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RECESSION IN ACTION: EXPLORING THE SPATIAL DIVERGENCE OF PER-CAPITA INCOME IN GREECE

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Abstract

The present study evaluates changes in the economic performance of 51 prefectures in Greece along 2000-2012 with the aim to explore the impact of recession on disparities between coastal/urban and inland/marginal areas. An exploratory data analysis was used to investigate specific development paths for homogeneous groups of regions. To debate on the recession's impact on the increasingly complex geography of economic development in Greece, this approach has been preferred to more traditional procedures based on convergence analysis on income level and changes over time. Our results outline the existence of a time period with generalized economic growth between 2000 and 2008 reflected into a quasi-normal distribution of per-capita income among regions and increased territorial disparities. This period preceded economic stagnation (2009-2012) producing an asymmetric distribution of regional income although with moderate disparities among prefectures. Spatial dynamics in per-capita income indicate that lower-income regions are less sensitive to short-term shocks responding better to the current recession (i.e. with a moderate decrease or even with a slight increase of per-capita income). These evidence contrast with recent literature indicating how dynamic and affluent regions (metropolitan zones, manufacture districts and tourism-specialized areas) resulted to be

less exposed to external shocks than disadvantaged regions. Our evidence have implications for regional science claiming for a 'turning back' to the economic geography of regional disparities in highly polarized countries, especially focusing on the different impact of growth and recession.

Keywords: Prefectures, Development, Exploratory data analysis, Gradient, Southern Europe

JEL: C38, O18, O52, R11, R15, R58

1. Introduction

Recent literature recognizing in the global crisis from 2008 to present a potential, major turning point in regional economic systems, has developed a reflection on convergence issues dealing with regional disparities, providing operational definitions and advanced analysis' techniques and possibly offering a cultural challenge in regional science (Storper, 2011). While being theoretically reconnected with the convergence problem (i.e. a country/region growing faster than others), economic theory has long been aware of this problem and various explanations to asymmetric regional growth have been provided in the past (Barro and Sala-i-Martin, 2004 for a review). The optimistic view predicting that a contiguous set of countries (or regions) will tend to assume a common level of output per-capita in the presence of constant returns to scale and decreasing productivity of capital is only partly supported by empirical studies showing contrasting - and often less optimistic - results (Dixon et al., 2001; Ezcurra et al., 2007; Liao and Wei, 2012; Fratesi and Percoco, 2013). It was demonstrated how processes of economic convergence produced only a partial reduction of territorial disparities even in affluent regions (Arbia and Paelinck, 2003).

In last decades, studies on convergence in regional income have experienced a growing interest in Europe since the unification process and the narrowing of regional disparities were regarded as fundamental objectives for the European Union policy (Davoudi, 2005; Van Well, 2012; ESPON, 2014). However, several exceptions still persist at the continental scale; one example is southern Europe, where important social and economic disparities can be observed among neighbouring regions (Cuadrado et al., 1999; Leontidou et al., 2001; Giannakourou, 2005). Marginal, inland rural areas in Portugal, Spain, Italy, Greece and Turkey exhibit less dynamic economic structures due to the limited chances to a rapid growth (King et al., 2001). Recent studies have challenged this perspective focusing on macro-scale factors such as urban hierarchy, housing systems, market-state interactions, welfare regimes and institutional changes as driving forces of regional disparities (Terrasi, 1999; Lois, 2009; Kyriakou and Roca Sagales,

2014). However, slow changes in the economic base, de-population and poor human capital remain the most relevant factors consolidating the gap with affluent and more accessible regions, generally located along coastal areas and around metropolitan districts (Prodromidis, 2014).

Being negatively impacted by recession, Greece - like other Mediterranean countries such as Italy and Spain (Benyaklef, 1997) - is actually one of the most disadvantaged economy in Europe with evident regional disparities. Despite the economic growth stimulated by Olympic games and boosting the public debt, the subsequent economic stagnation produced moderate changes in the productive structure at both national and regional level. Such conditions seem to be peculiar at the European level because of the short-term recession impact on the social context, with e.g. general unemployment rate growing up to 26% and young unemployment rate reaching 50%.

The recent economic development in Greece provides a unique opportunity for examining the short-term sensitivity of regional systems to expansion and recession verifying as well the crisis' overall impact on regional disparities. Our approach, based on exploratory data analysis, benefits from a time-series of per-capita income disseminated annually, since 2000, by the Hellenic Statistical Authority at an enough detailed spatial scale, allowing accurate analysis of growth and recession dynamics. The approach proposed attempts to overcome the supposed limits of both descriptive and econometric perspectives. Overcoming these criticisms, our approach was understood to refer to the district economic performances taken as a powerful factor influencing the potential for reducing regional disparities. Temporal variations in regional per-capita income can be interpreted as an implicit indicator of resistance to economic shocks (below-average reduction in a given district) or post-shock recovery (above-average increase in a given district). Their evolution over time was seen as a proxy indicator of resilience to recession. This approach provides further insight in the geography of economic development pointing out the variables contributing to the consolidation of regional disparities in Greece.

