

Patterns of economic development and inequality in the European regions

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Abstract

The aim of this paper is to analyse the relationship between inequality and per capita income level, obtaining data at a geographic disaggregate level (European regions). The research paper develops a regional analysis applying multivariable techniques and using inequality indices and the equivalent disposable income.

With regard to the empirical evidence of the Kuznets hypothesis there is a relevant controversy at national level. We expect that the regional level may provide an insight into this controversy. Our empirical results suggest that there are variations along the decreasing part of the U-inverted relationship (based on Kuznets` hypothesis) due to the rise of inequality in the richest regions. Therefore, a U-shaped relationship between equivalent disposable income and inequality emerges as statistically significant and robust.

Finally, cluster analysis permits to classify the European regions into five groups with the relevant case of the metropolitan and rich regions.

JEL classification: D31; D63; O52; R1

Keywords: inequality, Income, European regions, cluster analysis, Kuznets` curve.

1. Introduction

The aim of this paper is to analyse the relationship between inequality and aggregate income level, obtaining data at a disaggregate level of regions.

The interaction between inequality and average personal income has been a basic issue in the literature on income distribution over the last half century. Politics and economy have taken into account this relationship raised by Kuznets in his classic paper (Kuznets, 1955). The author postulates the inverse U-curve hypothesis between development and inequality. Afterwards, a relevant controversy took place both at empirical and theoretical levels.

The apparent inconclusive debate on the Kuznets curve partially derives from differences in the selection of variables, the range of empirical data, the statistical tests and also the sample of countries. In any case, the common feature of all studies is that they are dealing with country comparisons. By doing so, the empirical realm presents a narrowed range of dissimilarities and, at the same time, we can isolate some huge differences among the institutional systems of countries. Accordingly, many important differences across countries, like institutional set-up, political instability, macroeconomic policy and so on, could be isolated at the regional level. Our purpose is to go beyond studying the income-inequality relationship at a more disaggregate level, e.g., across the European regions.

Countries are not uniform and homogeneous spaces as far as inequality and average income are concerned. The European regional diversity has been studied quite well using different macroeconomic variables (GDP, labour market, demography, R&D, infrastructure, energy, etc.). Nevertheless, the variability of personal (household) income inequality patterns among the regions belonging to the same country have not received appropriate attention in the literature. Recent attempts (Vence, 2005; Perugini and Martino, 2008, Ezcurra, 2007) have been made to approach this issue at European regional level. The main idea is that eventual regional disparities in the inequality of personal income should mainly be originated by differences in regional economic and social structures.

We develop a regional analysis applying multivariable techniques and using inequality indices and the equivalent disposable income.

The structure of this paper is therefore as follows. The second section covers the review of the literature. Presentation of data is given in section 3 and section 4 develops

research methodology and introduces variables. Section 5 is divided into two parts. In the first part (section 5.1), we analyse the annual results, taking 1994, 1997 and 2001 as base years. In the second part we deal with the whole period. In this section the cluster analysis supplies a regional structure and permits a test on Kuznets' hypothesis. Conclusions are discussed in final chapter of paper.

2. Review of the literature

In this chapter we focus on the contributions to the debate on so called "Kuznets' hypothesis". The Kuznets' hypothesis postulates an inverted U-shaped relationship between income and inequality, that is, inequality first rises and later falls as an economy develops; but the empirical and theoretical analyses carried out over the last decades have been controversial and partially inconclusive.

Many authors have found empirical results highly compatible with the Kuznets curve hypothesis (Ahluwalia, 1979; Bourguignon and Morrison, 1998; Galor, 2000). Nevertheless, a wide parallel literature has refuted it (Anand and Kanbur, 1993; Galbraith, 2001 [2004]; Zweimüller, 2000; Sen, 1997). Even, some authors (Deininger and Squire, 1998) suggest an inconclusive relationship.

List and Gallet (1999) state "that for low-developed to middle-developed countries, the Kuznets curve is indeed an inverted-U. For higher-developed countries (Canada, Denmark, Sweden, United States, etc.), however, the relationship between inequality and per capita income becomes positive again." This result is consistent with the findings from previous studies (e.g. Ram, 1991; Partridge et. al., 1996; Tribble, 1996) of US income inequality. Table 1 shows some relevant examples of empirical results, which postulates different outcomes on the relationship between inequality and development.

INSERT TABLE 1

From a related approach, different factors influencing the relationship between inequality and economic growth are stressed from different perspectives: studies based on the capital market (Galor, 2000; Ray, 2002); on political economy (Alesina and Rodrik, 1994); on socio-political instability (Alesina and Rodrik, 1994; Barro, 2000; Rafael Muñoz, 2006) or based on demand (Ray, 2003; Zweimüller, 2000).

Most of the theoretical and empirical approaches dealing with the relationship between inequality and development have been developed at national level. However, some contributions have taken the first steps in approaching this question at the regional level (Vence, 2005; Troitiño, 2006; Perugini and Martino, 2008; Patridge, 1997, 2005; Panizza, 2002; Ezcurra, 2007). The main purpose is not only to have a more disaggregate view in terms of geography but also to isolate some institutional factors influencing income inequality level. In this way, Perugini and Martino (2008) point out some potential advantages of the regional level: first, more consistency of the social reference group for some purposes, second, regional data could uncover regional diversification of income inequality patterns that tends to merge at the aggregate national level and third, regional data probably assure a higher cultural and institutional homogeneity.

Perugini and Martino (2008) also provide analysis on the determinants and effects on growth of regional income inequality in Europe, finding a positive relationship between inequality and economic growth. However, Vence (2005) identifies a more complex pattern with negative relationship in the group of low and medium income regions and a positive one for the richest ones.

3. Data: The European Community Household Panel (ECHP)

The European Community Household Panel is a standardised multipurpose annual longitudinal survey carried out within the European Union, which contains information about households and individuals over certain time (1994-2001). ECHP has a pure panel structure, that is, the households, chosen in the first wave, are followed over time while, simultaneously allowing the entry of new members for a specific reason.

