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Conference Paper

The emergence of convergence clubs among Greek regions

50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Artelaris, Panagiotis; Kallioras, Dimitris; Petrakos, George (2010) : The emergence of convergence clubs among Greek regions, 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

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50th ERSa Congress, 19th – 23rd August 2010

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The Emergence of Convergence Clubs among Greek Regions

Abstract

The evaluation of regional inequalities and the monitoring of their evolution (regional convergence/divergence analysis) is an issue of extreme interest in the field of regional science as it demonstrates the role of market dynamics and appraises the effectiveness of regional policy. Extending the methodology of (regional) convergence clubs, the paper examines for the existence of convergence clubs, in per capita GDP terms, among the NUTS III regions of Greece during the period 1995–2005. The approach of (regional) convergence clubs relies on recent paradigms of economic growth and indicates the existence of (regional) convergence within (regional) convergence clubs without the precondition of (regional) convergence between those clubs. The findings of the paper do not verify the existence of regional convergence clubs in Greece. In contrast, they reveal clear trends of divergence, (identifying, additionally, sub-clubs of divergence) stressing out the underestimation of the country's regional problem.

Key-Words: regional convergence clubs, Greek regions

JEL: R11, R12, R15

1. Introduction

The evaluation of regional inequalities and the monitoring of their evolution (regional convergence/divergence analysis) is an issue of extreme interest in the field of regional science. The stimulus behind such an interest is twofold: a) from the theoretical viewpoint, the level and the evolution of regional inequalities can serve as an empirical test among alternative growth theories with sharply different policy implications, b) from the policy viewpoint, the level and the evolution of regional inequalities can be seen as a criterion for the appraisal of the effectiveness of regional policy.

Proponents of neoclassical theory argue that disparities are bound to diminish with growth through the activation of the equilibrating mechanisms of the declining marginal productivity of capital (under the assumptions of perfect competition, constant returns to scale, and exogenously-determined technical progress), interregional trade and interregional factor movement (see Barro and Sala-i-Martin, 1995, for a review). In contrast, other schools of thought such as the endogenous (new) growth theories (on the basis of the endogenously-determined technical progress due to existence of human capital, the investment in R & D activities, and the spill-over of knowledge) (see Aghion and Howitt, 1998, for a review) and the new economic geography (under the assumptions of monopolistic competition, increasing returns to scale, and non-zero transport cost) (see Fujita et al., 1999, for a review) tend to agree that growth is a spatially selective and cumulative process, which is likely to increase inequalities, stressing the role of policies in balancing growth patterns.

In the middle of this imaginable theoretical spectrum, there are also some other recent paradigms of economic growth, which point out that it is quite natural to expect that groups of (regional) economies are converging but that these groups are themselves diverging from each other. These paradigms transcend the “all or nothing” logic behind conventional regional convergence/divergence analysis and maintain that convergence may come about for different groups of (regional) economies, indicating, thus, the possibility of the existence of (regional) convergence clubs. In other words, the approach of (regional) convergence clubs indicates the existence of (regional) convergence within (regional) convergence clubs without the precondition of (regional) convergence between those clubs (see Azariadis, 1996, for a review).

The objective of the paper is to examine for the existence of convergence clubs, in per capita GDP terms, among the NUTS III regions of Greece, extending the methodology of (regional) convergence clubs. The methodology of (regional) convergence clubs examines the (possible) presence of a non-linear regional convergence/divergence pattern, being able to

offer a more detailed and informative picture, comparing to the conventional regional convergence/divergence analysis (see the seminal papers of Baumol, 1986; Barro and Sala-i-Martin, 1992; Mankiw et al., 1992). The analysis covers the period 1995-2005 and uses data derived from the NSSG. The findings of the paper are able to provide valuable insight for both theory and policy, and, also, a contribution to a better understanding of the regional problem in Greece.

The next section of the paper briefly outlines the methods developed to explore the regional convergence/divergence issue and identifies the most important empirical studies conducted over the recent years. The third section presents the most important empirical studies concerning the evolution of regional inequalities in Greece. The fourth section examines econometrically for the existence of regional convergence clubs in Greece. The last section of the paper offers the conclusions.

2. The Convergence / Divergence Debate: Methods and Empirical Evidence

The dominant approach in the convergence/divergence literature is derived from the neoclassical theory. Two main concepts of convergence have been developed in this literature: (unconditional or conditional) β -convergence and σ -convergence (Baumol, 1986; Barro and Sala-i-Martin, 1992; Mankiw et al., 1992).

