Growth and Convergence Across European Regions: an Empirical Investigation

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Abstract

In this paper we study economic growth and convergence in European Regions along different dimensions. We analyse the dynamics of per capita income, productivity, structural change, investment, consumption and unemployment, trying to assess the effects of the European Structural Funds. We find that Structural Funds appear to have a positive effect on convergence in income for a relevant fraction of regions, whose income was sufficiently close to European average. However, they did not help a non negligible set of the most backward regions, trapped in a state of low income. A similar type of dynamics is displayed by productivity, unemployment and, partially, by structural change. We also find the emergence of a small cluster of high-investment regions, although this appears disconnected from productivity. Finally, consumption appears to converge faster than income but, also in this case, there appears a relevant fraction of regions with persistently low relative consumption levels.

1 Introduction

Convergence across European regions has received attention as, at political level, there is concern that the process of European integration is effective in generating convergence in living standards for European citizens, given the heterogeneity of the areas affected by the process.

In this paper we provide an extended empirical analysis of growth and convergence across European Regions, along different dimensions. In particular, we assess whether recent trends show that the regions belonging to the European Union are becoming more homogeneous in terms of a broad set of economic variables, including income, productivity, and unemployment. In addition, we try to evaluate the effectiveness of the European Structural Funds, devoted by the European Union to the aid of backward regions.

We adopt the distribution dynamics approach (see Quah (1997)), and study the dynamics of growth and convergence for per capita gross value added (*GVA*), productivity (*PR*), economic structure proxied by agriculture share (*AS*), investment rates (*IS*), per capita consumption (*HE*) and unemployment rate (*RU*). That is, in the spirit of Feyrer (2003), we evaluate whether convergence or divergence in one variable is associated to convergence or divergence in related variables.[1]

We analyze a large sample of NUTS2 regions for the period $1977-1998$. To evaluate the effects of structural funds we subdivide the period in two subperiods: $1977-1985$ and $1986-1998$ as after 1986 the funds increased in amount and underwent a substantial reorganization.

We find that: i) in $1986-1998$ there is a higher tendency for convergence in per capita value added and productivity than in $1977-1985$, but a cluster of poor regions seems to be excluded from the process. In addition, the speed of convergence of the process is much lower in the second period. ii) There is convergence in the structure of economic activity, as the share of agricultural income tends to shrink below 10% in almost all regions but, again, there is evidence of some regions not converging; iii) there appears a relatively strong convergence in investment rates, although a small cluster of very high investment regions emerges; iv) the distribution of per capita consumption levels shows high dispersion in both periods; v) unemployment rates show in both periods relatively high persistence at high and low levels, although persistence is generally lower in the second period. The long-run tendency in the second period shows lack of full convergence in unemployment rates, as a cluster of regions seems to remain characterized by relatively high unemployment levels.

Therefore we have mixed results on the effectiveness of structural funds. Although they favoured convergence for a relatively high fraction of regions, they did not pre-

[1] However, our variables are not directly connected through a production function, as in Feyrer (2003).

vent a cluster of very poor regions to lag behind. The effects on unemployment appear more relevant, as persistence at high unemployment levels decreased, but still a set of regions appear to be trapped at above-average unemployment levels.

The rest of the paper is organized as follows: Section 2 describes the theoretical and empirical background; Section 3 describes the methodology for the empirical analysis; Section 4 analyzes the dynamics of per capita value added, productivity and structural change, while Section 5 focuses on investment rates and per capita consumption; Section 6 considers unemployment. Finally, Section 7 contains a discussion of the results while Section 8 concludes.

2 Background

Different results on convergence between European regions exist in the literature: according to Quah (1996), regional income distribution shows a tendency towards convergence; on the contrary, Magrini (1999) finds evidence of divergence. However, such different results are often based on different databases and different time periods, so that comparisons are not always easy.[2] In addition, papers such as Overman and Puga (2002) extend the analysis of convergence to unemployment rates, finding that the distribution of European regional unemployment rates tends to polarize in the period $1986-1996$.[3]

The huge amount of funds devoted by the European Union to the backward regions, where backwardness is in particular measured in terms of per capita income,[4] has drawn the attention of researchers, interested in assessing the effectiveness of such public spending. For instance, in an analysis of the period $1980-1996$, Boldrin and Canova (2001) draw very skeptical conclusions, arguing that the funds have been largely ineffective.

However, the funding has not always maintained the same characteristics: starting from the mid-eighties the amount of funds increased and the funding procedure itself was reformed in order to become more effective.[5] In addition, some remarkable

[2]For instance, Quah (1996)'s database comprises 78 regions, basically corresponding to Eurostat NUTS2 classification, for the period $1980-1989$ and for the following countries: Belgium, Germany, Spain, Italy, Netherlands, United Kingdom. Magrini (1999)'s database instead comprises 122 EU "functional urban regions" for the period $1979-1990$. The countries considered are: Portugal, Spain, Greece, Italy, Ireland, Germany, United Kingdom, France, Netherlands, Belgium.

[3]Their conclusions are however based only on the analysis of transition matrices and their continuous equivalent, stochastic kernel and not, as in this paper, also by the long-run distributions.

[4]For a succinct but exhaustive description of the different types of European funds, see Boldrin and Canova (2001), pp. 217-225.

[5]Structural funds have been reformed in 1988 and "it was agreed before the 1988 reform to double the Structural Funds ... concentrating aid on the poorest, most structurally underdeveloped (Objective 1) regions" (Michie and Fitzgerald (1997), p. 22). Objective 1 regions are those with a per capita GDP

institutional changes occurred: in 1985 Jacques Delors was appointed President of the European Commission, and one of his main concerns was since the beginning the cohesion across the different European areas. In 1986 the Single European Act was signed, giving strong impulse to the process of European economic integration. Finally, Spain and Portugal, which include relatively poor regions, joined the European Union in 1986, increasing the relevance of the issue of regional convergence. For these reasons, to evaluate the effects of Structural Funds, we divide our period of observation in two parts, $1977-1985$ and $1986-1997$, meaning that after 1986 the role of structural funds should be considered more relevant.[6]

3 Methodology for the Empirical Analysis

In this section we discuss the strategy of our empirical analysis. For our six variables, we compare the short-run and long-run dynamics in two periods: $1977-1985$ and $1986-1998$. Data for *GVA, PR, AS, IS* and *HE* come from the Cambridge Econometrics 2002 database, and include 199 NUTS2 European Regions belonging to the European Union, while data on *RE* come from Cambridge Econometrics 2004 database and include 195 NUTS2 European Regions belonging to the European Union.[7] If not differently indicated, data are expressed as ratios to the sample average.

In all cases we follow these steps: 1) we run a nonparametric regression of the relation between the growth rate (first difference for unemployment rates) and the level of the variable in both periods, and compare the estimated paths. By this step, we provide a first piece of evidence on convergence (negative relation between growth rate and level), divergence (positive relation), and on possible nonlinearities. 2) We define intervals of the variable's level, and study the distribution dynamics, that is the evolution of the distribution of regions in the intervals. In particular we estimate a transition matrix, and compare the initial, final and ergodic distribution associated with the estimated transition matrix. 3) As the definition a discrete state space may affect the probabilistic nature of data, in particular for what concerns the estimation of long-run tendencies,[8] we evaluate the distribution dynamics with a continuous state space, in particular by comparing the initial, final and ergodic density of the regions.[9]

Steps 2) and 3), that is the study of the distribution dynamics, are fundamental to

lower than 75% of EU average.

[6] Egger and Pfaffermayr (2004) take a similar approach, while Boldrin and Canova (2001), p. 225, note that: "[after] the mid 1980s, ..., the European Structural Funds started really to operate."

[7]See Appendix A for the list of regions.

[8]See, e.g. Durlauf et al. (2004), pp. 57 - 58.

[9]To estimate the ergodic distribution we followed Johnson (2005) (the author kindly provided us the instructions). To estimate the stochastic kernel, we used optimal normal badwith with Gaussian kernel. CHECK

gauge various aspects of the cross-region dynamics, such as intradistribution dynamics or persistence, which would not be detected by standard cross-section analyses of the relation between growth rates and income levels (typically initial), both parametric (as is the standard practice in much work on convergence) and nonparametric (see Quah (1997) and Fiaschi and Lavezzi (2003) for further discussion).

4 Growth, Productivity and Structural Change

In this section we analyze indicators related to production: per capita Gross Value Added, productivity and structural change.

4.1 Per Capita GVA

We report in Figure 1 a nonparametric estimation of the relationship between the growth rate and the level of *GVA*, for the whole period, and for the two periods $1977-1985$ and $1986-1998$.[10] Figure 2 compares the estimates in $1977-1985$ and $1986-1998$.[11] In the figures we indicate the boundaries of the GVA classes in Table 1 used for the estimation of the transition matrices.[12]

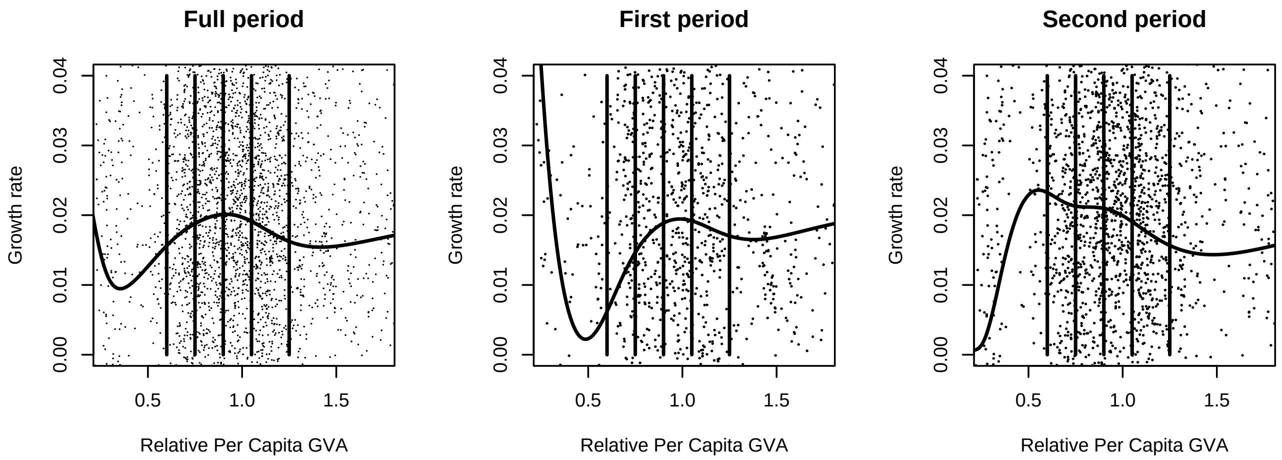

Figure 1: Nonparametric estimation of growth rate vs level of *GVA* in $1977-1998$, $1977-1985$ and $1986-1998$. Vertical lines refer to the *GVA* classes in Table 1

[10]For all the nonparametric regression we used R, in particular the statistical package mgcv (see Wood (2004)). Data sets and codes used in the empirical analysis are available on the authors' websites (http://www-dse.ec.unipi.it/fiaschi and http://www-dse.ec.unipi.it/lavezzi).