This Panel has information on 75.000 households at the level NUTS I (sometimes NUTS II) from 1994 to 2001. ECHP is designed to supply figures about: income, poverty, labour, health, education, migration, demographics, etc.

However, we must explain some of the problems this panel contains:

1. To begin with the first wave, conducted in 1994, included all current members of the EU except Austria, Finland and Sweden. Austria was added in the second wave, Finland in the third and Sweden in the fourth one.

2. The issue of “non-response” (total, partial, attrition and new entry). The panel has imputational methods to correct for these problems, but different researchers like Peracchi (2002) have questioned them.

4. Variables and methodology

4.1. Variables and Used Index

4.1.1. Equivalent disposable income

In this paper, we analyse the relationship between two variables: average income and inequality levels. In order to measure the income level, the *equivalent disposable income* is calculated. This variable is also used to calculate the inequality indices. The disposable income is obtained from the Eurostat’s ECHP. The *equivalent disposable income* is the result of applying the equivalence scale of the modified OCDE to the disposable income: 1 for the first adult, 0.5 for all remaining adults and 0.3 for children aged less than 14 years. This variable is expressed in purchasing power parities (PPP). The paper studies the Kuznets hypothesis by means of the relationship between inequality and average equivalent disposable income at the regional level. Although, the U-inverted shape of Kuznets’ curve traditionally relates income inequality and growth as measured by per capita GDP, the use of the equivalent disposable income is justified because this variable and GDP are highly correlated (R^2 roughly equal to 0.9, the result is statistically significant at 1%). The use of disposable income is preferred because it better represents household abilities and also incorporates the economies of scale of the families.

4.1.2. Estimation of inequality

There are different indices of inequality: Variance, Coefficient of Variation, Index of Theil aiming at approximating numerically the differences in income between individuals or households.

We use two indices, which permit the comparison of inequality levels in various regions: the Atkinson Index and the Gini Index¹. Precisely, we analyse the Gini, Atkinson (0.5, 1, 1.5 and 2 as aversion parameter) and Theil Indices; but, this paper only

¹ To calculate inequality measures we use the free distribution program “DAD: A Software for Distributive Analysis / Analyse Distributive” of Jean-Yves Duclos, Abdelkrim Araar and Carl Fortin. MIMAP programme, International Development Research Centre, Government of Canada, and CIRPÉE, Université Laval. <http://132.203.59.36:83/>

shows the results for the Gini and Atkinson 1 Indices because there are no relevant differences among them.

The Gini Index is defined as:

$$G = \frac{\sum_{i=1}^{n-1} [p_i - L(p_i)]}{\sum_{i=1}^{n-1} p_i} \quad 0 \leq G \leq 1$$

Where p is the cumulative percentage of population and $L(p)$ is the cumulative percentage of income.

The Atkinson Index is defined as:

$$A_\varepsilon = 1 - \left[\sum_{i=1}^n \frac{1}{n} \left(\frac{Y_i}{\mu} \right)^{1-\varepsilon} \right]^{1/(1-\varepsilon)}, \quad \varepsilon > 0, \varepsilon \neq 1, 0 \leq A_\varepsilon \leq 1$$

$$A_\varepsilon = 1 - \prod_{i=1}^n \left[\frac{Y_i}{\mu} \right]^{1/n}, \quad \varepsilon = 1, 0 \leq A_\varepsilon \leq 1$$

Here, ε is inequality aversion parameter. If this measure increases, it would give more weight to the low part distribution and less weight to the high part transfers. Generally, we take ε to be equal to 1.

4.2. Methodology: Cluster analysis

To test the Kuznets hypothesis we specify a quadratic function adjusted by the OLS regression method. After checking for alternative specifications it seems that the quadratic function produces the best results in terms of significance and robustness.

On the other hand, we use cluster analysis to classify elements into homogeneity groups based on the set of variables under consideration.

To make a cluster analysis, we have to choose a criterion to define the distances between groups and the measure of similarity or dissimilarity. In this paper we use the Squared Euclidean distance, which is a measure of dissimilarity. A standardisation of variables is performed to prevent the high disparity of values between both variables from producing dysfunction in the results, due to the fact that equivalent income data have values far higher than the inequality index.

In order to define distances between groups we have chosen “the between group linkage method”. This method extracts information on all members of the two clusters under

scrutiny, and measures the proximity between two groups calculating the mean of distances between regions of both groups and, as a result, we obtain a new matrix of distances.

Finally, cluster analyses offer us different levels of association and we have to choose which level to use. Here we take the level of association which allows us to obtain not so high number of groups and to keep an important inter-group heterogeneity, after analysing different annual dendrograms. Different scatter graphs are also taken into account to contrast the results.

For the geographic desegregation we use regions defined at the NUTS I level (large regions and länder) except for Portugal, Sweden and Finland where NUTS II proves to be more accurate.

5. Results and Analysis

5.1. Stability and change in the income-inequality relationship from 1994 to 2001

In this section, the paper examines the relationship between average equivalent disposable income and inequality and the result of the cluster analysis is studied in lieu of establishing a generic regional association.

The main results are discussed in three ways: cluster analysis, scatter graphs and regression curves. These exercises were implemented in all consecutive years. We show the results for 1994 and 2001, which are the first and last studied years, respectively. We also comment on 1997 because this is the year when ECHP introduced the regions of Austria, Sweden and Finland.

Figure 1 represents the results of three methods applied to 1994. Cluster analysis gives five groups (represented by grey ellipses). There is a circle, which integrates two clusters, because we relate some cases on the basis of group composition, but this one is not significant and it could also contribute to a simplification of the study.

Five main groups stand out: Group 1 (high inequality and low income), Group 2 (medium income and medium inequality), Group 3 (low inequality and medium income), Group 4 (high inequality and high income) and Group 5 (low inequality and high income).

In 1997, Austria, Sweden and Finland were incorporated into the sample and, therefore, the above structure has to be compared. As Figure 2 shows, five groups are identified.