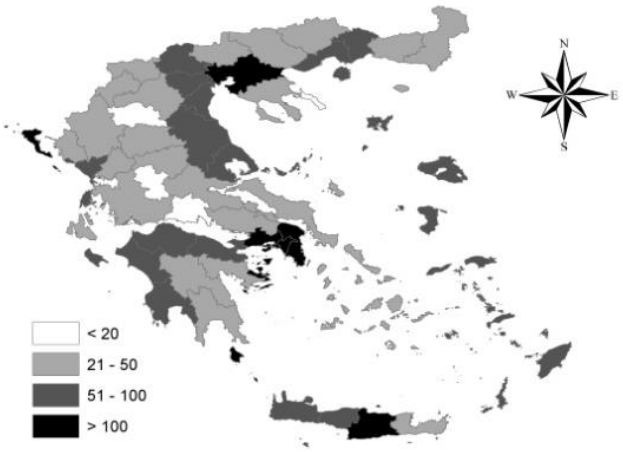
2. Methods

2.1. Study area and income data

The examined area covers the whole of Greece (131,982 km^2). Our observation units are the 51 prefectural departments (nomoi in greek) corresponding to the NUTS-3 hierarchical level of the European Union (Figure 1). Prefectures in Greece reflect homogeneous areas from the administrative (and possibly economic perspective) at an enough detailed spatial scale allowing to identify the role of some key geographical gradients (e.g. urban-rural, coastal-inland). The

Greek urban system centred on three metropolitan areas (Athens, Salonika and Iraklio) and several medium-size cities (including Patra, Larissa, Volos, Kalamata, Chania, among others) is satisfactory outlined by the administrative partition selected in this study, as illustrated in Figure 1 using population density as proxy of the urban-rural gradient. Internal, rural areas are exposed to depopulation and contrast with more dynamic, tourism-specialized coastal regions, including islands in both Ionian and Aegean sea. Per-capita income (euros) has been made available at the prefectural level from data provided by the Hellenic Statistical Authority (ELSTAT) referring to the time-series encompassing 13 years between 2000 and 2012.

Figure 1. Population density (2011) in Greek prefectures



2.2. Statistical analysis

The present study proposes an analysis' framework integrating descriptive statistics and multivariate techniques. Eleven indicators were calculated from the database described above with the aim to assess the concentration (or dispersion) of regional per-capita income towards a progressive spatial equilibrium condition. These indicators elaborate the spatial series of data on per-capita income for each prefecture and year identifying measures of central tendency, indexes of dispersion, skewness and kurtosis, as well as turning points in municipal time series.

Indicators include: (i) the percent annual change in per-capita income (Chg), (ii) the coefficient of variation (%) of regional per-capita income (CV), (iii) the absolute range (euros) between the maximum and the minimum observed per-capita income at the prefectural scale (Ran), (iv) the range between the maximum and the minimum observed per-capita income at the prefectural scale (euros) normalized to the median income (Med), (v) the ratio of median to arithmetic average per-capita income (Nor) taken as an index of normality of the spatial

distribution of incomes by prefecture, (vi) the skewness of income distribution at the prefectural level (Ske); (vii) the kurtosis of income distribution at the prefectural level (Kur), (viii) the ratio of harmonic mean to geometric mean (Har) and, finally, (ix) the reciprocal of the Pearson's correlation coefficient (Pea) between the spatial series of income at time t and t + 1. Pea index pinpoints the major points of discontinuity in the time series: positive values around zero indicate a substantial uniformity in the spatial distribution of per-capita income at the regional level, while progressively greater positive values indicate increasing deviations from the spatial distribution observed in the previous year, suggesting the existence of processes of income redistribution at the regional scale.

A Principal Component Analysis (PCA) has been performed on the values of the nine indicators described above available for the 13 observation years. Multivariate analysis was used to reduce redundancy among measures and to assess the relation between indicators over time by identifying few latent factors, as a possible contribution to the study of the evolution of per-capita income disparities in Greece. A hierarchical clustering (Euclidean distances, Ward's agglomeration rule) was developed on the original data matrix reporting standardized per-capita income by year and prefecture. Dendrograms were used to illustrate clustering outcomes for both years and prefectures. Greek prefectures were further classified in two groups (higher- and lower-income) based on per-capita income level observed in 2000 with a threshold fixed to 11,000 euros per-capita. A Mann-Whitney non-parametric statistic was used to test for significant differences in the distribution of per-capita income between rich and poor prefectures. Two PCAs were run on the nine indicators described above available for the 13 observation years separately for higher-income and lower-income prefectures.