[11]95% confidence bands are calculated by an appropriate resampling method (*wild bootstrap*), suggested by Härdle et al. (2004), p. 127.

[12]These classes are defined in order to consider the criteria for the eligibility to European Funds and to have a relatively equiproportionate distribution of observations in each class.

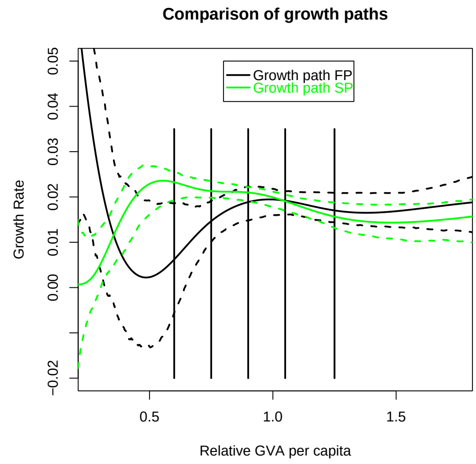

Figure 2: Nonparametric estimation in $1977-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to the *GVA* classes in Table 1

I	II	III	IV	V	VI
$(0-0.60)$	$(0.60-0.75)$	$(0.75-0.90)$	$(0.90-1.05)$	$(1.05-1.25)$	(>1.25)

Table 1: *GVA* classes

We can observe that the paths display nonlinearities, although in Figure 2 we may notice from the large confidence bands that the estimates are not very precise for high and low *GVA* levels. What is more relevant is that, at low *GVA* levels, the shape of the path in the second period changes, and the growth path of regions in the *GVA* classes I, II and III lies above the growth path of the first period, and this difference is statistically significant in *GVA* part of GVA class I and in *GVA* class II. Since the growth path in increasing *GVA* class I in the second period implies that poorer regions in that range grew slower than richer ones. We will see that this had important consequences for the regional income distribution.

Regions in *GVA* classes I, II and III are very likely to include recipients of *Objective 1* Structural Funds (and of *Cohesion Funds*) because, as noted, regions with per capita GDP less than 75% of EU average fall under the *Objective 1 Funding Program*.[13] From Figure 2 it appears that these regions had, with some remarks, a higher growth in the second period.

To gain further insights on the dynamics, we estimate a transition matrix in both periods, highlighting the transitions across GVA classes.[14]

[13] *Cohesion Funds* were established in 1993 to finance particular projects, for example infrastructures. Regions belonging to states with per capita GDP below 90% of EU average are eligible to Cohesion Funds (see Boldrin and Canova (2001), p. 224). Given the small differences between the definitions of GVA and GDP, we assume that these terms are interchangeable.

[14] With our state space definition, the distributions of observations respectively in the first and in the

GVA	I	II	III	IV	V	VI
I	0.81	0.11	0.06	0.01	0	0
II	0.06	0.82	0.10	0.02	0	0
III	0	0.19	0.67	0.14	0	0
IV	0.01	0	0.14	0.75	0.09	0
V	0	0	0	0.12	0.84	0.03
VI	0	0	0	0	0.10	0.90

Table 2: Transition matrix 1977-1985: *GVA*

GVA	I	II	III	IV	V	VI
I	0.94	0.06	0	0	0	0
II	0.03	0.84	0.12	0	0	0
III	0	0.06	0.83	0.11	0	0
IV	0	0	0.08	0.79	0.13	0
V	0	0	0	0.09	0.84	0.07
VI	0	0	0	0	0.13	0.87

Table 3: Transition matrix 1986-1998: *GVA*

These transition matrices determine the distribution dynamics in Tables 4 and 5.

GVA	I	II	III	IV	V	VI
1977	0.16	0.10	0.22	0.18	0.17	0.18
1985	0.14	0.15	0.19	0.18	0.18	0.16
Ergodic	0.10	0.27	0.19	0.21	0.16	0.05

Table 4: Distribution dynamics 1977-1985: *GVA*

GVA	I	II	III	IV	V	VI
1985	0.14	0.15	0.19	0.18	0.18	0.16
1998	0.13	0.13	0.19	0.20	0.23	0.14
Ergodic	0.05	0.09	0.17	0.21	0.32	0.17

Table 5: Distribution dynamics 1986-1998: *GVA*

From the transition matrices, it appears that persistence in *GVA* class III is much higher (0.83 vs 0.67), that the probability to fall in *GVA* class II from *GVA* class III is much lower (0.06 vs 0.19), and that the probability to fall into *GVA* class I from *GVA* class II is lower (0.03 vs 0.06). However there appears also a strong increase in persistence in *GVA* class I (0.94 vs 0.81), indicating that at the very bottom of the distribution regions take a relatively long period of time to escape their state of backwardness.

These tendencies are reflected in the ergodic distributions. In the first period most of the mass concentrates in *GVA* classes II, III and IV, while in the second in III, IV and, especially, V.[15] This may be supportive of the idea that structural funds distributed to accomplish *Objective 1* have been indeed effective with one important caveat. That is, this is a long-run result: the interpretation is that the ergodic distribution is reached if the process characterizing the $1986-1998$ period remains stationary. In fact, in 1998 there appears little variation in the distribution of regions in the *GVA* classes, meaning that the the dynamics in 1998 is still far from its steady state. Given the improved perspectives for regions at the low end (but not at the lowest), there also ap-

second period are: $(0.16, 0.12, 0.19, 0.17, 0.18, 0.18)$ and $(0.14, 0.13, 0.19, 0.19, 0.21, 0.15)$. We considered 3-year transitions in order to circumvent the possible presence of autocorrelation of growth rates due to measurement errors.

[15]The ergodic distribution in $1977-1985$ has a peak in *GVA* class II, while the ergodic distribution in $1986-1998$ has a peak in *GVA* class V. These peaks are statistically significant, respectively, at 10% and 5% confidence level. Details on these tests are available upon request from the authors.

pears an improvement in the perspectives for regions with above-average per capita GVA. In the second period the mass in *GVA* classes V and VI increases respectively from from 16% to 32%, and from 5% to 17% in the long-run distribution.

Note that the reduction in the mass in *GVA* class I in the second period has to be ascribed to the reduction of the probability to fall into *GVA* class I from *GVA* class II, which counterbalanced the strong increase in persistence in *GVA* class I. The analysis of continuous state space shows indeed that this result may depend on discretization, as the mass in the ergodic distribution at low *GVA* level tends to increase.

The speed of convergence of the process can be directly measured by the *asymptotic half life*, that is the time the process takes from period t to reach half of the distance from its equilibrium level, that is the ergodic distribution.[16] In the present case, the asymptotic half life is 11 periods (33 years) and 21 periods (63 years), respectively in $1977 - 1985$ and $1986 - 1998$, indicating that the process became much slower.

We also report the results when the *GVA* state space is continuous: Figure 3 corresponds to Tables 4 and 5, while Figure 4 directly compare the densities referring to the ergodic distributions.

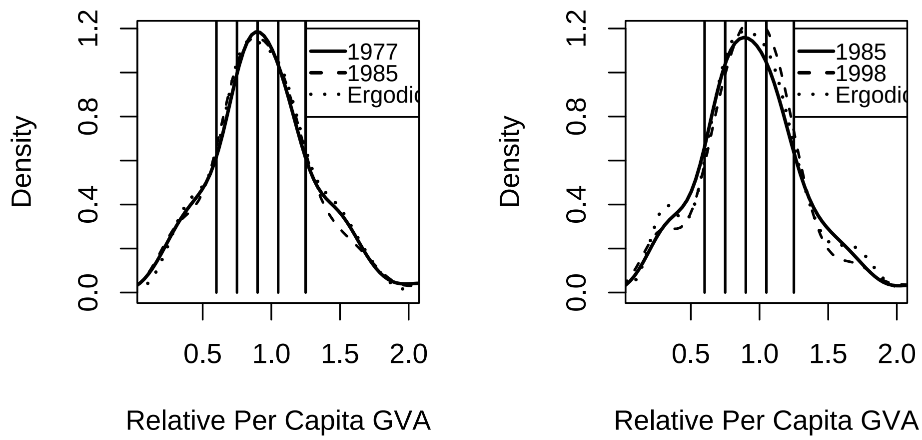

Figure 3: Distribution dynamics in $1977 - 1985$ and $1985 - 1998$ with continuous state space: *GVA*

[16]The asymptotic half life is defined as $h = -log2/log\,|\lambda_2|$, where λ_2 is the second largest eigenvalue of the transition matrix. See Shorrocks (1978), pp. 1021-1022.