The same groups are obtained with the data on the last year (2001)².

² Exceptionally, cluster analysis excludes from general classification some specific regions: Luxembourg, for 1997 Abruzzo-Molise, and for 2001 Lisboa e Val de Tejo.

The last figure represents the Atkinson Index with an aversion rate equal to 1. This figure makes two specifications: first, the results don't change irrespective of whether the Gini or the Atkinson Indices are used; and, second, the habitual situation of Luxembourg can be studied.

Moreover, the figure shows the results of the regression curves. These ones contribute to the better understanding of the characterisation of each group (high, medium and low income). In some cases, some groups were situated between medium and low income or between medium and high income. However, the regression curve is taken as a point of reference in order to establish its classification.

INSERT FIGURE 1, 2, 3 AND 4

Finally, in order to clarify the relationship between inequality and equivalent disposable income, we establish a basic model for all European regions. Our model is:

$$\mathbf{Gini}_{ti} = \mathbf{B}_0 + \mathbf{B}_1 Y_{ti} + \mathbf{B}_2 (Y_{ti})^2 + \varepsilon_{ti}$$

Where Y_{ti} is the equivalent disposable income which we analyse using PPP's and using its Neperian Logarithm (Ln), i being the regions and t, time.

The following tables show the main results when the model is OLS tested.

INSERT TABLE 2 AND 3

Both models estimate a U-shaped relationship between inequality and equivalent disposable income. These results are statistically significant at 1%. The estimated coefficients are reasonably stable particularly when Ln (Y) is used. The R-squared values are robust. Nonetheless, these figures demonstrate that we have to introduce more variables in our future models research.

Thus, the obtained results imply that, in the developed countries:

1. Inequality is high in the poorest regions.
2. Inequality goes down in the medium income regions.
3. And, finally, inequality increases in the high-income regions, especially in the biggest capitals of Europe (London, Paris and Brussels).

A relevant qualification has to be emphasized when we refer to the Kuznets' model in this context. The original Kuznets explanation took into account poor economies as well as developing and developed ones. Nevertheless, in current study, as we are dealing with European regions, we assume that poor regions are not present. Then, in terms of Kuznets curve we are dealing with the decreasing part (the part where development and inequality are inversely related), because the initial increasing part is presumed inexistent in the European Union. Thus, the U-shaped relationship which we have found implies the existence of a minimum critical point on the Kuznets curve, due to the fact that richest regions tend to show a relatively higher inequality.

5.2. Typology and characteristics of groups

Following the above structure, five groups can be defined by means of the levels of income and inequality.

INSERT TABLE 4

The cluster analysis classifies the European regions combining the Gini and the Atkinson Indices, respectively, with regional equivalent disposable income taking panel data for every year in the period 1994-2001. The same study is performed for the period 1997-2001 with the Gini index in order to compare results with including of Austria, Sweden and Finland to the sample.

Table 5 represents the composition of different groups. It is divided in five columns. The first column shows the number of groups. The second presents the regions that are common for all cluster analyses. In the rest of the columns, we show the regions present in each group for each of the three specific indices. In this way we observe the regional variations between the different analyses.

In the following paragraph, we summarize the main result for the whole period (1994-2001).

First, some minor differences between the Gini 94-01 and the Atkinson 94-01 Indices can be observed, mainly in the composition of Group 3 and Group 5. These changes are

probably due to small statistical differences in the index values, which don't seem to imply significantly different characteristics.

INSERT TABLE 5

Maps 1 and 2 in the appendix also represent the different clusters obtained from the cluster analyses, which are characterized as:

Group 1 (high inequality and low income) is formed by regions of Southern Europe (Portugal, Spain, South of Italy and Greece) or the so-called peripheral regions. This group is the most constant and homogeneous.

Group 2 (medium inequality and medium income) is formed by the regions of France, United Kingdom, Ireland, The Netherlands and by the Northeast and East of Spain, North of Italy, Community of Madrid and Attiki (the last two are the capitals of countries which are in Group 1, but they have higher levels of income).

The same applies to Île de France and South East, which are the exceptions in this group, and together with Region Bruxelles-capital, they create the fourth cluster. Group 4 is also homogeneous and contains regions with high income and high inequality.

Groups 3 and 5 represent the Central part of Europe (some regions of Belgium, Germany and Denmark). Both groups have a medium-low level of inequality, but they differ in their level of income. We can observe a first cluster formed by the regions of Belgium, the Western part of Germany, the Eastern part of France and the regions of Denmark (all characterised by a high level of income). Finally, Group 3 is characterised by a medium level of income.

In order to summarize the discussion of the results, a brief comment has to be made on the time span 1997-2001. The above mentioned cluster division suffers slight modifications when the period 1997-2001 is taken into account, that is, when the Austrian, Sweden and Finish regions were incorporated. The summarized results are the following:

1. Groups 1 and 4 don't suffer variations, except Lisboa and Val do Tejo. Therefore, this group has an elevated homogeneity.
2. Regions of Finland and Sweden, except Uusimaa and Stockholm, are located in the cluster 3. This group represents the oriental part of Europe.

3. Stockholm is located in group 2. This case shows that capital regions have a inequality level higher than the rest of the country.
4. Austria and Uusimaa (FI11) are in Group 5.

6. Conclusion

The Kuznets hypothesis plays a key role in the literature on inequality and development. In current paper, we analyse the Kuznets curve obtaining data at the disaggregate regional level. This regional level allows us to get quite robust results and, thus, we can avoid the ambiguity of the results obtained at country level caused by differences like institutional set-up or political instability.

Firstly of all, empirical data suggests a U-shaped relationship between the inequality index and average equivalent disposable income. In fact, the less developed European regions are also the most unequal; the medium and high income ones have medium and low inequality; but, in the highest income regions, the level of inequality is significantly higher than the intermediate groups. This effect can be observed in table 6 of the group classification.

Moreover, the statistical relationship between inequality and equivalent disposable income is relatively strong (R^2 approximately equals to 0,4).

