t}$$

seriously limited by the fact that it gives equal weight to positive and negative deviations from the mean. In other words, all income transfers within the distribution are valued equally. The values of R', however, are lower (and therefore mobility is greater) when they are calculated using Theil's or Atkinson's index. Both these measures of inequality allow more weight to be given to the lower end of the distribution. (In fact, the greater the aversion to inequality parameter, the more sensitive Atkinson's index becomes to events at low income levels)[15].

In order to complete the above analysis, we have calculated the so-called *stability profiles* (Shorrocks, 1981) of the distribution under consideration. These curves are obtained on a graph by plotting the values of the rigidity index on the *y* axis and the various periods of analysis on the *x* axis. The reference curve is R=1, which corresponds to a totally immobile distribution. The further the profiles stray from this curve, therefore, the more mobile the distribution.

Graph 1: Stability profiles.



Graph 1 shows how the resulting profiles are relatively close to the line of total immobility (note that the scale of the *y* axis goes from 0.95 to 1). Furthermore, all the profiles, whatever inequality measure is used, show a similar structure. Indeed they all decrease very slowly, tending to zero when *m* increases indefinitely. This could be taken as a sign of a continuing tendency towards convergence in the very long term.

3. Mobility and regional disparity

Shorrocks' rigidity index, which was calculated in the previous section, may in some circumstances, give rise to problems when it comes to interpreting the significance of departures

[15] A detailed description of the regulatory properties of the inequality indices used here can be found, for example, in Sen (1973) or Cowell (1995)

from the status quo with respect to the position of regions in terms of income per capita (Esteban, 1994). The nature of the problem is illustrated in the following example. Let us again imagine a country in which there are two different regions, one of which has a comparative advantage over the other, as regards, say, to its location. All else being equal, this region will systematically register a higher growth rate than the other, with the result that disparity between them will increase. In other words the relative positions of the two regions will remain unaltered over time. In such a situation, the R′ index might take significant values, even when the regional income distribution exhibits no mobility.

So far, moreover, we have not considered temporal changes in regional mobility in the European Union. A better understanding of this issue should enable us to determine the direction and impact of shifts in distribution in the 1977-1996 period of analysis.

Bearing in mind these two factors, it was decided to complete the regional mobility analysis with the data provided by the *transition matrices*. Much of the literature dealing with mobility reports of the use of transition matrices, since these enable the analysis of changes in distribution between two points in time.

In order to define the notion underlying the term "transition matrix", let us suppose that regional income per capita is aggregated and divided into *m* classes, each of which is made up of n/m regions[16]. Let us then assume that there is data regarding the evolution of this particular distribution for two points in time, t_0 and t_1. The transition matrix for the change in distribution between t_0 and t_1 will be $A = [a_{ij}] \in \mathrm{R}_{+}^{m \times m}$, where a_{ij} is the proportion of regions in class *i* at point t_0 and in class *j* at point t_1[17].

Among the wide range of mobility measures based on transition matrices to be found in the literature[18], it was decided to consider the following index proposed by Shorrocks (1978a):

$$M(A) = \frac{m - tr(A)}{m - 1} \tag{18}$$

where *tr(A)* denotes the trace of matrix *A* and *m* is the number of groups into which the distribution is divided. In the case in hand, all the regions considered were grouped in deciles, such that m=10[19].

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[16] Generally speaking it is not necessary for the *m* clases to be made up of the same number of elements. There are, however, technical reasons that may justify such a procedure (Fields and Ok, 2000).

[17] According to our own definition, A is a bistochastic matrix, since $\sum_{j=1}^{m} a_{ij} = \sum_{i=1}^{m} a_{ij} = 1$.

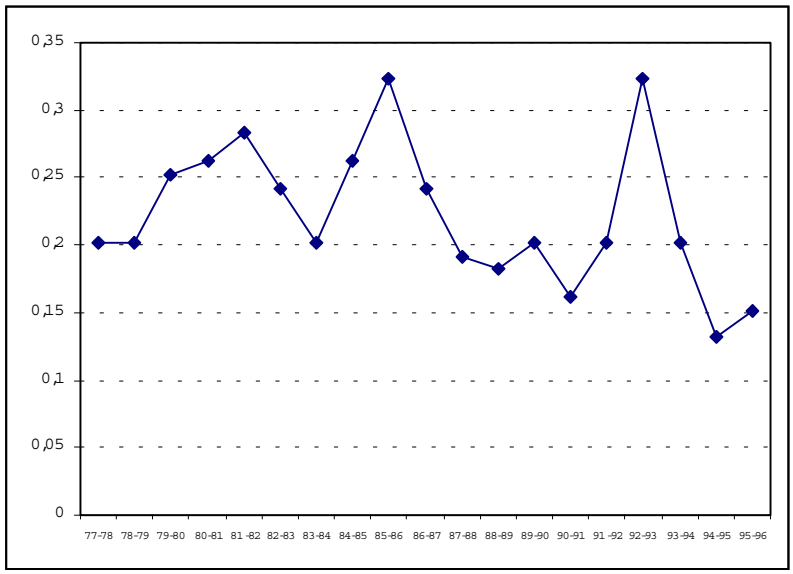
[18] Readers may if they wish consult, for example, Prais (1955), Bibby (1975), Bartholomew (1982) or Sommers and Conlisk (1985 and 1990).