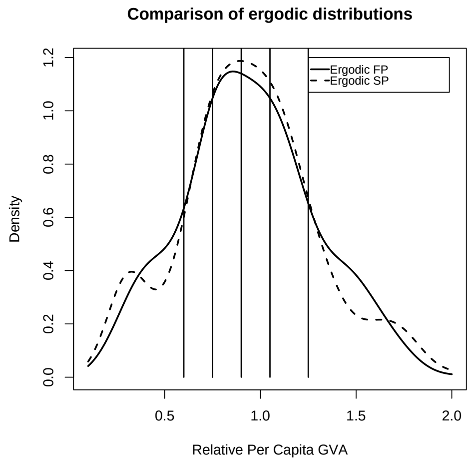

Figure 4: Ergodic distributions in $1977-1985$ (FP) and $1986-1998$ (SP): *GVA*

From Figure 3 we observe that, in the first period the distribution is flatter, while in the second period, there is a thinning out of the distribution in the tails, more visible in the right tail. However, this is accompanied by the appearance of a bump in the left tail, that is at very low *GVA* levels. From Figure 4 we have a clear indication that the long-run dynamics in the second period features a stronger tendency for convergence, represented by an increase in the density for near-average *GVA* level, with a relatively higher density for above-average *GVA* levels, in particular in the range between $1-1.25$, and for below-average density, in particular in the range $0.75-1$.

Note, however, that in the second period there appears another peak at very low levels of *GVA*, indicating the appearance of a cluster of regions with an average *GVA* lower than 50% of EU average. In addition, in accordance with the ergodic distribution in Table 5, there appears also a peak at above-average *GVA* levels. This may indicate that structural funds, although targeted to low-income regions, have indeed helped regions with *GVA* not too far from the average, but they may still leave a fraction of very poor regions in a state of economic backwardness. This is accompanied by the emergence of a peak at high relative *GVA* levels, indicating that rich regions tend to cluster. This scenario may be considered worrisome on the grounds of economic cohesion across European regions.

4.2 Productivity

In this section we repeat the analysis with respect to the productivity of labor, measured by *GVA* per worker. Figure 5 reports a nonparametric estimation of the relation between growth rate and level of labor productivity in $1977-1998$, $1977-1985$ and $1986-1998$. Figure 6 directly compares the estimates in the two subperiods. In both cases we report the *PR* classes used for the estimation of the transition matrix (see Table

6) which, to compare the results, correspond to those used in the analysis of *GVA*.

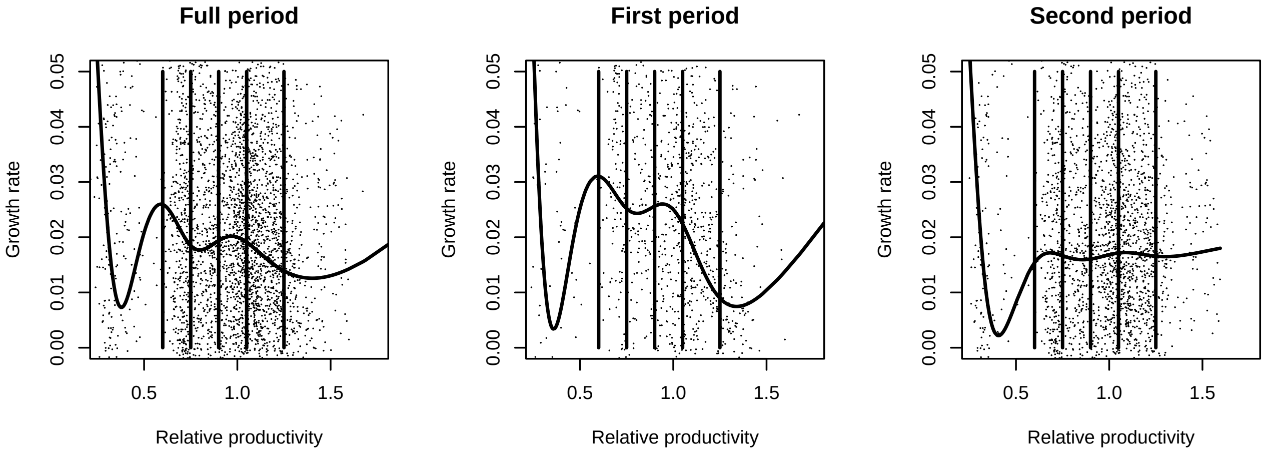

Figure 5: Nonparametric estimation of growth rate vs level of *PR* in $1977-1998$, $1977-1985$ and $1986-1998$. Vertical lines refer to *PR* classes in Table 6

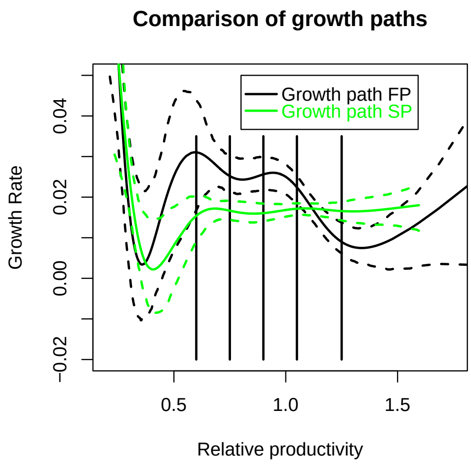

Figure 6: Nonparametric estimation of growth rate and level of productivity in $1977-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to *PR* classes in Table 6

I	II	III	IV	V	VI
$(0-0.60)$	$(0.60-0.75)$	$(0.75-0.90)$	$(0.90-1.05)$	$(1.05-1.25)$	(>1.25)

Table 6: *PR* classes

The estimates in Figures 5 and 6 appear nonlinear, although there is a relatively large confidence band at high and low *PR* levels CHECK. However, we can note that also in this case there appears a difference between the two periods. In the first period the relation is nonlinear, and decreasing for productivity values greater than approximately 0.6.

In the second period the portion of the path for productivity levels below average shifts down, and becomes essentially flat. The downward shift of the path is surprising as much of the funds were directed toward capital formation, R&D, and human capital accumulation. The downward shift of the path at low *PR* levels suggests more persistence at those levels in that period. In general, more precise conclusions can be drawn by analysing the distribution dynamics, presented in what follows.[17]

PR	*I*	*II*	*III*	*IV*	*V*	*VI*
I	0.74	0.05	0.16	0.05	0.01	0
II	0.05	0.74	0.14	0.03	0.04	0
III	0	0.17	0.60	0.21	0.02	0
IV	0	0	0.13	0.71	0.16	0
V	0	0	0.02	0.17	0.79	0.03
VI	0	0	0	0	0.34	0.66

Table 7: Transition matrix $1977 - 1985$: *PR*

PR	*I*	*II*	*III*	*IV*	*V*	*VI*
I	0.99	0.01	0	0	0	0
II	0.01	0.91	0.08	0	0	0
III	0	0.08	0.80	0.11	0	0
IV	0	0	0.10	0.75	0.15	0
V	0	0	0	0.10	0.84	0.07
VI	0	0	0	0.01	0.17	0.83

Table 8: Transition matrix 1986-1998: *PR*

These transition matrices determine the distribution dynamics in Tables 9 and 10.

PR	*I*	*II*	*III*	*IV*	*V*	*VI*
1977	0.18	0.12	0.13	0.18	0.23	0.17
1985	0.11	0.14	0.16	0.21	0.31	0.08
Ergodic	0.02	0.11	0.17	0.34	0.33	0.03

Table 9: Distribution dynamics 1977-1985: *PR*

PR	*I*	*II*	*III*	*IV*	*V*	*VI*
1985	0.11	0.14	0.16	0.21	0.31	0.08
1998	0.11	0.13	0.17	0.19	0.31	0.10
Ergodic	0.20	0.16	0.14	0.16	0.24	0.10

Table 10: Distribution dynamics 1986-1998: *PR*

Tables 7 and 8 show that the tendency observed for *GVA* appears more pronounced as, in $1986 - 1998$, the elements on the principal diagonal clearly increased indicating higher persistence. However, the perspectives improved the most for regions in *PR* class III, for which we detect a marked decrease in the probability to fall into *PR* class II (from 17% to 8%). On the contrary, they worsened for regions in *PR* class I, where the probability to persist in that class increased from 0.74 to 0.99.

Overall, the long-run tendency seems to be more favourable to convergence at average or above-average productivity levels in the first period, while in the second period

[17] With the productivity classes in Table 6, we have the following distribution of observations, respectively in $1977 - 1985$ and $1986 - 1998$: $(0.13, 0.16, 0.13, 0.20, 0.25, 0.13)$ and $(0.11, 0.13, 0.16, 0.23, 0.31, 0.07)$.

we observe a relatively high dispersion, with a relatively high mass at low productivity levels and one statistically significant peak in *PR* class V and one non statistically significant in class I.

In terms of speed of the process, we observe a dramatic increase in the asymptotic half life, from 4 periods (12 years) to 75 periods (225 years). This means that the process becomes extremely slow.

Now we consider the distribution dynamics with continuous state space.