In reference to the Kuznets debate it is assumed that all European regions are mainly developed and we would expect to find all of them along the decreasing part of the U-inverted curve. Assuming this, the empirical data suggest that the Kuznets curve represents the decreasing pattern of low and medium income regions quite well. Nevertheless, the opposite is true for the highest income regions, where inequality is also high. This last result suggests that inequality is higher in the richest regions than in the middle income regions. Putting these results together, we observe the emergence of a U-shaped curve.

INSERT TABLE 6

Secondly, we have found a geographic relationship among regions, which permits to classify European regions into five clusters with specific patterns of inequality and income:

- Group 1 (high inequality and low income): South of Italy and the regions of Portugal, Spain and Greece.
- Group 2 (medium income and inequality): North of Italy, Northeast of Spain and the regions of United Kingdom, Ireland, France and the Netherlands constitute the third group.
- Group 3 (medium income and low inequality): East of Germany and regions of Denmark, Finland and Sweden.
- Group 4 (high inequality and high income). We found a metropolitan group formed mainly by the biggest European metropolitan regions: South East (London), Region Bruxelles-capital and Île de France. In reference to state capitals in general, it is interesting to underline that, generally speaking, all regions, encompassing the capitals of the respective states, belong to a cluster different (with higher inequality and income) from that of their nearby geographic zone or country.
- Group 5 (low inequality and high income): West of Germany and the regions of Belgium and Austria.

Finally, results suggest that differences in income inequality can be due to differences in regional economic and social structures. We have left the analysis of the specific factors explaining the above results for future research. Thus, the causes for the U-shaped relationship between inequality and income need to be analysed for a better understanding of the model. In any case, the results suggest that the first step of the explanation should be the better understanding of what happens in metropolitan and rich regions in order to explain their high inequality levels. Among the expected explanatory factors, we might consider at least the following issues: the concentration of the “wealthiest” people in metropolitan regions, the high migration rates or the less per capita transfers and social public expenditures. Moreover, we can also expect the influence of more general factors like the specific impact of the huge tertiarisation of the economy of these regions or the possible polarisation effect of the transition to a knowledge-based economy, among others.

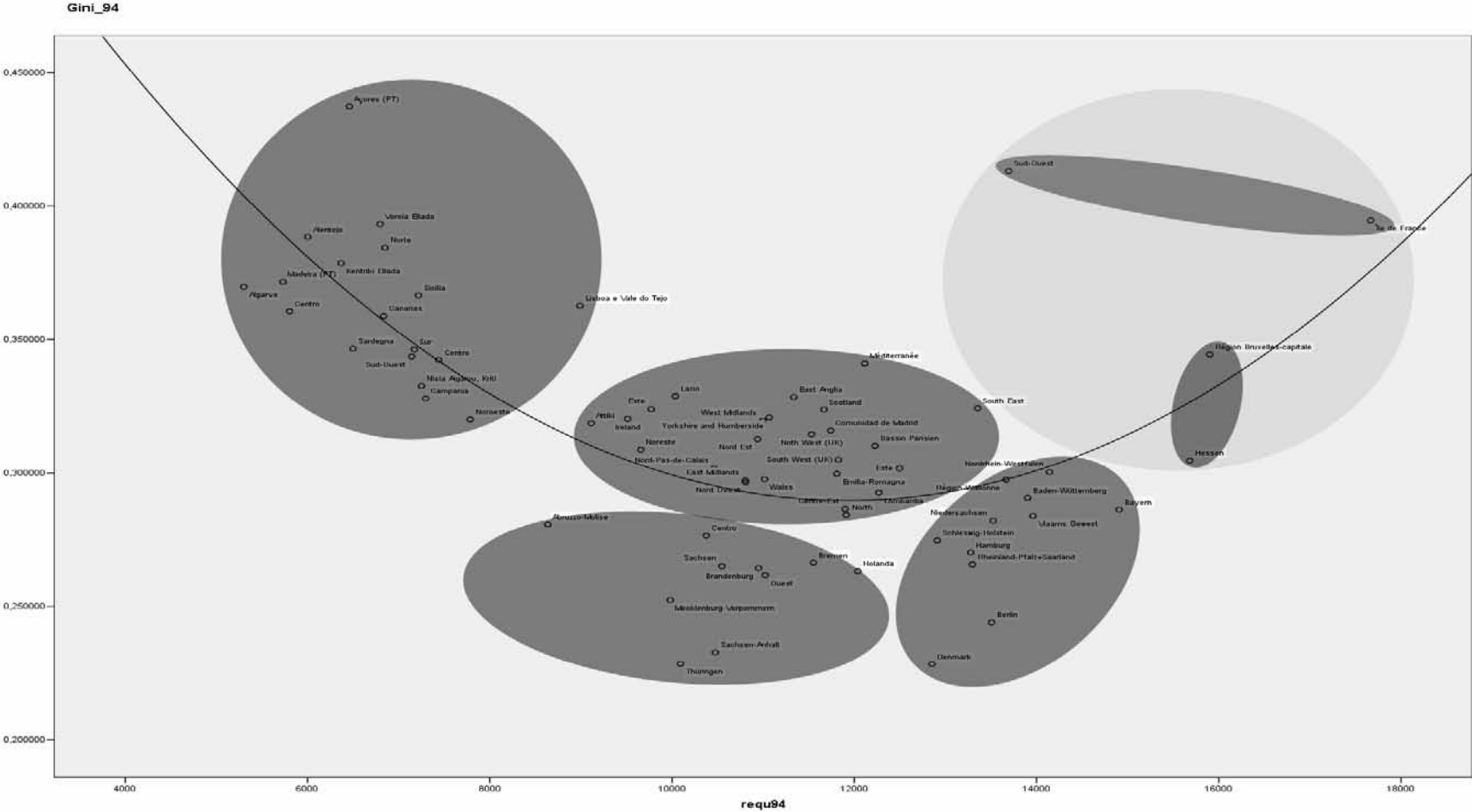
References

Aghion, P.; Williamson, J. G. (1998): Growth, Inequality and Globalization. *Theory, History and Policy*. Cambridge University Press