If economies are homogeneous convergence can occur in an absolute sense (unconditional β -convergence) since they will converge towards the same steady-state. This concept implies that poor economies grow faster than rich ones and therefore, over a long period of time, they converge to the same level of per capita income. Unconditional β -convergence among countries or regions is observed when a negative and statistically significant relation is found between the growth rate of income per capita and the initial level of income. Conversely, if economies are heterogeneous, convergence may occur only in a conditional sense (conditional β -convergence) since economies will grow towards different steady-state positions.

The concept of σ -convergence examines the dispersion of income at a given moment in time. Thus, convergence is accepted if the dispersion (measured by the coefficient of variation) of per capita income among economies falls over time.

Quah (1993a, 1993b) stresses the importance of σ -convergence over β -convergence on the basis that the former also provides an indication whether the distribution of income across economies is becoming more equitable. However, β -convergence analysis has dominated in

the literature because it is considered to be a necessary (though not sufficient) condition for σ -convergence.

At the regional level, there is ample empirical evidence of this type of research (see Magrini, 2004, for a review). Barro and Sala-i-Martin (1992, 1995) and Sala-i-Martin (1996) found evidence of convergence for 48 states of the USA, 10 Canadian provinces, 47 Japanese prefectures and 90 regions of 8 European countries. Convergence trends were also detected in Canada (Coulombe and Lee, 1995), in Australia (Cashin, 1995), in Austria (Hofer and Wörgötter, 1997), in Sweden (Persson, 1997), and in Finland (Kangasharju, 1998). In contrast, some other studies such as Mauro and Podrecca (1994), for Italian regions and Grippaio et al. (2000), for UK counties, do not support the convergence hypothesis.

The aforementioned studies have examined convergence/divergence processes utilising econometric or statistical models of linear specification since empirical research on the issue has been dominated by models (with linear specification) suggested by the neoclassical theory (Durlauf, 2001). Recently, however, a few pieces of empirical research have asserted the presence of nonlinearities in the growth process implying multiple steady-states and convergence clubs (Chatterji, 1992; Quah, 1993b; Durlauf and Johnson, 1995; Hansen, 2000). These pieces are based on theoretical models that yield multiple (locally stable) steady-state equilibria and classify geographical units into different groups with different convergence characteristics. Azariadis and Drazen (1990), for instance, developed a model where multiple steady-states emerge due to the presence of externalities. Such externalities give rise to increasing social returns to scale, once a threshold level of human capital is reached. Similarly, Durlauf (1993), Galor (1996) and Quah (1996) have demonstrated that multiple equilibria can emerge on account of differences in, among others, human capital, income distribution, capital or market imperfections, local complementarities and externalities. These models transcend the “all or nothing” logic behind conventional convergence analysis and maintain that convergence may come about for different groups of economies.

Since economic theory does not offer much guidance, empirical studies have come to various conclusions regarding the number and characteristics of groups, affected heavily by the particular method employed. Baumol and Wolff (1988), for instance, using a simple non-linear model, detected the existence of two groups: a high income convergence club and a low income divergence one. Quah (1993b), using a different method, identified an emergent twin-peak, implying polarization of countries into two different income classes. Durlauf and Johnson (1995), using regression tree analysis, found evidence of four regimes, each one subscribing to a different linear model, with convergence observed for high income countries

and divergence for low incomes ones. In turn, Liu and Stengos (1999), employing a semi-parametric partially-linear method, and Hansen (2000), relying on threshold regression, concluded that convergence is evident only for countries of the middle and upper income range. More recently, a few pieces of empirical research, using a wide variety of methods, have tested and confirmed convergence club hypothesis at the European regional level (Canova, 1999; Baumont et al., 2003; Ertur et al., 2006; Dall'erba et al., 2008, inter alia). Overall, the aforementioned studies suggest that convergence might not be a widespread phenomenon. Convergence or divergence trends do not hold for all countries or regions.

An alternative approach to examine for the existence of convergence clubs has been proposed by Chatterji (1992). This approach, that requires the identification of a lead economy, relates the economic gap (i.e. the difference between the per capita GDP of the leading economy and the per capita GDP of each of the economies under consideration) at one date with the corresponding economic gap at an earlier date, including further powers of those earlier levels. On empirical grounds, Chatterji (1992) showed the existence of two mutually exclusive convergence clubs: one including the rich countries and another including the poor countries. Similar results are obtained by Chatterji and Dewhurst (1996) for the regions of the UK during the period 1977-1991. In other words, these studies concluded that while convergence occurs within any club, no convergence exists between the members of different clubs. Using the same approach, Armstrong (1995) and Kangasharju (1999) do not show evidence of convergence clubs for the regions of the EU during the period 1975-1992, and the regions of Finland during the period 1934-1993, respectively, whereas Artelaris et al. (2010) have found evidence of convergence clubs in many EU NMS during the period 1990-2005.