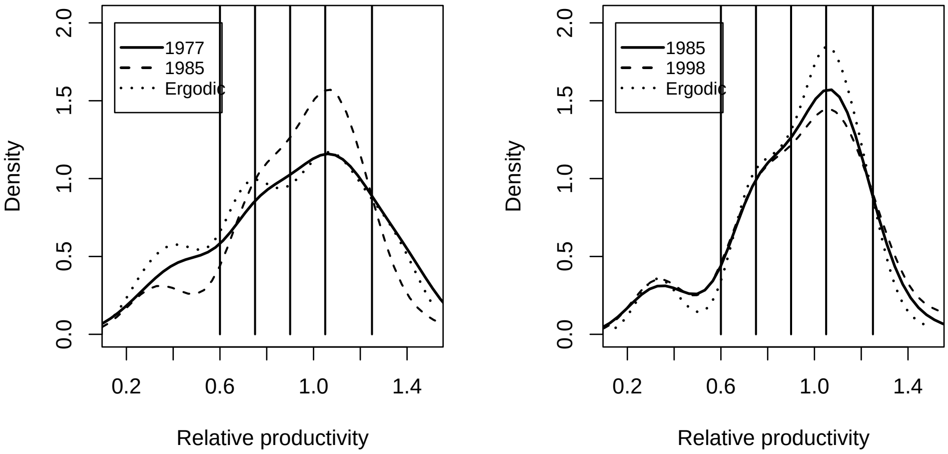

Figure 7: Distribution dynamics in $1977-1985$ and $1985-1998$ with continuous state space: productivity

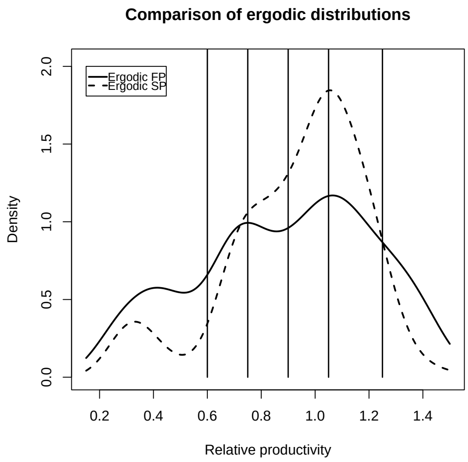

Figure 8: Ergodic distributions in $1977-1985$ (FP) and $1986-1998$ (SP): productivity

In Figure 7 we see that in 1985 the distribution is more concentrated than in 1977, although there appears a peak at very low productivity levels, and this movement is reflected in the associated ergodic distribution. In the second period we have little movement between 1985 and 1998, and the ergodic distribution shows a peak near the average and a peak at very low levels of productivity. A comparison of the ergodic distributions in Figure 8 shows very clearly the different long-run implications of the dynamics in the two periods: more dispersion in the first period, more concentration around the mean in the second period but with the emergence of a peak at low *PR* levels

In this case the conclusion is similar to that of *GVA*: the decade after 1985 witnessed a reinforcement of the tendency for convergence for a large majority of regions, but at the same time a small number of regions saw a worsening of their perspectives of catching up with the richest, as shown again also by the strong increase in persistence in *PR* class I. In 1998, we find 25 regions in *GVA* class I: thirteen are Greek, seven Portoguese, three Spanish, one Italian and one British. These can be compared with the 19 regions in *PR* class I in the same year: regions of the same states with the exception of Spain and Italy. We conjecture that the differences are driven by differences in unemployment rates.

4.3 Structural Change

In this section we analyse the dynamics of structural change, proxied by the share of agricultural *GVA* on total *GVA* (*AS*). In this case we do not normalize the agricultural share to the sample average. First we present the nonparametric estimation of the relation between growth rate and level of *AS* in Figure 9, and then directly compare the estimated paths in the two subperiods in Figure 10 (the AS classes are defined in Table 11).

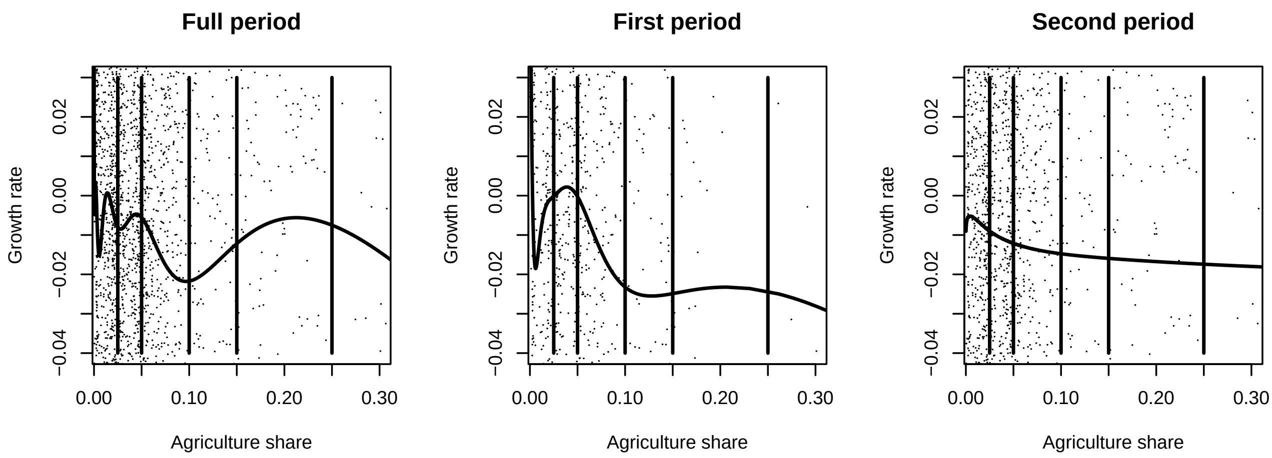

Figure 9: Nonparametric estimation of growth rate vs level of AS in $1977-1998$, $1977-1985$ and $1986-1998$. Vertical lines refer to the AS classes in Table 11

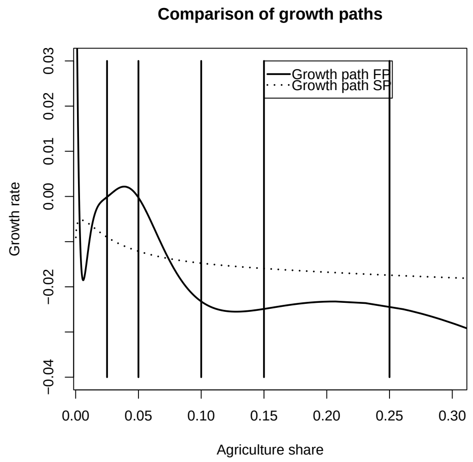

Figure 10: Nonparametric estimation of growth rate and level of AS in $1977-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to the AS classes in Table 11

I	II	III	IV	V	VI
$(0-0.025)$	$(0.025-0.05)$	$(0.05-0.10)$	$(0.10-0.15)$	$(0.15-0.25)$	(>0.25)

Table 11: AS classes

In this case the paths appear decreasing in both periods, although with some nonlinearities. In the second period the path lies essentially below zero indicating that, for all *AS* ranges, the tendency was for a reduction of the agricultural sector. However, although the estimates are rather imprecise CHECK. FARE BOOTSTRAP?, the path for high *AS* shifts upwards in the second period, implying that the speed of reduction in the dimension of the agricultural sector for regions in that range slowed down.

The analysis of transition matrices and of the distribution dynamics, with both discrete and continuous state space confirm this result.[18] In particular, note that in the transition matrices the probability to fall into *AS* class I from *AS* class II increases from 7% to 14%, the probability to fall into *AS* classes V and IV from *AS* class VI increases from 5% to 19%, but the probability of downward transitions from *AS* class V decreases from 55% to 16%, with a remarkable increase in the proabability to persist in that class (from from 41% to 83%).

[18] The distributions of observations in the classes in Table 11 are, respectively, $(0.32, 0.23, 0.26, 0.09, 0.04, 0.07)$ and $(0.36, 0.27, 0.24, 0.04, 0.05, 0.03)$, indicating that the majority of regions have a small AS.

AS	I	II	III	IV	V	VI
I	0.91	0.09	0	0	0	0
II	0.07	0.82	0.11	0	0	0
III	0	0.13	0.81	0.06	0	0
IV	0	0.02	0.35	0.54	0.09	0
V	0	0	0.12	0.43	0.41	0.04
VI	0	0	0	0.01	0.04	0.95

Table 12: Transition matrix 1977-1985: AS

AS	I	II	III	IV	V	VI
I	0.96	0.04	0	0	0	0
II	0.14	0.81	0.05	0	0	0
III	0	0.14	0.84	0.02	0	0
IV	0	0	0.33	0.54	0.13	0
V	0	0	0	0.16	0.83	0.01
VI	0	0	0	0	0.19	0.81

Table 13: Transition matrix 1986-1998: AS

AS	I	II	III	IV	V	VI
1977	0.35	0.20	0.27	0.08	0.04	0.07
1985	0.32	0.26	0.28	0.06	0.03	0.06
Ergodic	0.26	0.37	0.31	0.05	0.01	0.01

Table 14: Distribution dynamics 1977-1985: AS

AS	I	II	III	IV	V	VI
1985	0.32	0.26	0.28	0.06	0.03	0.06
1998	0.42	0.27	0.21	0.03	0.05	0.03
Ergodic	0.71	0.21	0.08	0	0	0

Table 15: Distribution dynamics 1986-1998: AS

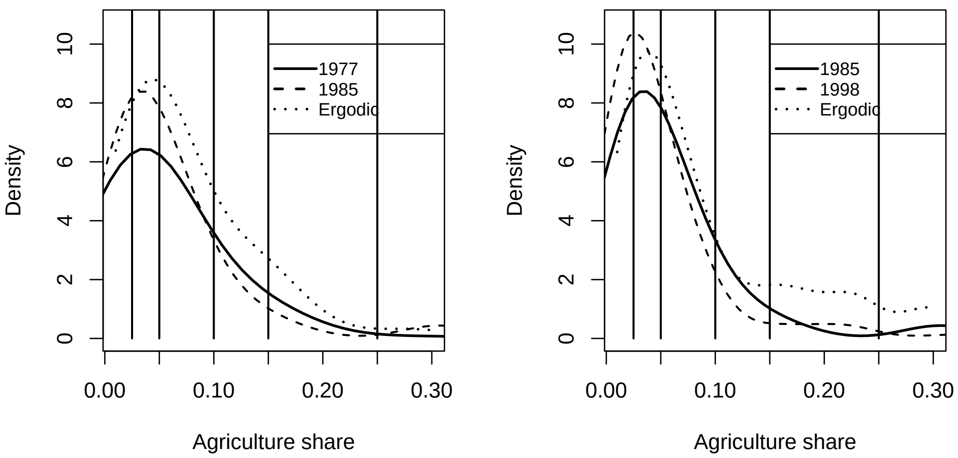

Figure 11: Distribution dynamics in $1977-1985$ and $1985-1998$ with continuous state space: AS

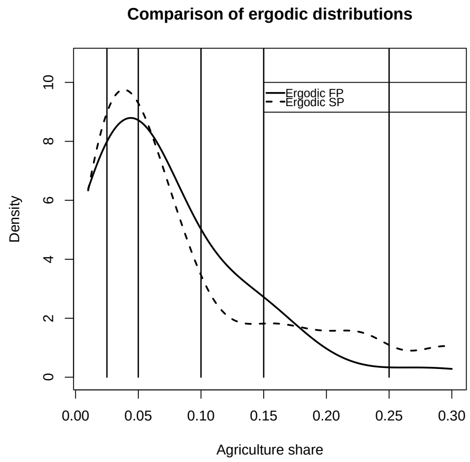

Figure 12: Ergodic distributions in $1977-1985$ (FP) and $1986-1998$ (SP): AS

The ergodic distributions in Tables 14 and 15 show a broad tendency to converge to AS classes I, II and III, with a more pronounced tendency to reach AS class I in the first period. The analysis with a continuous state space follows.