- Ahluwalia, M. et al. (1979): Growth and poverty in developing countries. *Journal of Development Economics*. N° 6, pp. 299-341
- Alesina; Rodrik (1994): Distributive politics and economics growth. *Quarterly Journal of Economics*, 109, num. 2, pp. 465-490
- Anand, S; Kanbur, S.M.R. (1993): Inequality and development. A critique. *Journal of Development Economics*. Vol. 41, pp. 19-43. North-Holland
- Anand, S; Kanbur, S.M.R. (1993): The Kuznets process and the inequality-development relationship. *Journal of Development Economics*. Vol. 40, pp. 25-52
- Barro, R. (2000): Inequality and Growth in a Panel of Countries. *Journal of Economic Growth*, n°5, pp 5-32.
- Bourguignon, F.; Morrison, C. (1998): Inequality and development: the role of dualism, *Journal of Development Economics*, vol. 57, pp. 233-257.
- Deininger, K.; Squire, L. (1998): New ways of looking at old issues: inequality and growth, *Journal of Development Economics*, vol. 57, pp. 259-287.
- Ezcurra, R. (2007): Is income inequality harmful for regional growth? Evidence from the European union. *Urban Studies* 44, 1953-1971
- Galbraith, J.K; Berner, M. (2004): *Desigualdad y cambio industrial. Una perspectiva global*. Akal.
- Galbraith, J.K.; Kum, H. (2002): Inequality and Economic Growth: Data Comparations and Econometric Test. *Working paper UTIP*, n° 22
- Galor, O. (2000): Income distribution and the process of development. *European Economic Review*, n° 44, pp. 706-712.
- Hampton, P; Rayner, A.C. (1977[1976]): The use of multivariate methods in economics with reference to regional analysis. *Regional Science & Urban Economics*. Vol. 7, n° 3, pp. 267-287.
- INE (1996): Panel de hogares de la Unión Europea (POGHE). Metodología. INE.
- Knowles, S. (2005): Inequality and Economics Growth: The Empirical Relationship Reconsidered. *Journal of Development Studies*. Vol 41, n° 1, pp. 135-159.
- Kuznets, S (1970): *Crecimiento económico y estructura económica*. Colección Ciencia Económica. Editorial Gustavo Gili, S.A, Barcelona.
- List, J.A.; Gallet, C.A. (1999): The Kuznets curve: what happens after the U-inverted?. *Review of Development Economics*, 3(2), 200-206