3. Regional Inequalities in Greece: Literature Review

Regional inequalities in Greece have been explored by several studies during last years leading to controversial results emerged from different databases, statistical/econometric methods and time periods of investigation. The vast majority of studies focus its analysis on single, rather than composite, indicators, and especially on per capita GDP.

A few studies show a narrowing of regional inequalities and a convergence process to be in motion. Giannias et al. (1997) for the period 1961-1991 and Liargovas et al. (2003) for the period 1960-2000 found reduction on regional inequalities at the NUTS II level, using the coefficient of variation. Their analyses are based not only on per capita GDP but also on a

large number of social variables. Christopoulos and Tsionas (2004), using a model that allows for the presence of technological gaps, detected strong evidence of convergence in productivity growth of NUTS III regions over the period 1971-1995. Petrakos and Saratsis (2000) showed the presence of both σ and (conditional) β -convergence using as dependent variable the household electricity consumption per inhabitant rather than per capita GDP. Furthermore, Michelis et al. (2004), focusing their analysis on the 1981-1991 time period, noticed the existence of both σ - and (unconditional and conditional) β -convergence for a wide variety of variables at the NUTS III level. Both unconditional and conditional convergence speed lie in the neighborhood of 1-2% per year with the exception of taxable income that was found around 6.5% per year. Finally, Karaganis and Artelaris (2005), concentrating on industrial sector during the period 1984-1998 at the NUTS III level, used the approach of GWR. This approach can produce local convergence speeds for each region and capture the spatial variations in convergence/divergence trend. The results revealed a wide geographical variation since the local convergence speeds were ranged between 1.8% and 5.6% per year.

In contrast, some other studies show evidence of divergence rather than convergence among Greek regions. Siriopoulos et al. (1997) rejected both β - (unconditional and conditional) and σ -convergence hypotheses for NUTS III regions during the period 1981-1991. Siriopoulos and Asteriou (1998) obtained the same results for NUTS II regions over the period 1971-1996, recognizing, furthermore, the presence of economic dualism between southern and northern Greece. Finally, Alexiadis and Tomkins (2004), using time series techniques for NUTS II regions over the period 1970-2000, rejected convergence hypothesis for all sample, indicating the existence of club convergence.

A controversial picture is emerged from a few other studies. Fotopoulos et al. (2002), examining regional disparities for NUTS III regions in the period 1970-1994, showed the presence of unconditional (2% per year) and conditional convergence (their speed depend on explanatory variables), and weak evidence of σ -convergence, while distribution analysis (Markov chains) did not reveal evidence of convergence. Similar results are reported by Tsionas (2002) at the NUTS III level since β -convergence (unconditional) analysis revealed convergent growth patterns (annual speed ranges from 2%, for the period 1971-1978, to 4%, for the period 1982-1993), while the evidence for σ -convergence is mixed. Moreover, Markov chain analysis showed evidence in favor of polarization and dualism for the entire period of analysis. Finally, Petrakos and Artelaris (2006) examined β - and σ -convergence hypotheses at the NUTS III level in the period 1990-2000, modifying the traditional β -

convergence model in order to take into account the relative population size of each region. The results indicated a clear widening of regional disparities.

4. Econometric Examination for the Existence of Regional Convergence Clubs in Greece

The estimation of β - and σ -convergence can offer the general trend concerning the level and the evolution of regional inequalities. This general trend, however, might give a misleading picture since it rules out the possibility that economies can form convergence clubs (Chatterji, 1992). Hence, regional inequalities can be evaluated in a more detailed and informative way, using the approach of regional convergence clubs, as proposed by Chatterji (1992). In essence, β -convergence analysis, as introduced by Barro and Sala-i-Martin (1992), has been modified and extended by Chatterji (1992) in order to incorporate the possibility of the existence of convergence clubs.