[19] This classification takes account only of the total number of regions. Obviously, the resulting categories do not with those that would result from taking the distribution of regional income per capita each weighted by its relative population. In the latter case each decile would not necessarily be made up, of the same number of regions.

According to this index, if the distribution were completely immobile, matrix *A* should coincide with the identity matrix (*A=I*), the trace of which is equal to *m*. In such as situation, we would find that *M(A)=M(I)*=0. If, on the other hand, there were to be perfect mobility, all the elements in matrix A would be equal to $1/m$. It is to be assumed in this case that the chances of moving between classes are equal. Thus, the traza of *A* will be equal to one and, therefore, *M(A)*=1.

The calculation of this index gives a first assessment of the degree of regional mobility present in the European Union in the period between 1977 and 1996 (graph 2).

Graph 2: Regional mobility in the European Union. 1977-1996.



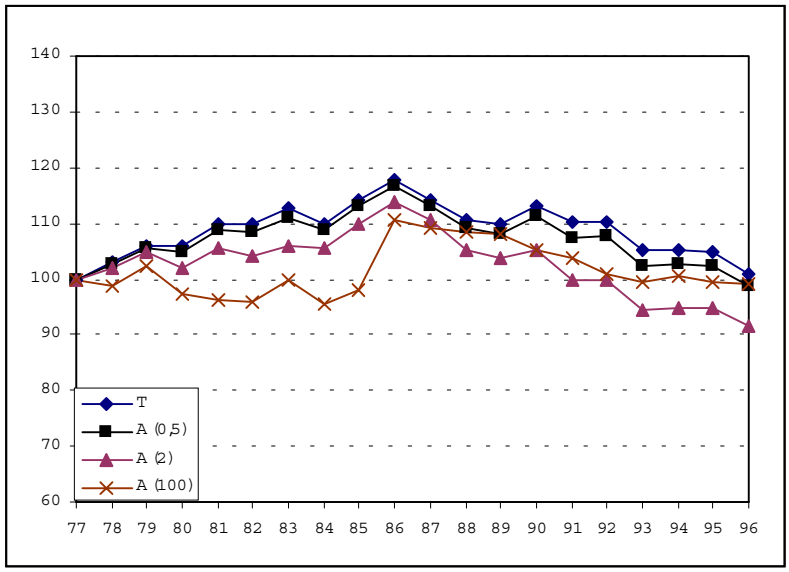
The values of *M(A)* that emerge are fairly low, which is consistent with the results indicated in previous sections, where there was mention of the relatively limited mobility of the distribution under analysis.

Over the whole period *M(A)* there is a 25% reduction, from 0.202 in the period 1977-1978 to 0.151 in the period 1995-1996. This can be interpreted as a sign of a reduction in regional mobility in the European Union between 1977 and 1996. It can be seen from the graph, however, that this apparent decrease in mobility was not steady throughout the period. In fact, generally speaking, it is possible to identify several sub-periods with different trends. Thus, between 1977 and 1986 it is possible to detect an upward trend in regional mobility. Thenceforth, however, except for a brief interval from 1991-1993, the trend is downward, and reaches such a point as to compensate for the earlier increase.

These results should in any event be viewed with a degree of caution. In fact, the validity of the index used is only relative, since it is estimated using only those elements on the main diagonal, thereby omitting the remaining elements of matrix *A*.

It is also necessary to bear in mind that ethical assessment of the results obtained in graph 2 is not possible without taking into account the degree of inequality observed. We therefore took the data from graph 3 to perform an initial assessment of the dynamics of interregional inequality in the European Union between 1977 and 1996.

Graph 3: Regional inequality in the European Union. 1977-1976.