From Figure 11 we see how, gradually, the mass at low AS levels increases. From Figure 12 it is clear that the tendency is stronger in the second period, as the mass at low AS levels increases and the mass at intermediate AS levels decreases but, at the same time, the mass at high AS appears to be higher than in the first period (an aspect not captured by the ergodic distributions in in Tables 14 and 15). In addition, in contrast to what we have observed for GVA and PR, the asymptotic half life is lower in the second period (14 periods (42 years) vs 9 periods (27 years)), implying that the process becomes faster.

An economic structure with a relatively higher share of agriculture is expected to have a low productivity level, as long as the latter depends especially on industrial development. In our data, we find some correspondence between a low level of PR and high AS. In 1998, we have 19 regions with $AS > 10\%$ and 21 regions in *PR* class I; the intersection of these two sets is given by 12 Greek regions and 2 Portoguese regions. However, if this holds from a static point of view, the dynamics may be more complex. The two processes have different speeds, and the mass of regions predicted to remain at low *PR* levels and high AS levels is respectively positive and neglibible with a discrete state space, and positive in both cases with a continuous state space (although the masses at the tails in the two estimated densities are hardly comparable).

5 Investment and Consumption

In this section we study the dynamics first of the investment share on GVA (IS henceforth) and then of household expenditure (HE henceforth).

5.1 Investment Shares

As usual we present the nonparametric regressions (Figures 13 and 14) and the class definition (Table 16).[19]

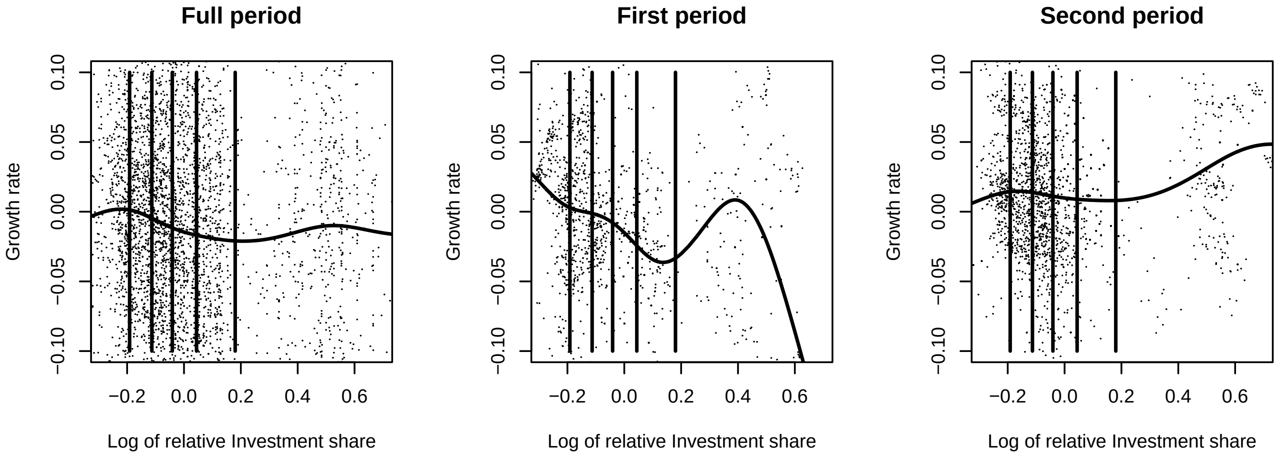

Figure 13: Nonparametric estimation of growth rate vs level of *IS* in $1977-1998$, $1977-1985$ and $1986-1998$. Vertical lines refer to the *IS* classes in Table 16

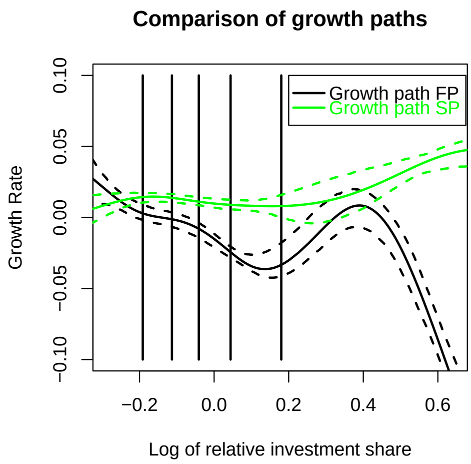

Figure 14: Nonparametric estimation of growth rate and level of *IS* in $1977-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to the *IS* classes in Table 16

[19] In this case, given that *IS* has a different scale with respect to *GVA* and productivity, we do not use the same classes. Instead we resort to a criterium often found in the literature and define the classes in order to have the same fraction of observations in each class (the choice is made considering the full sample).

I	II	III	IV	V	VI
$(0-0.82)$	$(0.82-0.89)$	$(0.89-0.95)$	$(0.95-1.04)$	$(1.04-1.19)$	(>1.19)

Table 16: *IS* classes

In the comparison of growth paths, we note the following: the path is essentially flat for the full period; in the first period the path is decreasing for the first five *IS* classes and crosses zero, but has an increasing part in *IS* class VI bringing the path near zero. Notice that the path is below zero for *IS* classes III-VI CHECK. In the second period the path lies below the path of the first period in *IS* class I, while it lies above it in the remaining classes CHECK. In particular, it is flat around zero in *IS* classes II-V, and becomes increasing and positive in *IS* class VI. This suggests that in the first period we should observe convergence into two *IS* classes, the second and the last,[20] while in the second period we should observe more persistence at low levels of investment and in *IS* classes V and VI CHECK.

Let us consider the distribution dynamics in the *IS* classes of Table 16 and, subsequently, without the discretization.[21]

IS	I	II	III	IV	V	VI
I	0.31	0.41	0.16	0.04	0.08	0
II	0.28	0.37	0.27	0.05	0.03	0
III	0.13	0.21	0.36	0.22	0.08	0
IV	0.05	0.02	0.15	0.44	0.33	0.01
V	0	0.03	0.14	0.34	0.46	0.02
VI	0	0	0	0.15	0.09	0.76

Table 17: Transition matrix 1977-1985: *IS*

IS	I	II	III	IV	V	VI
I	0.59	0.25	0.14	0.01	0	0
II	0.36	0.35	0.21	0.07	0.01	0
III	0.10	0.30	0.26	0.21	0.13	0
IV	0.08	0.09	0.23	0.37	0.21	0.04
V	0.02	0.03	0.10	0.07	0.76	0.01
VI	0	0.02	0	0.02	0.08	0.88

Table 18: Transition matrix 1986-1998: *IS*

IS	I	II	III	IV	V	VI
1977	0.33	0.08	0.11	0.05	0.18	0.26
1985	0.08	0.17	0.25	0.26	0.08	0.16
Ergodic	0.13	0.17	0.21	0.24	0.22	0.03

Table 19: Distribution dynamics 1977-1985: *IS*

IS	I	II	III	IV	V	VI
1985	0.08	0.17	0.25	0.26	0.08	0.16
1998	0.27	0.15	0.16	0.01	0.29	0.13
Ergodic	0.25	0.20	0.17	0.11	0.22	0.05

Table 20: Distribution dynamics 1986-1998: *IS*

[20] We should observe convergence in the second because the path in that range is decreasing and crosses zero, and in the sixth as the path lies near zero.

[21] The distributions of observations in the classes in Table 16 are, respectively, $(0.23, 0.18, 0.08, 0.10, 0.20, 0.22)$ and $(0.13, 0.15, 0.21, 0.23, 0.14, 0.15)$, indicating that the majority of regions have a small *IS*.