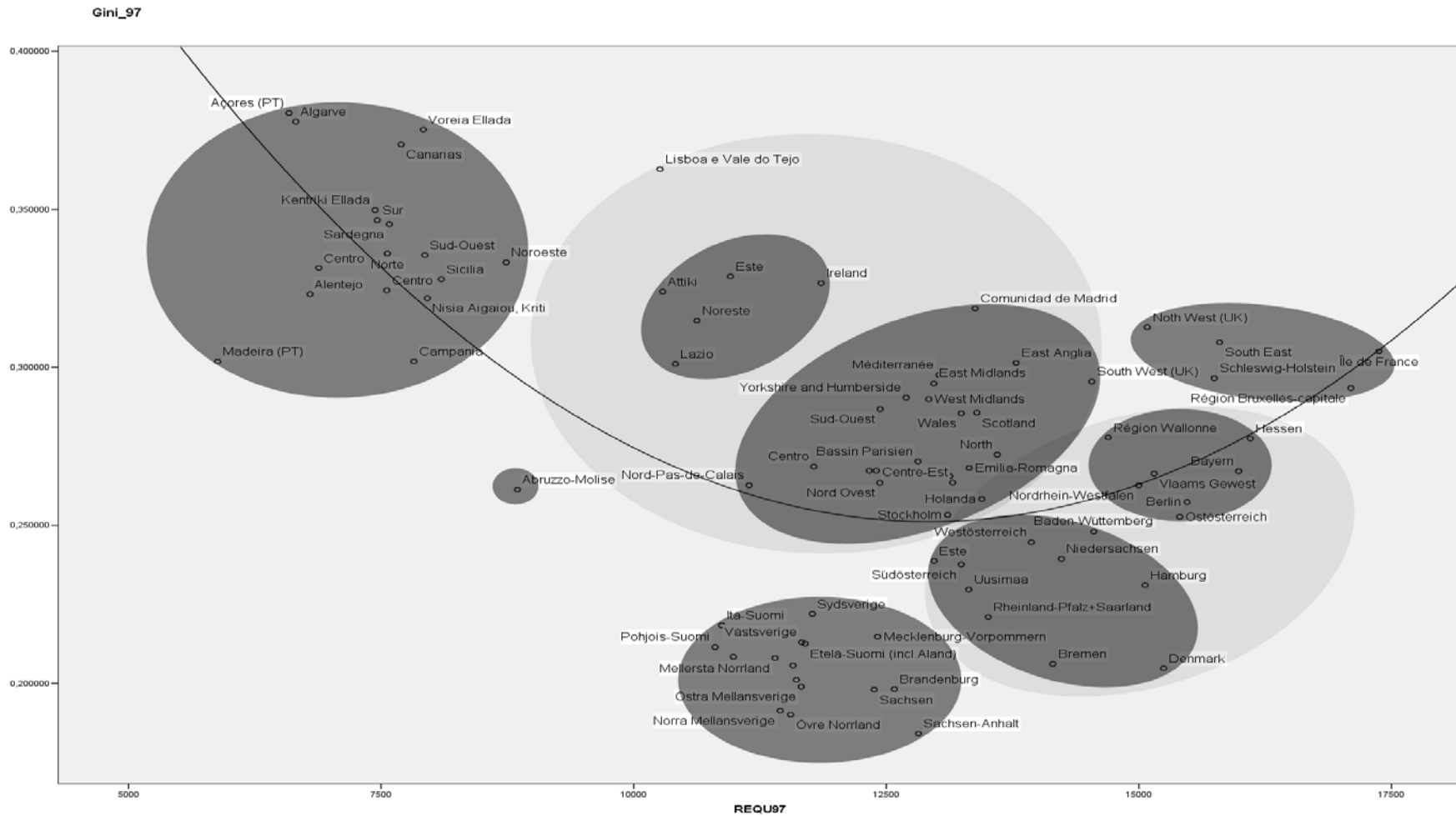
- Lin, S.C.; Huang, H.C.R.; Weng, H.W. (2006): A semiparametric partially linear investigation of the Kuznets` hypothesis. *Journal of Comparative Economics* 34, 634-647.
- Panizza, U. (2002) Income inequality and economic growth: Evidence from American data. *Journal of Economic Growth* 7, 25-41.
- Pardo, A; Ruíz, M.A. (2002): SPSS 11. Guía para el análisis de datos. Mc Graw Hill.
- Partridge, M.D. (1997) Is Inequality Harmful for Growth? Comment. *American Economic Review* 87, 1019-1032.
- Partridge, M.D. (2005) Does income distribution affect U.S. state economic growth. *Journal of Regional Science* 45, 363-394.
- Peña, D. (2002): *Análisis de datos multivariantes*. Mc Graw Hill.
- Peracchi, F. (2002): The European Community Household Panel: A review, *Empirical Economics*. Nº 27, pp. 63-90.
- Pérez, C. (2001): *Técnicas Estadísticas con SPSS*. Prentice Hall
- Perugini, C. and G. Martino (2008): Income inequality within European regions: Determinants and effects on growth. *Review of Income and Wealth* 54, 373-406.
- Ram, R. (1991): Kuznets´ inverted-U hypothesis: Evidence from a highly developed countries. *Southern Economic Journal* 57 (4), 1112-1123.
- Ray, D. (2002): *Economía del desarrollo*. Antoni Bosch Editor.
- Tribble, J.R. (1996): The Kuznets-Lewis Process within the Context of Race and Class in the U.S. Economy. *International Advances in Economic Research* 2(2), 151-164.
- Troitiño, A. (2005): Inequality of disposable income within and between the UE (15) countries. Levels, sensitivity and recent evolution using the ECHP (1994-01). Paper presented at ECINEQ. Palma de Mallorca.
- Vence, X (2005): Personal income inequality and income per capita in the European countries and regions: From the U-inverted to the U-shaped?. Paper presented at 1st Meeting of ECINEQ. Palma de Mallorca.
- Zweimüller, J. (2000): Inequality, Redistribution and Economic Growth. Working paper, nº 31. Institute of Empirical Research in Economics. University of Zurich.