Although an in-depth analysis of this issue is beyond the scope of this study, we can see that Theil's index shows a sustained level of interregional inequality throughout the study period. Specifically, there is scarcely a 1% increase in this index between 1977 and 1996. Various Atkinson indices were also calculated, taking different degrees of aversion to inequality. Generally speaking, however, the results obtained provide qualitative support for the observations suggested by the evolution of the Theil index. This process of sustained interregional inequality, however, does not remain constant throughout the whole period of analysis. In fact, inequality increases up to half way through the eighties. However, this trend is offset by the decrease that takes place in the subsequent period.

According to these results, there was no reduction in interregional inequality between 1977 and 1996. This suggests the need for more dynamic regional policies within the community, as long as there exists the political will to reduce the current disparities in living standards in the European regions.

Before fully accepting this conclusion, however, it is necessary to carry out a more detailed analysis of the nature of the inequality that has been observed to exist. The fact is that, as happens with interpersonal income distribution, these conditions of significant inequality may well fail to justify (in the sense used above) intervention in the form of measures aimed at redistribution. The evaluation of inequality levels specifically requires a temporal approach in order to view changes in

the relative positions of the different regions. In other words, the priority given to a policy intended to reduce regional disparities, for any given level of inequality, will depend on the mobility of the positions of regions in relation to one another. Thus, limited mobility at any given level of inequality, will be a sign of rigidity in the relative positions. Such a situation, would underline the need to adopt traditional development policies. A situation of high mobility, on the other hand, would be an indication not only of strong cyclical variation in regional incomes but also of a growth process (a deterioration) in interregional inequality. Under this type of circumstances, regional policy should be aimed primarily at alleviating the adverse effects of economic cycles, while leaving convergence policies temporarily to one side.

The empirical evidence presented in the various sections of this study shows regional mobility within the European Union to be relatively low. There even seems to have been a reduction between 1977 and 1996. The sustained interregional inequality throughout the period of analysis, therefore, would seem to have coincided with a process of consolidation in the relative positions of the regions. These results would appear to underline the need to strengthen regional development policies at community level.

4. The relative positions of the regions

In this section an attempt will be made to give an approximation of the direction and extent of changes in the relative positions of the European regions between 1977 and 1996, using different observation periods. The aim, in other words, is to use data taken from various transition matrices in order to ascertain which regions altered their positions and in what direction they did so.

As was to be expected, analysis reveals marked differences in regional mobility from one period of analysis to another (Table 3). In particular, stability in the distribution of regional income per capita decreases, the longer the time interval considered. Thus, over a twenty-year period, 73% of all the regions considered either remain within the same decile or shift to the one above or the one below, while only 14% of the regions shift more than two deciles. When year-by-year readings are taken, however, the corresponding figures are 99% and y 0.7% respectively.

Table 3: Total mobility

	Time period				
	1 year	2 years	4 years	10 years	20 years
Total mobility *(% of regions)*					
Remain within the same decile	80,00	70,40	61,64	45,00	32,73
Remain within the same decile or shift to the one adjacent	99,47	98,89	96,73	87,72	73,64
Shifts *(% of all the regions that change position)*					
Shift to the decile above	46,65	42,32	42,18	39,67	24,32
Shift to the decile below	50,72	49,49	49,29	38,02	36,49
Shift to one of the two deciles above	48,33	43,69	46,92	46,28	40,54
Shift to one of the two deciles below	50,95	50,51	52,13	48,76	44,59
Shift more than two deciles	0,72	1,49	0,95	4,96	14,86
Shift upwards more than two deciles	0,48	1,12	0,95	3,31	6,76
Shift downwards more than tow deciles	0,24	0,37	0	1,65	8,10

There is also a series of common features that can be detected irrespective of the time period considered. The fact is that most of the European regions remain in the same decile or shift to an adjacent one. Moreover, regions that shift more than two deciles represent a clear minority. These results once again clearly reveal the limited mobility of the distribution on which this study is focused.

Next, an examination was made to see how the regions behaved with respect to their level of development, the distinction being made between low income, average income and high income regions (Tables 4, 5 and 6). For the purposes of this analysis, low income regions were considered to be those with a per capita income within the first three deciles of the distribution[20]. By analogy, therefore, high income regions were those that fell within the last three deciles. Finally, the remaining regions (in other words, those belonging to the fourth, fifth, sixth and seventh deciles) would be considered to be average income regions.

Table 4: Mobility of low income regions.