The examination for the existence of regional convergence clubs is based on the econometric estimation of the equation:

$$G_{F,l-r} = \sum_{k=1}^K \gamma_k (G_{B,l-r})^k \quad (1),$$

where B denotes the base (initial) year of estimation, F denotes the final year of estimation, l denotes the richest of the regions under consideration (lead region), r denotes all the regions under consideration (including lead region), G is the difference (gap) of the logarithms of the variable under consideration (i.e. per capita GDP) between the lead and each of the regions under consideration (including the gap between the lead region and itself), γ_k ($\gamma_1, \gamma_2, \dots, \gamma_K$) are the coefficients of G , and k ($1, 2, \dots, K$) are the powers of G . Thus, it is possible for a non-linear relation between the income gap (among the richest and the each of the regions under consideration) in an initial year and the respective gap in a final year to be found.

In contrast to the majority of the empirical studies in the convergence/divergence literature, the equation is econometrically estimated using the WLS (instead of the conventional OLS) method. OLS studies tend to overlook the relative importance or size of each region in the (inter)national setting, treating all regional observations as equal. Yet, regions (economies) vary widely in terms of (relative) population and this can produce unrealistic or misleading results (Petrakos et al., 2005). Even though comparisons are rarely

referred to similar-sized economies, this issue has, paradoxically, been almost completely ignored in the literature, especially at the regional level. The WLS method, however, is able to overcome this major drawback allowing regions to have an influence, which is analogous to their relative size, on the econometric results (Petrakos and Artelaris, 2009).

WLS allow regions (observations) to have an influence on the econometric results, according to their relative size, through the weight matrix W . The relative population of each region ($p_i = \frac{P_i}{\sum p_i}$) can be used as the diagonal element in the weighting non-singular positive

definite matrix $W_{n \times n}$, which has zero off-diagonal elements, as follows:

$$W_{n \times n} = \begin{pmatrix} p_{11} & 0 & . & . & . & 0 \\ 0 & p_{22} & . & . & . & 0 \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 0 & 0 & . & . & . & p_{nn} \end{pmatrix}$$

(2). In this case, the WLS estimator and the estimated covariance matrix are:

$$\mathbf{b}_{k \times 1}^{wls} = (\mathbf{Y}'_{k \times n} \mathbf{W}'_{n \times n} \mathbf{W}_{n \times n} \mathbf{Y}_{n \times k})^{-1} \mathbf{Y}'_{k \times n} \mathbf{W}'_{n \times n} \mathbf{W}_{n \times n} \mathbf{g}_{n \times 1}$$

(3),

and

$$\mathbf{V}(\mathbf{b}^{wls}) = s_{wls}^2 (\mathbf{Y}' \mathbf{W}' \mathbf{W} \mathbf{Y})^{-1}$$

(4),

respectively.

Prior to the estimation of the regional convergence clubs equation for the Greek case, one important remark has to be made. This remark concerns the “accuracy” of the data provided by the NSSG. The NSSG data for the capital region of Attiki, in particular, seem to be “incompatible” with the real-life situation since Attiki has “exported” a significant part of its industrial activity to its neighbouring satellite regions of Voiotia and Korinthia (see Petrakos and Psycharis, 2004). This is in order to avoid congestion costs and negative externalities and to exploit the incentives provided from the Greek governments for the decentralization of industrial activity. Though interesting, this might distort the picture obtained. Having no data for the regional counterpart of GNP makes it difficult to account for this caveat. One first attempt for the “correction” of the NSSG data was made from Petrakos and Psycharis (2004), which “attributed” a part of Attiki’s industrial product to the corresponding industrial products of Voiotia and Korinthia. After this “correction”, the industrial GDPs of Voiotia and Korinthia were no larger than the industrial GDPs of their neighboring regions. The present paper deals with this “incompatibility” concerning the regions of Attiki, Voiotia and

Korinthia as a single region (hereinafter: region AVK). On the basis of this standpoint, and for the needs of the present paper, Greece consists of 49 (and not 51) NUTS III regions.

Table 1 presents the results (p-values are in parentheses) of the econometric investigation for the emergence of regional convergence clubs, in per capita GDP terms, among the NUTS III regions of Greece, during the period 1995-2005. The dependent variable of the regional convergence clubs equation is the GDP per capita gap (between the richest region and each of the regions under consideration) in the year 2005 (G_{2005,l_r}) and the independent variable is the respective gap in the year 1995 (G_{1995,l_r}). The lead region is considered to be the region of AVK since this was the richest region in the year 2005, the final year of the analysis (the richest region in the year 1995, the initial year of the analysis, was the region of Kozani; the region of AVK held the 3rd place in the ranking, following the region of Evvoia). The variable of regional population in the year 1995 ($POP_{1995,r}$) is the weighting variable. Since considerable multicollinearity between the various powers of the independent variable makes difficult the choice of the best parsimonious estimation (Chatterji, 1992; Chatterji and Dewhurst, 1996), the final specification of the equations was made under the rule of dropping the statistically insignificant terms. When two or more equations had statistically significant coefficients, the specification with the lowest figure of the AIC (Akaike, 1973) was chosen. Under these rules, the third power regional convergence clubs equation was chosen.