Figure 1: Squared Model (Rsq.0.501³), Composition of groups. Year 1994



³ All regressions are statistically significant at 1%.

Figure 2: Squared Model (Rsq. 0.428), Composition of groups. Year 1997



*In the last three figures, not all regions are represented in view of clarifying the vision of the names of some representative regions.

Figure 4: Squared Model (Rsq. 0.224), Composition of groups. Year 2001

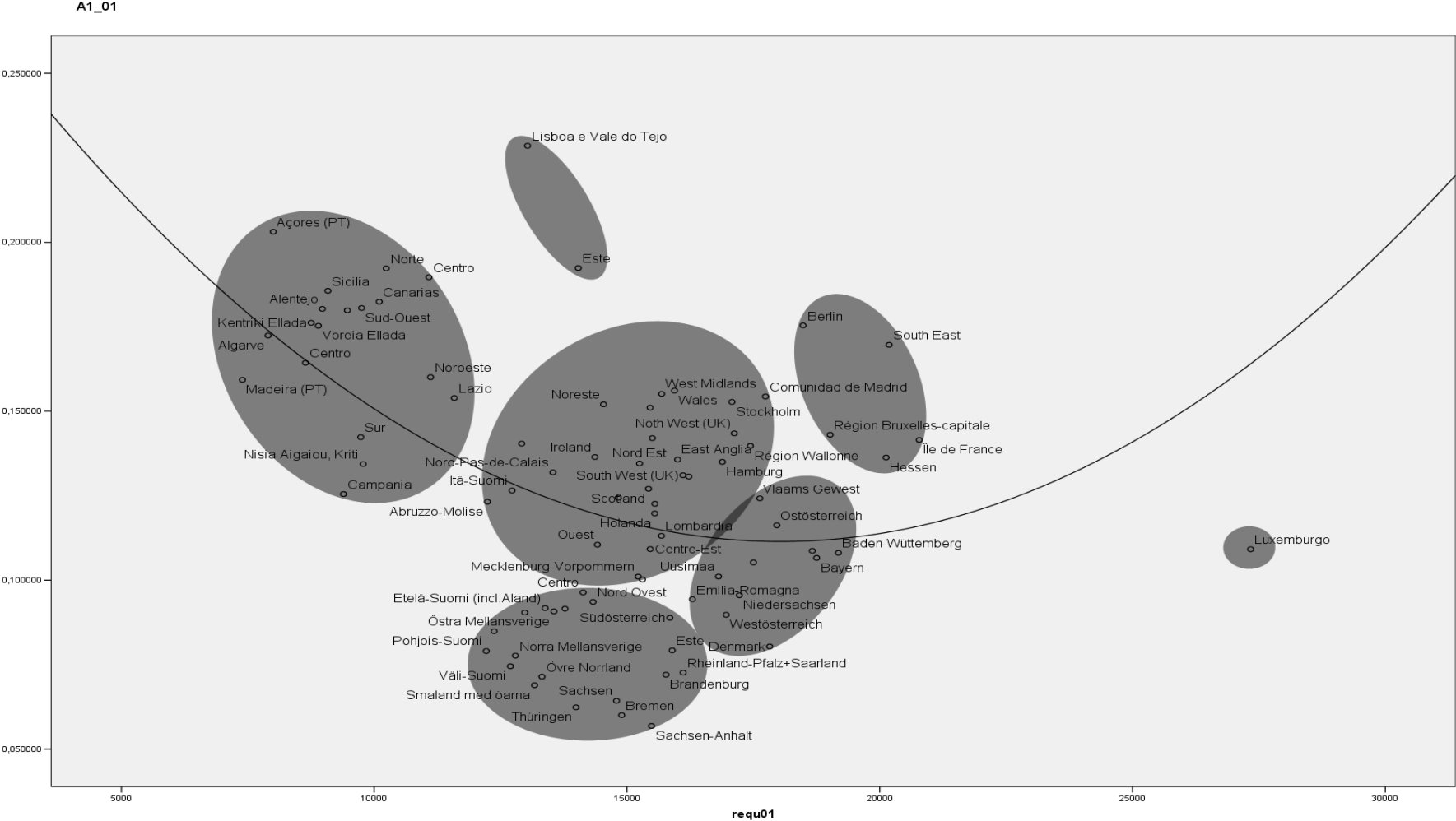


Table 1: Inconclusive empirical results from literature

| AUTHOR | YEAR | RESULT |
|--------------------------|-------------|------------------|
| Kuznets | 1955 | U-inverted curve |
| Ahluwalia et al | 1979 | U-inverted curve |
| Ram | 1991 | Curve U |
| Anand e Kanbur | 1993 | Curve U |
| Tribble | 1996 | Curve S |
| Bourguignon and Morrison | 1998 | U-inverted curve |
| Deininge e Squire | 1998 | Inconclusive |
| List e Gallet | 1999 | Curve S |
| Barro | 2000 | U-inverted curve |
| Galor e Moav | 2003 | U-inverted curve |
| Galbraith e Kum | 2002 | Curve S |
| Lin et al | 2006 | U-inverted curve |

Table 2: Coefficients of the model. Y in PPP's and Gini Index

| YEAR | B₀ | B₁ | B₂ | R² |
|-------------|----------------------|--------------------------|--------------------------|----------------------|
| 1994 | 0.657 ^{***} | -6.2E-005 ^{***} | 2.58E-009 ^{***} | 0.501 |
| 1997 | 0.540 ^{***} | -3.8E-005 ^{***} | 1.24E-009 ^{***} | 0.341 |
| 2001 | 0.484 ^{***} | -2.7E-005 ^{***} | 7.68E-010 ^{***} | 0.213 |

Table 3: Coefficients of the model. Ln (Y) and Gini Index

| YEAR | B₀ | B₁ | B₂ | R² |
|-------------|-----------------------|-----------------------|----------------------|----------------------|
| 1994 | 19.447 ^{***} | -4.101 ^{***} | 0.220 ^{***} | 0.452 |
| 1997 | 16.910 ^{***} | -3.490 ^{***} | 0.183 ^{***} | 0.341 |
| 2001 | 17.857 ^{***} | -3.650 ^{***} | 0.189 ^{***} | 0.259 |

Table 4: Characteristics of groups

| | | <u>Income</u> | | |
|-------------------|---------------|----------------------|---------------|-------------|
| | | Low | Medium | High |
| Inequality | High | Group 1 | | Group 4 |
| | Medium | | Group 2 | |
| | Low | | Group 3 | Group 5 |

Table 5: Composition of groups. Variations between inequality indices.

| | Base (common) regions | Gini 94-01 | Atkinson 94-01 | Gini 97-01^a |
|----------------|--|-------------------------|-------------------------|--|
| Group 1 | PT2, PT3, PT11, PT12, PT14, PT15, ITA, ITB, IT8, IT9, ES1, ES4, ES6, ES7, GR1, GR2, GR4 | | PT13 | PT13 |
| Group 2 | GR3, IE, ES2, ES3, ES5, IT1, IT2, IT3, IT4, IT5, IT6, NL, FR2, FR3, FR5, FR7, FR8, UK1, UK2, UK3, UK4, UK6, UK7, UK8, UK9, UKA | | DE8 | FR6, SE01 |
| Group 3 | DE4, DED, DEE, DEG | IT7, DE8 | DK0, DE5, DE6, DEX, FR4 | DE5,IT7,FI12, FI13, FI14,FI15,SE02, SE03,SE04SE05, SE06,SE07SE08 |
| Group 4 | BE1, FR1, UK5 | | | |
| Group 5 | BE2, BE3, DE1, DE2, DE3, DE7, DE9, DEA, DEF | DK0, FR4, DE5, DE6, DEX | | DK0, FR4, DE6, DE8, DEX, AT1, AT2, AT3, FI11 |

^a We have excluded 1999 because it produced statistical problems.

Table 6: Classification of clusters. U-shaped relationship between income and inequality