	Time period				
	1 year	2 years	4 years	10 years	20 years
Total mobility *(% of regions)*					
Remain within the same decile	85,49	77,10	70,30	54,55	39,39
Remain within the same decile or shift to the one adjacent	99,81	99,67	98,18	92,42	81,82
Shifts *(% of all the regions that change position)*					
Shift to the decile above	59,34	61,76	57,14	40,00	15,00
Shift to the decile below	39,56	36,76	36,73	43,33	55,00
Shift to one of the two deciles above	60,44	61,76	61,22	50,00	40,00
Shift to one of the two deciles below	39,56	38,24	38,78	46,67	55,00
Shift of more than two deciles	0	0	0	3,33	5,00
Shift upwards more than two deciles	0	0	0	3,33	5,00
Shift downwards more than two deciles	0	0	0	0	0

Table 5: Mobility of average income regions.

	Time period				
	1 year	2 years	4 years	10 years	20 years
Total mobility *(% of regions)*					
Remain within the same decile	69,62	56,81	46,82	29,55	22,73
Remain within the same decile or shift to the one adjacent	98,92	97,72	94,09	81,82	70,46
Shifts *(% of all the regions that change position)*					
Shift to the decile above	45,28	42,54	40,17	41,94	29,41
Shift to the decile below	51,18	46,96	48,72	32,26	32,35
Shift to one of the two deciles above	47,64	44,75	47,01	50,00	47,06
Shift to one of the two deciles below	51,58	48,07	51,28	43,55	38,24
Shift of more than two deciles	0,79	1,65	1,71	6,45	14,71
Shift upwards more than two deciles	0,79	1,65	1,71	4,84	11,76
Shift downwards more than two deciles	0	0	0	1,61	2,95

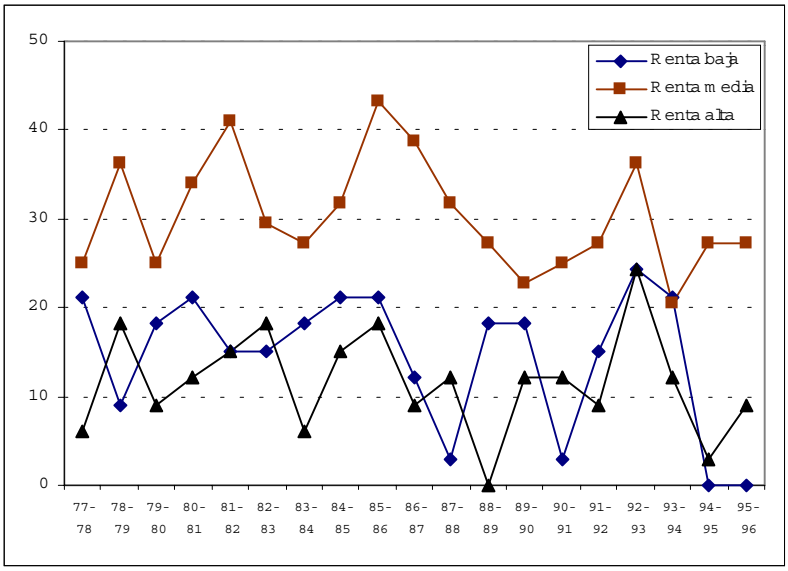
[20] The whole of this group is made up of Objective 1regions. These are the least developed regions of the European Union, wich have been the primary objective of regional policy within the community since the 1988 reform of Structural Funds.

Table 6: Mobility of the high income regions.

	Time period				
	1 year	2 years	4 years	10 years	20 years
Total mobility *(% of regions)*					
Remain within the same decile	88,35	81,82	72,72	56,06	39,39
Remain within the same decile or shift to the one adjacent	99,84	99,96	98,79	90,91	69,70
Shifts *(% of all the regions that change position)*					
Shift to the decile above	35,62	33,33	31,11	34,48	25,00
Shift to the decile below	63,01	64,81	64,44	27,08	25,00
Shift to one of the two deciles above	35,62	33,33	31,11	34,48	30,00
Shift to one of the two deciles below	63,01	64,81	68,89	55,17	45,00
Shift of more than two deciles	1,37	1,85	0	10,34	25,00
Shift upwards more than two deciles	0	0	0	0	0
Shift downwards more than two deciles	1,37	1,85	0	10,34	25,00

If a comparison is made between the regions that remain within their original decile, it can be seen that there is more mobility among the regions in the central part of the distribution. In other words, low and high income regions exhibit greater rigidity in their relative positions over the period analysed. Thus, on average, 85% of the low income regions and 88% of those in the high income category remain within the same decile the following year. Figures drop to 69%, however, when it comes to average income regions. Furthermore, as the time periods considered extend in duration, the relative differences in the degree of mobility become more marked. In fact, for a twenty-year interval, the above-mentioned percentages fall to 39% for high income regions, 39% for low income regions and 22% for those classed as average.

Graph 4: Regional shifts per income level (%).