Table 1: Convergence clubs among the NUTS III regions of Greece (final per capita GDP gap on initial per capita GDP gap), Period 1995-2005

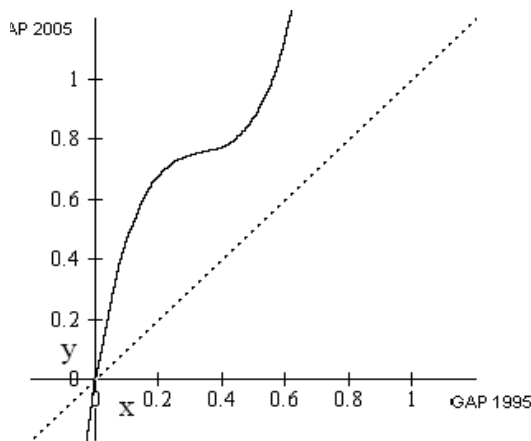
$G_{2005,l_r} = \sum_{k=1}^K \gamma_k (G_{1995,l_r})^k$			
GAP2005 = = 17.758 GAP1995^3 – 17.928 GAP1995^2 + 6.278 GAP 1995			
	(0.006)***	(0.000)***	(0.000)***
$R_{adj}^2 = 0.737$			
F-statistic = 119.510 (0.000)***			
weighting variable: $POP_{1995,r}$			
N = 49 observations (NUTS III regions)			
*** statistically significant at the level of 1%			

Source: NSSG data / Authors' Elaboration

The overall explanatory power of the model is very satisfactory. The R_{adj}^2 figure is relatively high for cross-section data and the independent variable has a statistically significant impact (at the level of 1%) in all powers.

Figure 1 depicts the estimated function. Having the function $y = x$ as a benchmark (see the dotted straight line), it is evident that all Greek regions diverge from the lead region (the region of AVK) during the period 1995-2005. This is because the per capita GDP gap in the final year is higher comparing to the respective gap in the initial year (the line of the estimated function is above the line of the benchmark function; see the upper right quadrant). Indeed, the first derivative of the function $y = 17.758x^3 - 17.928x^2 + 6.278x$ is always positive and this means that when the initial gap increases the final gap also increases.

Figure 1: Convergence clubs among the NUTS III regions of Greece (final per capita GDP gap on initial per capita GDP gap), Period 1995-2005