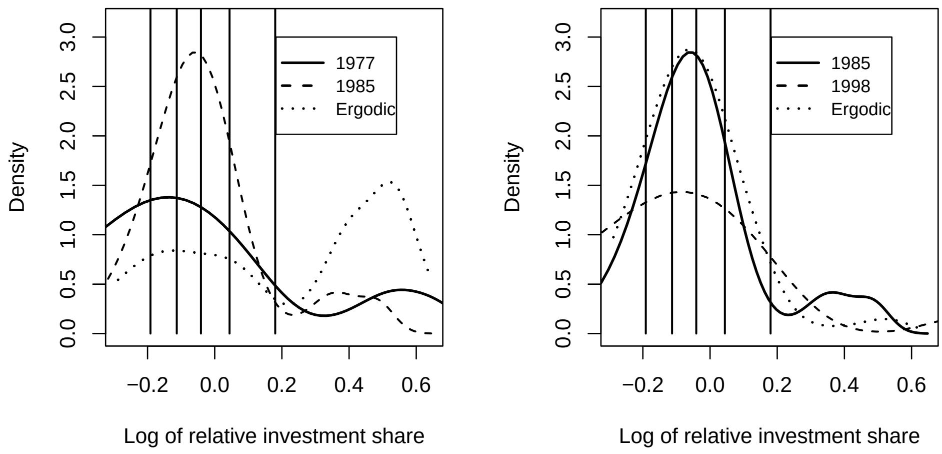

Figure 15: Distribution dynamics in $1977 - 1985$ and $1985 - 1998$ with continuous state space: *IS*

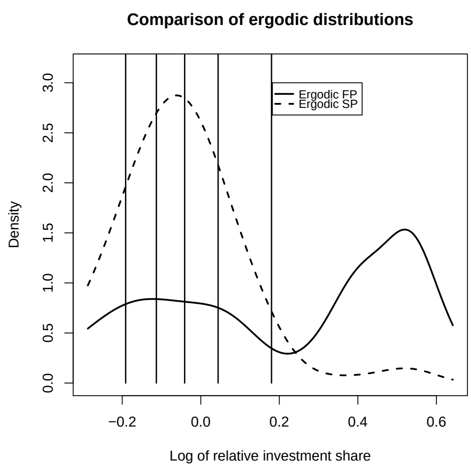

Figure 16: Ergodic distributions in $1977 - 1985$ (FP) and $1986 - 1998$ (SP): *IS*

As predictable, from the transition matrices we observe in general a low level of persistence given the higher volatility of *IS* as compared to the variables observed so far. In the second period persistence increases at high and low levels of *IS*, as observable from a comparison of the elements on the principal diagonal for *IS* classes I, V and VI (respectively 0.59 vs 0.31, 0.76 vs 0.46 and 0.88 vs 0.76). In the first period we observe a tendency for the mass to concentrate in classes II-V. This is in partial contrast with what we expected from Figure 14, but this is likely to depend on the discretization of the state space. As observable from the distribution in 1985 and the density for the same year in Figure 15, there is a low number of observations in *IS* class V, which makes the two distributions twin peaked. In fact, there exists a cluster of regions with very high levels (about 2) of *IS*, which is separated from the rest. This is reflected in the value of the element on the principal diagonal for *IS* class VI, which is the highest in both periods.

In the second period the long-run ergodic distribution is bimodal in agreement with the estimated path in Figure 14. The discretization causes the second peak in *IS* class V instead of class VI (see Figure 15).

Observing the estimates with a continuous state space we note that in the first period the long-run distribution is clearly twin-peaked with a relatively high mass at both low and high levels of *IS*. In the second period the distribution is still twin-peaked, but the peak at low levels of *IS* has a much higher mass.

The cluster of high-investment regions include in 1985 thirteen regions from Greece, one from Italy, twelve from Netherlands and six from Finland. We do not find a correlation between high *IS* and high *PR* in 1985, as high-productivity regions mainly belong to Belgium (1 region) Germany (4 regions), France (2 regions), Italy (1 region), Netherland (1 region), Finland (3 regions), Sweden (3 regions).[22]

To conclude, let us note that the asymptotic half life is 3 periods (9 years) in $1977-1985$ and 5 periods (15 years) in $1986-1998$ that is, as with GVA and productivity, the process slows down in the second period.

5.2 Household Expenditure

In this section we study the dynamics of consumption by analyzing per capita household expenditure, *HE*. We present the nonparametric regressions in Figures 17 and 18, the class definition, which corresponds to the one used for *GVA* and productivity, in Table 21, the transition matrices in Tables 22 and 23, the distribution dynamics in Tables 24 and 25, and in Figures 19 and 20.[23]

[22] We find a similar pattern in 1998.

[23] The distributions of observations in the classes in Table 21 are, respectively, $(0.24, 0.15, 0.13, 0.15, 0.18, 0.15)$ and $(0.21, 0.16, 0.16, 0.19, 0.16, 0.13)$.

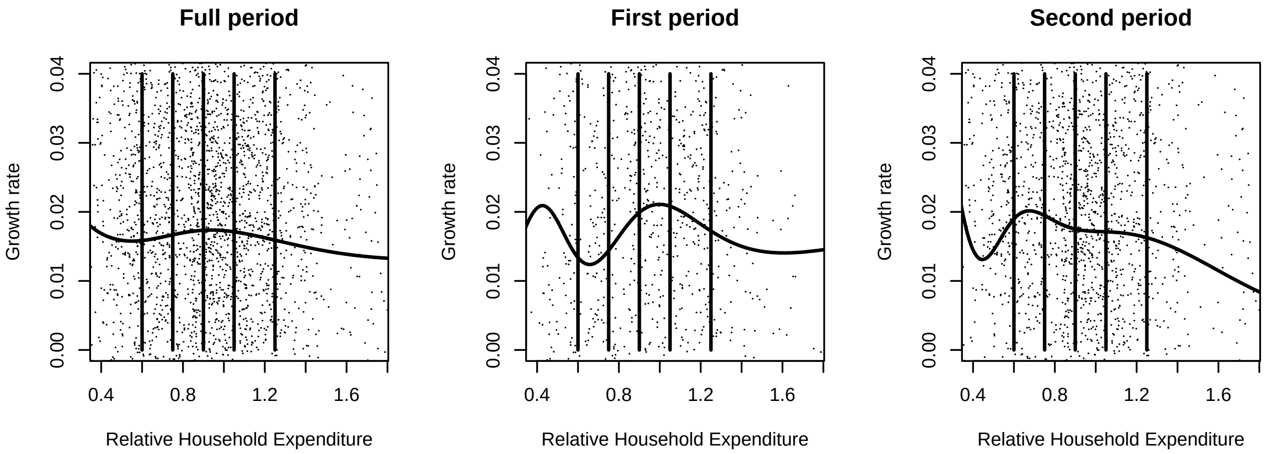

Figure 17: Nonparametric estimation of growth rate vs level of HE in $1977-1998$, $1977-1985$ and $1986-1998$. Vertical lines refer to the HE classes in Table 21

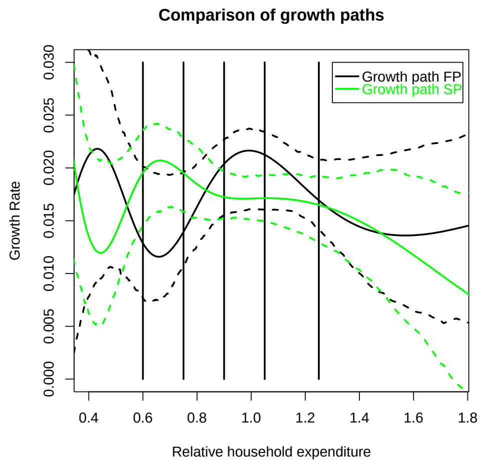

Figure 18: Nonparametric estimation of growth rate and level of HE in $1977-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to the HE classes in Table 21

I	II	III	IV	V	VI
$(0-0.60)$	$(0.60-0.75)$	$(0.75-0.90)$	$(0.90-1.05)$	$(1.05-1.25)$	(>1.25)

Table 21: HE classes

HE	I	II	III	IV	V	VI
I	0.83	0.17	0	0	0	0
II	0.24	0.61	0.11	0.03	0.01	0
III	0.02	0.15	0.64	0.17	0.01	0
IV	0.04	0.01	0.12	0.67	0.16	0.01
V	0.02	0.01	0	0.07	0.76	0.13
VI	0.01	0	0.02	0.01	0.15	0.83

Table 22: Transition matrix 1977-1985: HE

HE	I	II	III	IV	V	VI
I	0.85	0.14	0.01	0	0	0
II	0.20	0.65	0.14	0.01	0	0
III	0	0.11	0.72	0.17	0.01	0
IV	0	0	0.14	0.76	0.10	0.01
V	0	0	0.01	0.20	0.69	0.11
VI	0	0	0	0	0.16	0.83

Table 23: Transition matrix 1986-1998: HE

HE	I	II	III	IV	V	VI
1977	0.16	0.19	0.17	0.17	0.16	0.16
1985	0.23	0.18	0.12	0.15	0.17	0.15
Ergodic	0.33	0.19	0.10	0.10	0.15	0.12

Table 24: Distribution dynamics 1977-1985: HE

HE	I	II	III	IV	V	VI
1985	0.23	0.18	0.12	0.15	0.17	0.15
1998	0.25	0.13	0.15	0.22	0.14	0.12
Ergodic	0.18	0.14	0.20	0.25	0.13	0.10

Table 25: Distribution dynamics 1986-1998: HE

From Figure 18 we observe that in the second period the path lies almost entirely above the path of the first period. From Table 22 we also note that in the first period consumption shows a high volatility and a general tendency to fall into low *HE* classes. This is reflected in the increase in the mass in *HE* class I from 1977 to 1985 and in the high mass in *HE* classes I and II in the ergodic distribution. In the second period there appears a peak in *HE* class IV, while the peak in *HE* class I is smaller.