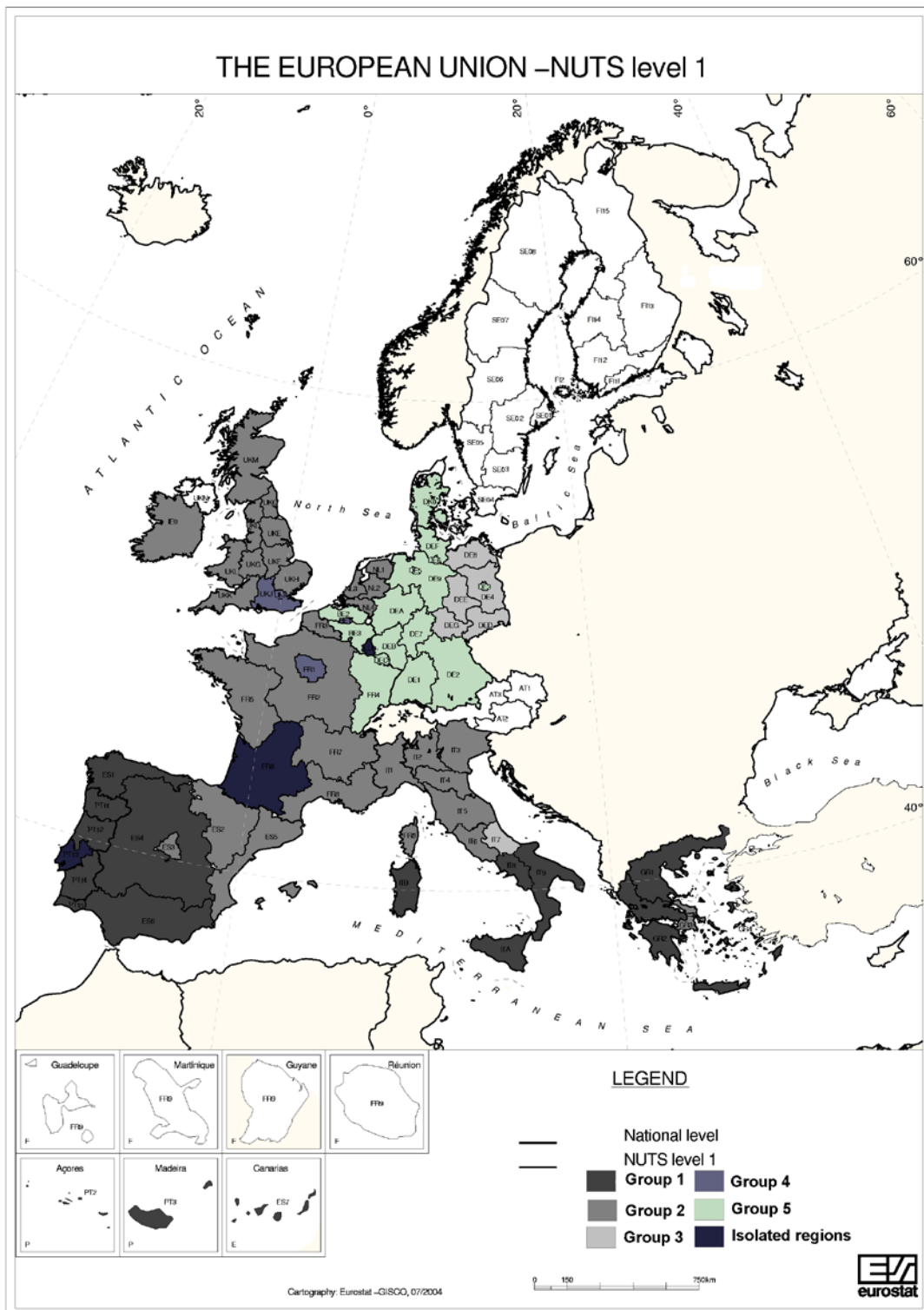
| | | <u>Income</u> | | |
|-------------------|---------------|----------------------|---------------|-------------|
| | | Low | Medium | High |
| Inequality | High | Group 1 | | Group 4 |
| | Medium | | Group 2 | |
| | Low | | Group 3 | Group 5 |

APPENDIX

Table 6: Codes of regions

| CÓDE | REGIÓN | CÓDE | REGIÓN |
|------|---------------------------|------|--------------------------|
| AT1 | Ostösterreich | GR1 | Voreia Ellada |
| AT2 | Südösterreich | GR2 | Kentriki Ellada |
| AT3 | Westösterreich | GR3 | Attiki |
| BE1 | Région Bruxelles-capitale | GR4 | Nisia Aigaiou, Kriti |
| BE2 | Vlaams Gewest | IE | Ireland |
| BE3 | Région Wallonne | IT1 | Nord Ovest |
| DE1 | Baden-Württemberg | IT2 | Lombardia |
| DE2 | Bayern | IT3 | Nord Est |
| DE3 | Berlin | IT4 | Emilia-Romagna |
| DE4 | Brandenburg | IT5 | Centro |
| DE5 | Bremen | IT6 | Lazio |
| DE6 | Hamburg | IT7 | Abruzzo-Molise |
| DE7 | Hessen | IT8 | Campania |
| DE8 | Mecklenburg-Vorpommern | IT9 | Sud-Ouest |
| DE9 | Niedersachsen | ITA | Sicilia |
| DEA | Nordrhein-Westfalen | ITB | Sardegna |
| DED | Sachsen | LU | Luxemburgo |
| DEE | Sachsen-Anhalt | NL | Holanda |
| DEF | Schleswig-Holstein | PT11 | Norte |
| DEG | Thüringen | PT12 | Centro |
| DEX | Rheinland-Pfalz+Saarland | PT13 | Lisboa e Vale do Tejo |
| DK0 | Denmark | PT14 | Alentejo |
| ES1 | Noroeste | PT15 | Algarve |
| ES2 | Noreste | PT2 | Açores (PT) |
| ES3 | Comunidad de Madrid | PT3 | Madeira (PT) |
| ES4 | Centro | SE01 | Stockholm |
| ES5 | Este | SE02 | Östra Mellansverige |
| ES6 | Sur | SE04 | Sydsverige |
| ES7 | Canarias | SE06 | Norra Mellansverige |
| FI11 | Uusimaa | SE07 | Mellersta Norrland |
| FI12 | Etelä-Suomi (incl.Aland) | SE08 | Övre Norrland |
| FI13 | Itä-Suomi | SE09 | Smaland med öarna |
| FI14 | Väli-Suomi | SE0A | Västsverige |
| FI15 | Pohjois-Suomi | UK1 | North |
| FR1 | Île de France | UK2 | Yorkshire and Humberside |
| FR2 | Bassin Parisien | UK3 | East Midlands |
| FR3 | Nord-Pas-de-Calais | UK4 | East Anglia |
| FR4 | Este | UK5 | South East |
| FR5 | Ouest | UK6 | South West (UK) |
| FR6 | Sud-Ouest | UK7 | West Midlands |
| FR7 | Centre-Est | UK8 | Noth West (UK) |
| FR8 | Méditerranée | UK9 | Wales |
| | | UKA | Scotland |

Map 1: Composition of groups. 1994-2001



Map 2: Composition of groups. 1997-2001