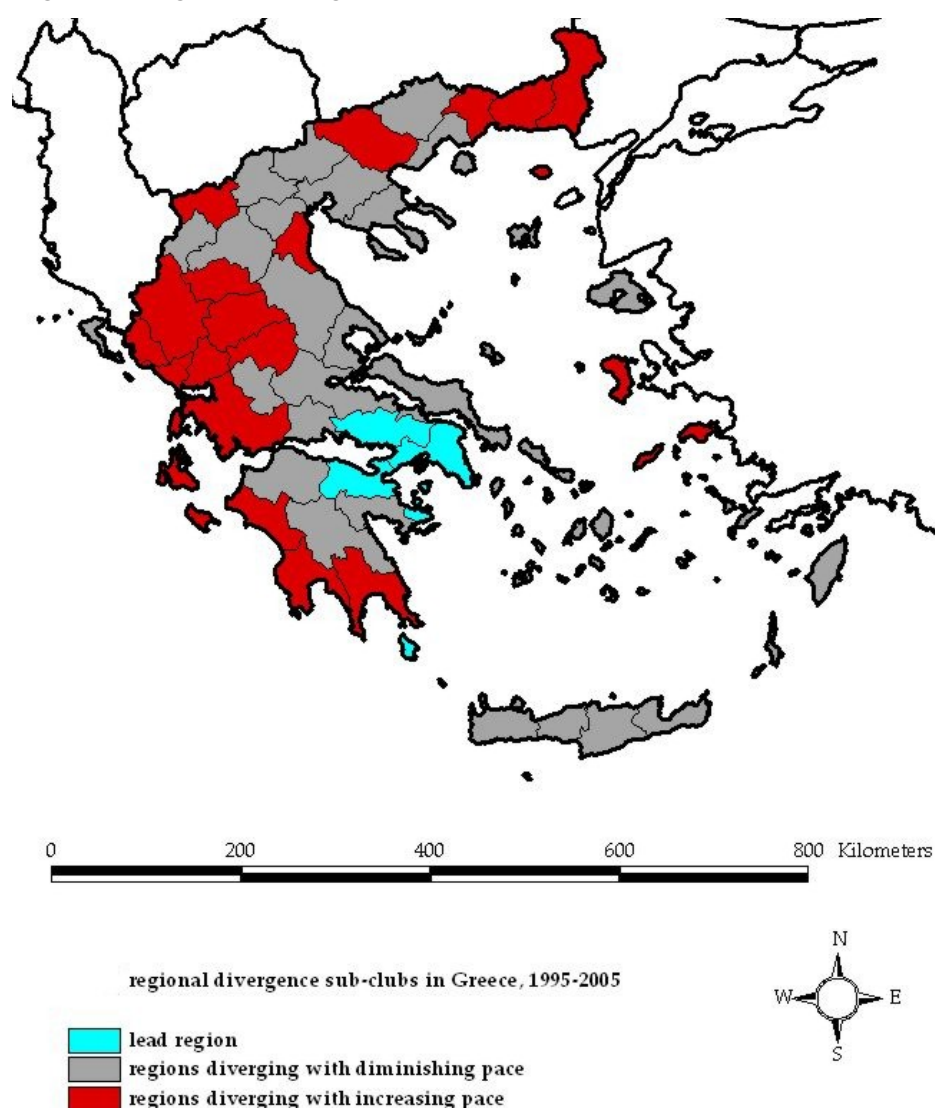


Source: NSSG data / Authors' Elaboration

Observing the graph of the estimated function, evident is the change in convexity. Thus, concerning the present analysis, regional divergence sub-clubs are possible to be found. Indeed, estimating the second derivative of the aforementioned function, it is proved that when the initial gap is lower than 0.337 the function is concave down (since the second derivative is negative) and when the initial gap is higher than 0.337 the function is concave up (since the second derivative is positive). This means that up to a level of initial gap equal to 0.337, when the initial gap increases the final gap increases with a diminishing pace. After

this level, when the initial gap increases the final gap increases with an increasing pace. This means that divergence, with region AVK, follows a diminishing pace only when the initial gap is lower than 0.337. In contrast, divergence, with region AVK, follows an increasing pace when the initial gap is higher than 0.337 (this is the situation for the regions of Karditsa, Messinia, Xanthi, Trikala, Aitoloakarnania, Zakynthos, Kefallinia, Samos, Pieria, Evros, Preveza, Ioannina, Florina, Lakonia, Serres, Lefkada, Grevena, Thesprotia, Chios, Arta, Ileia, and Rodopi). Thus, as it is depicted in Figure 2, in an, overall, context of divergence (from the lead region), dualistic phenomena can be, further, observed among the Greek regions.

Figure 2: Regional divergence sub-clubs in Greece, Period 1995-2005



Source: NSSG data / Authors' Elaboration

5. Conclusions

The findings of the paper do not verify the existence of regional convergence clubs in Greece, during the period 1995-2005. In contrast, they reveal clear trends of divergence (identifying, additionally, sub-clubs of divergence). This verifies the pro-cyclical pattern of regional inequalities in Greece, detected in earlier studies (Lyberaki, 1996; Petrakos and Saratsis, 2000). In a period that Greece exhibited high rates of growth, in comparison to its European counterparts, under the prospect of the EMU accession and just after the accession, regional inequalities tend to increase. This reveals that the Greek governments have (diachronically) underestimated the importance of regional problem in Greece (see Petrakos and Psycharis, 2004). The increase of the income gap between the richest and the other parts of Greece causes reasonable and understandable concerns and questions regarding the effectiveness of the Greek regional policy.

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Abbreviations

- AIC = Akaike Information Criterion
- AVK = the single region of Attiki, Voiotia and Korinthia
- EMU = Economic and Monetary Union
- EU = European Union
- EU NMS = new European Union member states
- GDP = Gross Domestic Product
- GNP = Gross National Product
- GWR = Geographically Weighted Regressions

NSSG = National Statistical Service of Greece

NUTS = Nomenclature of Territorial Units for Statistics

OLS = Ordinary Least Squares

R & D = research and development

UK = United Kingdom

USA = United States of America

WLS = Weighted Least Squares