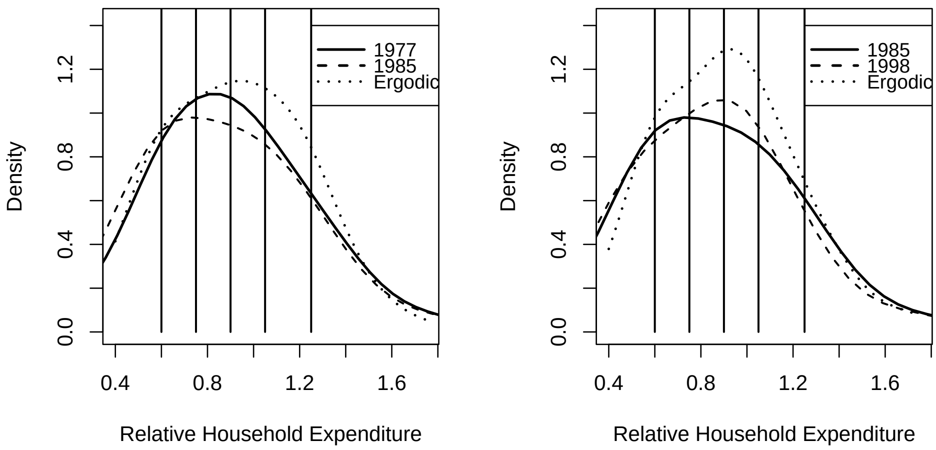

Figure 19: Distribution dynamics in $1977-1985$ and $1985-1998$ with continuous state space: HE

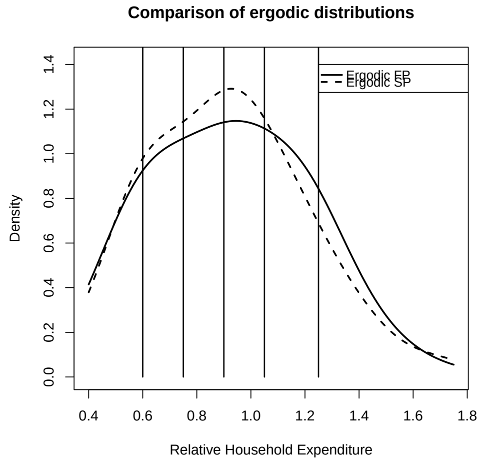

Figure 20: Ergodic distributions in $1977-1985$ (FP) and $1986-1998$ (SP): HE

The estimated densities in Figure 19 show that the overall situation improves in the second period. By comparing the results with those of *GVA* we note that the distribution is less concentrated, but it does not feature any apparent cluster of low-consumption regions separated from the rest. However, for a general assessment of convergence in living standards, there appears a relevant fraction of regions with consumption levels much lower than the European average (in 1998 25% of regions had a consumption level lower than 60% of EU average).

Finally, the process is slower in the second period, as the asymptotic half life is 11 periods (33 years) in the first and 13 periods (39 years) in the second.

6 Unemployment

In this section we study the dynamics of EU labour market by focusing on (relative) unemployment *RU*. Since the database on this variable contains a lower number of data we utilize a restricted sample of 195 regions for the period $1980-1998$. Appendix A contains details on the data.

As usual, we present the nonparametric regressions where we considered the relation between first differences and levels of unemployment rates (Figures 21 and 22), the classes' definition, based on the number of observations in each class (Table 26), the transition matrices (Tables 27 and 28), the distribution dynamics (Tables 29 and 30, and Figures 23 and 24.[24]

[24]The distributions of observations in the classes in Table 26 are, respectively, $(0.10, 0.14, 0.15, 0.23, 0.21, 0.18)$ and $(0.18, 0.17, 0.17, 0.15, 0.16, 0.17)$.

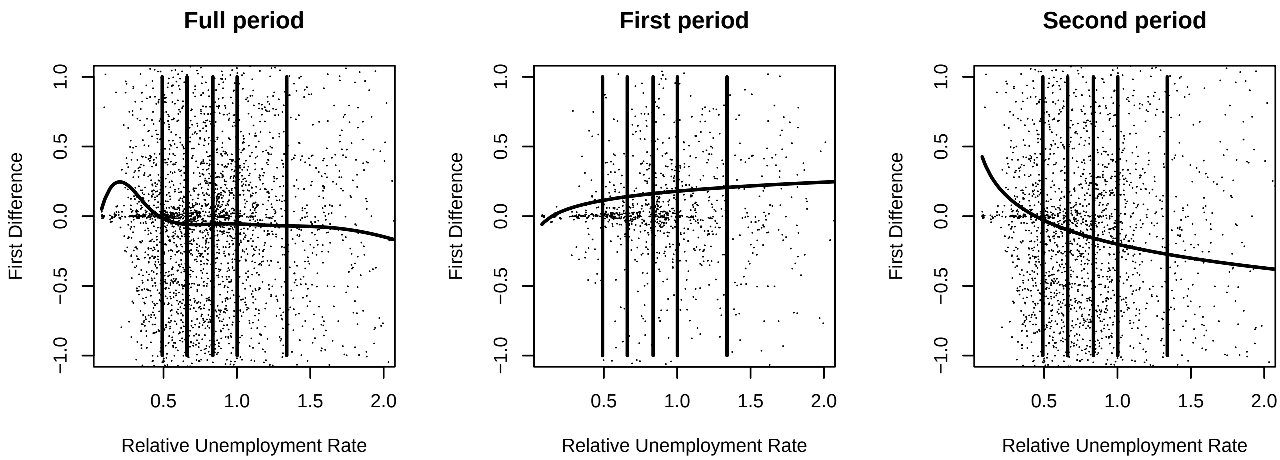

Figure 21: Nonparametric estimation of growth rate vs level of *RU* in $1980-1998$, $1980-1985$ and $1986-1998$. Vertical lines refer to the *RU* classes in Table 26

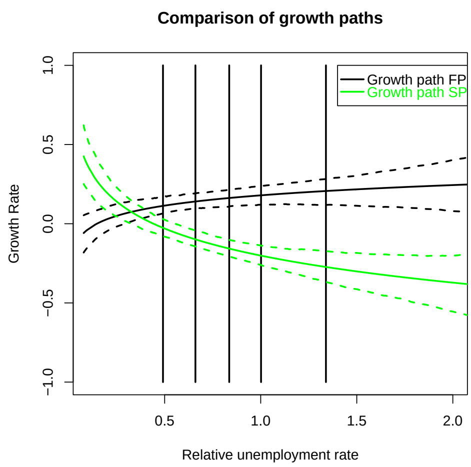

Figure 22: Nonparametric estimation of growth rate and level of *RU* in $1980-1985$ (FP) and $1986-1998$ (SP). Vertical lines refer to the *RU* classes in Table 26

I	II	III	IV	V	VI
$(0-0.49)$	$(0.49-0.66)$	$(0.66-0.84)$	$(0.84-1.00)$	$(1.00-1.34)$	(>1.34)

Table 26: *RU* classes

RU	I	II	III	IV	V	VI
I	0.89	0.02	0.02	0.05	0.02	0
II	0.25	0.60	0.06	0.04	0.05	0
III	0	0.31	0.52	0.15	0.01	0
IV	0	0.02	0.38	0.40	0.19	0.02
V	0	0	0.03	0.27	0.62	0.07
VI	0	0	0	0.01	0.13	0.86

Table 27: Transition matrix 1980-1985: *RU*

RU	I	II	III	IV	V	VI
I	0.69	0.21	0.06	0.03	0.01	0
II	0.33	0.38	0.22	0.04	0.02	0
III	0.09	0.35	0.34	0.17	0.04	0.01
IV	0	0.17	0.27	0.38	0.17	0.01
V	0	0.01	0.11	0.30	0.47	0.11
VI	0	0	0	0.02	0.17	0.81

Table 28: Transition matrix 1986-1998: *RU*

RU	I	II	III	IV	V	VI
1980	0.11	0.13	0.15	0.23	0.22	0.17
1985	0.14	0.13	0.19	0.16	0.20	0.17
Ergodic	0.33	0.14	0.15	0.14	0.14	0.09

Table 29: Distribution dynamics 1980-1985: *RU*

RU	I	II	III	IV	V	VI
1985	0.14	0.13	0.19	0.16	0.20	0.17
1998	0.26	0.19	0.15	0.14	0.13	0.13
Ergodic	0.31	0.24	0.17	0.12	0.09	0.07

Table 30: Distribution dynamics 1986-1998: *RU*

The paths in Figure 22 indicate a tendency to divergence in the first period and convergence to low unemployment rates in the second. This is reflected in the following tendencies in Table 28: the principal diagonal elements for *RU* classes I and VI are higher in the first period (respectively 0.89 vs 0.69 and 0.86 vs 0.81), but for the other classes they are lower; there appears an increase in the transition probabilities to lower *RU* classes.[25] Indeed, the ergodic distributions show that in the second period there is higher concentration of regions in intermediate classes.

[25] In both periods the highest elements on the principal diagonal are at extreme *RU* classes, broadly in accordance with Overman and Puga (2002), but in the first period we have a higher persistence. Hence, the high persistence detected by Overman and Puga (2002) in the period $1986 - 1996$ is however lower than that of the previous decade.

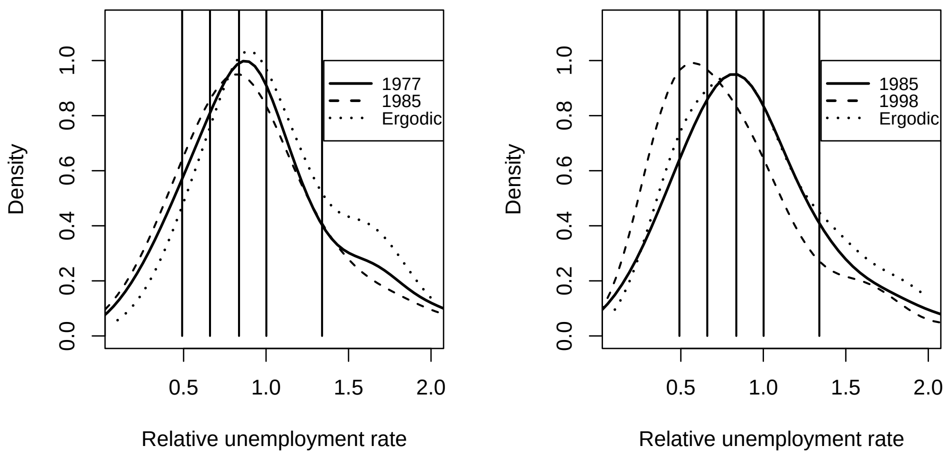

Figure 23: Distribution dynamics in $1980 - 1985$ and $1985 - 1998$ with continuous state space: *RU*

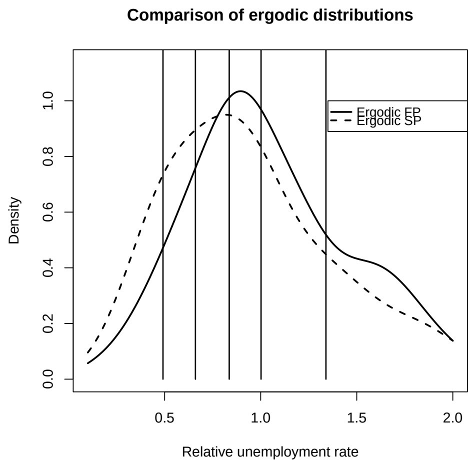

Figure 24: Ergodic distributions in $1980 - 1985$ (FP) and $1986 - 1998$ (SP): *RU*

From Figures 23 and 24 it emerges that the mass moves broadly to the left, that is to low unemployment. However, differently from the results in Table 28, there appears a non negligible mass in *RU* class VI. This discrepancy depends on the discretization: with a discrete state space we are able to detect only transitions from *RU* class VI to the same class or to *RU* class V. Therefore we miss transitions from high levels of unemployment to higher levels. When the state space is continuous, these transitions are instead taken into account. Hence we conclude that it seems that a noticeable cluster of regions is expected to remain at very high levels of RU.