In order to confirm these results, we calculated in each of the groups considered the percentage of regions that shift from their original decile over the time period[21]. The data resumed in graph 4 were found to be consistent with the figures quoted earlier.

The final stage of the analysis was to examine the stability of the distribution in the first decile (less-developed regions) and the tenth (more highly developed regions). Findings show that the degree of mobility in the regions belonging to the first decile is higher than that of the regions in the tenth. In fact, on average, 90% of the less developed regions remain in the first decile the following year, whereas the percentage for the more developed regions reached 96%. When the time period is extended, differences in the degree of mobility between these two groups of regions can be seen to widen, thus supporting the findings reported above.

5. Final considerations

This paper was concerned with analysing mobility in per capita income distribution at regional level in the European Union from 1977 to 1996. Findings based on various different indices commonly used when analysing the dynamics of interpersonal income distribution show a relatively low level of mobility within the distribution.

Empirical findings suggest a trend towards a reduction in regional mobility throughout the period of analysis coinciding with sustained interregional inequality in the European Union. This may indicate that the relative positions of the regions are becoming consolidated. If such is the case, this would highlight the need for the community to implement an active policy to reduce regional disparities.

Attention was also paid to differences in the behaviour of regions relative to their respective levels of growth. Findings revealed greater mobility among regions situated at the centre of the distribution. In other words, generally speaking, both high and low income regions tended towards greater stability in their relative positions over the period of analysis.

Summing up, and looking to possibility of extending the scope of this study, let it be said that there are several aspects of the subject that are worth further development and improvement. Some would involve extending the period covered by the available data for Europe. Although some effort was made towards this in the present study, it is wise to bear in mind that the shorter the period of analysis, the more difficult it is to obtain a reliable assessment of the underlying trends in regional mobility processes. The use of further mobility measures would also provide the opportunity to test the robustness of the findings. Finally, if various different levels of geographical

[21] This measure is known in the literature as the *immobility ratio*. See also Lillard and Willis (1978) or Gottschalk (1982), among others.

subdivision were included in the analysis, this would help to identify geographically-related differences in behaviour patterns

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Appendix

The 110 regions observed in the present study are as follows:

- BELGIQUE
  - Bruxelles-Brussel
  - Vlaams Gewest
  - Region Wallonne
- DENMARK
- DEUTSCHLAND
  - Baden Württemberg
  - Bayern
  - Berlin
  - Bremen
  - Hamburg
  - Hessen
  - Niedersachsen
  - Nordrhein-Westfalen
  - Rheinland-Pfalz
  - Saarland
  - Schleswig-Holstein
- ELLADA
  - Anatoliki Makedonia,Thraki
  - Kentriki Makedonia
  - Dytiki Makedonia
  - Thessalia
  - Ipeiros
  - Ionia Nisia
  - Dytiki Ellada
  - Sterea Ellada
  - Peloponnisos
  - Attiki
  - Voreio Aigaio
  - Notio Aigaio
  - Kriti
- ESPAÑA
  - Galicia
  - Asturias
  - Cantabria
  - País Vasco
  - Navarra
  - La Rioja
  - Aragón
  - Madrid
  - Castilla y León
  - Castilla La Mancha
  - Extremadura
  - Cataluña
  - Comunidad Valenciana
  - Murcia
  - Baleares
  - Andalucía
  - Canarias
- 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

- FRANCE
  - Poitou Charentes
  - Aquitaine
  - Midi Pyrénées
  - Limousin
  - Rhône-Alpes
  - Auvergne
  - Languedoc-Rousillon
  - Provence-Alpes-Côte d´Azur
  - Corse
- IRELAND
- ITALIA
  - Piemonte
  - Valle D´Aosta
  - Liguria
  - Lombardia
  - Trentino-Alto Adige
  - Veneto
  - Friuli-Venezia Giulia
  - Emilia Romagna
  - Toscana
  - Umbria
  - Marche
  - Lazio
  - Campania
  - Abruzzi
  - Molise
  - Puglia
  - Basilicata
  - Calabria
  - Sicilia
  - Sardegna
- LUXEMBURG
- NEDERLAND
  - Noord Nederland
  - Oost Nederland
  - West Nederland
  - Zuid Nederland
- PORTUGAL
  - Norte
  - Centro
  - Lisboa e Vale do Tejo
  - Alentejo
  - Algarve
- UNITED KINGDOM
  - North East
  - Yorkshire and Humberside
  - East Midlands
  - Eastern
  - London
  - South East
  - South West
  - West Midlands
  - North West
  - Wales
  - Scotland
  - Northern-Ireland