In particular, we find 35 regions in *RU* class VI in 1985 (two from Belgium, sixteen from Spain, two from France, five from Italy, two from Portugal, two from Sweden and six from UK), and 25 regions in 1998 (one from Belgium, one from Greece, twelve from Spain, three from France, seven from Italy, one from Portugal).

The asymptotic half life decreases from 6 periods (18 years) to 5 periods (15 years) indicating a higher speed of convergence.

7 Discussion

In Table 31 we summarize our results.

Variable	Results
GVA	• Higher dispersion in the first period in the long run.
	• Tendency to "asymmetric" twin peaks in the second period (3 peaks).
	• Convergence for regions near average but peak at very low *GVA* levels.
	• AHL(1986 − 1998)>AHL(1977 − 1985)→ slower process.
PR	• Tendency similar to *GVA*. Peak around 1 in the second period.
	• A cluster of regions lags behind in the second period in the long run
	• AHL(1986 − 1998)>>AHL(1977 − 1985)→ much slower process
AS	• Convergence in both periods: stronger in the second but two peaks?
	• Correlation between high *AS* and low productivity.
	• AHL(1986 − 1998)<AHL(1977 − 1985)→ faster process.
IS	• Higher dispersion and volatility in the first period.
	• Presence of high-investment regions in both periods.
	• No clear relation between high investment and high productivity.
	• AHL(1986 − 1998)>AHL(1977 − 1985)→ slower process.
HE	• Relatively high dispersion in both periods.
	• Slightly higher concentration in the second period.
	• High fract. of regions with below-average cons. levels in both periods.
	• AHL(1986 − 1998)>AHL(1977 − 1985)→ slower process.
RU	• High persistence at high and low levels.
	• Tendency to converge to low levels of unemployment in both periods.
	• Higher tendency to converge to low unemp. in the second period.
	• In both periods a fraction of regions lags behind.
	• AHL(1986 − 1998)<AHL(1977 − 1985)→ faster process.

Table 31: Summary of results. AHL: asymptotic half life

From Table 31 we see that the second period is characterized by a stronger tendency to convergence in terms of GVA, productivity and unemployment, but that this tendency is at work for regions belonging to a certain range. Regions further away from EU average appear not able to catch up. Hence structural funds, which we argued should have been more effective from the second half of the eighties, actually improved the perspectives of "poor" regions, but not of the "very poor".

As to the structure of regional economies, the overall effect of structural funds, which have been devoted to both the industrial and agricultural sectors, seem to have consisted in an acceleration of the process of structural change, characterized by a marked tendency to a reduction of the agricultural sectors, although it is not completely clear that the the process differs in important respects for the one detected for *GVA*, *PR* and *RU*, as some regions appear to remain persistently characterized by large agricultural sectors. The relation between a relatively large agricultural sector and a relatively low level of productivity appears to exist, but we do not have conclusive evidence that it characterizes the long run.

The evidence on the dynamics of investment rates is somewhat mixed, given the high priority attributed to investment. In particular we find a partial convergence in investment rates, with a cluster of regions with persistent above-average investment rates, but this is not fully reflected in the dynamics of productivity.

Finally, our measure of living standards, per capita consumption relative to EU average, shows that we are far from convergence in the sense that in both periods the distribution is rather flat.

The dynamics of unemployment shows a tendency for a reduction of differences in unemployment rates, but a cluster of regions shows persistence at above-average unemployment levels.

In addition, from the analysis of asymptotic half life, we see that the process is generally slow, and becomes slower in the second period.

To conclude, we find that European funding of regional economies has been effective to some degree, but it should probably pay more attention to the differences existing among the recipient regions, and be more specifically targeted to those starting from particularly low levels of *GVA*, productivity and unemployment.

8 Concluding Remarks

This paper represents a first attempt to study the dynamics of European regions in a multidimensional framework. We argue that this approach can provide useful information for a more comprehensive understanding of the effect of participating to the European Union. We plan: i) to extend the analysis to other labor market indicators such as employees' compensations and participation rates as key variables in the explanation of unemployment rates; ii) to focus on some insights from the new economic geography in order to examine how our results relate to issues of localization/concentration of economic activity and, iii) to analyze the dynamics of the new members of the European Union.

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A Appendix 1: the Datasets

The following tables contains the list of regions used in this paper. Data were provided by Cambridge Econometrics (www.camecon.com). The regions' definition basically corresponds to the Eurostat NUTS2 classification.

BE1	BE21	BE22	BE23	BE24	BE25	BE31	BE32	BE33	BE34
BE35	DK01	DK02	DK03	DE11	DE12	DE13	DE14	DE21	DE22
DE23	DE24	DE25	DE26	DE27	DE3	DE5	DE6	DE71	DE72
DE73	DE91	DE92	DE93	DE94	DEA1	DEA2	DEA3	DEA4	DEA5
DEB1	DEB2	DEB3	DEC	DEF	GR11	GR12	GR13	GR14	GR21
GR22	GR23	GR24	GR25	GR3	GR41	GR42	GR43	ES11	ES12
ES13	ES21	ES22	ES23	ES24	ES3	ES41	ES42	ES43	ES51
ES52	ES53	ES61	ES62	ES63	ES7	FR1	FR21	FR22	FR23
FR24	FR25	FR26	FR3	FR41	FR42	FR43	FR51	FR52	FR53
FR61	FR62	FR63	FR71	FR72	FR81	FR82	FR83	IE01	IE02
IT11	IT12	IT13	IT2	IT31	IT32	IT33	IT4	IT51	IT52
IT53	IT6	IT71	IT72	IT8	IT91	IT92	IT93	ITA	ITB
NL11	NL12	NL13	NL21	NL22	NL23	NL31	NL32	NL33	NL34
NL41	NL42	AT11	AT12	AT13	AT21	AT22	AT31	AT32	AT33
AT34	PT11	PT12	PT13	PT14	PT15	PT2	PT3	FI13	FI14
FI15	FI16	FI17	FI2	SE01	SE02	SE04	SE06	SE07	SE08
SE09	SE0A	UKC1	UKC2	UKD1	UKD2	UKD3	UKD4	UKD5	UKE1
UKE2	UKE3	UKE4	UKF1	UKF2	UKF3	UKG1	UKG2	UKG3	UKH1
UKH2	UKH3	UKI1	UKI2	UKJ1	UKJ2	UKJ3	UKJ4	UKK1	UKK2
UKK3	UKK4	UKL1	UKL2	UKM1	UKM2	UKM3	UKM4	UKN	

Table 32: List of regions for 2002 database

BE1	BE21	BE22	BE23	BE24	BE25	BE31	BE32	BE33	BE34
BE35	DK01	DK02	DK03	DE11	DE12	DE13	DE14	DE21	DE22
DE23	DE24	DE25	DE26	DE27	DE5	DE6	DE71	DE72	DE73
DE91	DE92	DE93	DE94	DEA1	DEA2	DEA3	DEA4	DEA5	DEB1
DEB2	DEB3	DEC	DEF	GR11	GR12	GR13	GR14	GR21	GR22
GR23	GR24	GR25	GR3	GR41	GR42	GR43	ES11	ES12	ES13
ES21	ES22	ES23	ES24	ES3	ES41	ES42	ES43	ES51	ES52
ES53	ES61	ES62	ES63	ES7	FR1	FR21	FR22	FR23	FR24
FR25	FR26	FR3	FR41	FR42	FR43	FR51	FR52	FR53	FR61
FR62	FR63	FR71	FR72	FR81	FR82	FR83	IE01	IE02	IT11
IT12	IT13	IT2	IT31	IT32	IT33	IT4	IT51	IT52	IT53
IT6	IT71	IT72	IT8	IT91	IT92	IT93	ITA	ITB	NL11
NL12	NL13	NL21	NL22	NL31	NL32	NL33	NL34	NL41	NL42
AT11	AT12	AT13	AT21	AT22	AT31	AT32	AT33	AT34	PT11
PT12	PT13	PT14	PT15	PT2	PT3	FI13	FI18	FI1A	FI2
SE01	SE02	SE04	SE06	SE07	SE08	SE09	SE0A	UKC1	UKC2
UKD1	UKD2	UKD3	UKD4	UKD5	UKE1	UKE2	UKE3	UKE4	UKF1
UKF2	UKF3	UKG1	UKG2	UKG3	UKH1	UKH2	UKH3	UKI1	UKI2
UKJ1	UKJ2	UKJ3	UKJ4	UKK1	UKK2	UKK3	UKK4	UKL1	UKL2
UKM1	UKM2	UKM3	UKM4	UKN					

Table 33: List of regions 2004 database