3. Results

3.1. Descriptive statistics

The average per-capita income by prefecture in Greece increased between 2000 and 2008 by 48% passing from less than 11 thousand euros to more than 17 thousand euros during eight years. Income declined rapidly in the subsequent four years (-23%) reaching 13.8 thousand euros per-capita in 2012 (Table 1). The income coefficient of variation was rather stable in the growth phase (ranging between 22% and 24%) decreasing to 20% in the recession phase. The statistical distribution of regional per-capita income in Greece was illustrated in Figure 2. In 2000, the statistical distribution of regional income was relatively uniform with 44 prefectures below 14 thousand euros per-capita. In 2008, the distribution was quite normal below 22 thousand euros

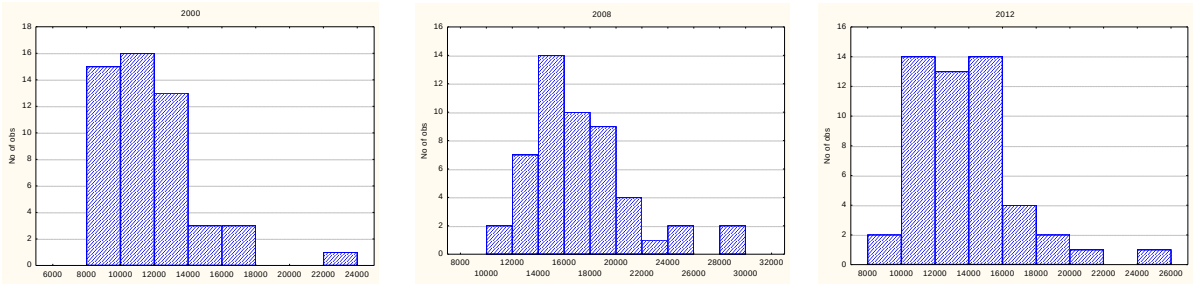
with an upper tail composed of five high-income prefectures. In 2012, regional income concentrated in the range 10-16 thousand euros per-capita with an upper tail composed of five medium-income prefectures.

Table 1. Selected indicators of the statistical distribution of per-capita income (euros) in Greek prefectures by year

Year	Average income[1]	% change	CV[2]	maximum-minimum	max-min/median	median/average[c]	Inverse Pearson[d]	Skewness	Kurtosis	Harmonic/Geometric average
2000	10981	-	23.9	12422	1.21	0.938	-	1.4	2.3	0.978
2001	11813	0.08	23.7	14147	1.30	0.918	0.010	1.5	3.1	0.979
2002	12330	0.04	22.3	13291	1.17	0.924	0.014	1.2	1.7	0.980
2003	13549	0.10	22.8	14192	1.13	0.931	0.011	1.1	1.3	0.979
2004	14378	0.06	22.9	13697	1.00	0.957	0.013	1.1	1.0	0.979
2005	14805	0.03	23.1	14979	1.02	0.988	0.013	1.1	1.3	0.978
2006	15792	0.07	23.4	15596	1.04	0.954	0.014	1.0	0.7	0.977
2007	16744	0.06	22.8	16506	1.00	0.986	0.011	1.0	1.2	0.978
2008	17367	0.04	22.3	17522	1.03	0.983	0.006	1.1	1.3	0.979
2009	16927	-0.03	21.9	17337	1.05	0.977	0.015	1.2	1.6	0.980
2010	16158	-0.05	20.7	16374	1.02	0.991	0.015	1.4	2.5	0.983
2011	14763	-0.09	19.8	15063	1.03	0.986	0.013	1.5	3.6	0.985
2012	13807	-0.06	19.8	14444	1.05	0.993	0.013	1.5	3.3	0.984

[1]Arithmetic average, [2]Coefficient of variation, [3]Arithmetic average, [4]Pearson correlation coefficient.

Figure 2. Statistical distribution of per-capita income in Greece at three different points in time (left: 2000, middle: 2008; right: 2012)



The statistical distribution of per-capita income at the prefectural level by year was analyzed using a Box-Wisher plot (Figure 3). This plot indicates a more regular distribution centred around the median value at the end of the growth period and a reverse trend - albeit less intense - in the recession phase. The spatial distribution of per-capita income in Greece (Figure 4) highlights the urban-rural gradient centred on Athens and, more generally, central Greece and

Aegean islands, being the only prefectures with average per-capita income encompassing 15 thousand euros. The number of prefectures with income > 15 thousand euros per-capita increased drastically in 2008 evidencing the divide between coastal/island prefectures, internal lowland with agriculture intensification, urban systems and marginal rural areas. The prefectures hosting large urban areas or with tourism specialization were the only regions maintaining an average per-capita income higher than 15 thousand euros.

Figure 3. Box-Wisher plot of the statistical distribution of per-capita income (euros) in Greece by year

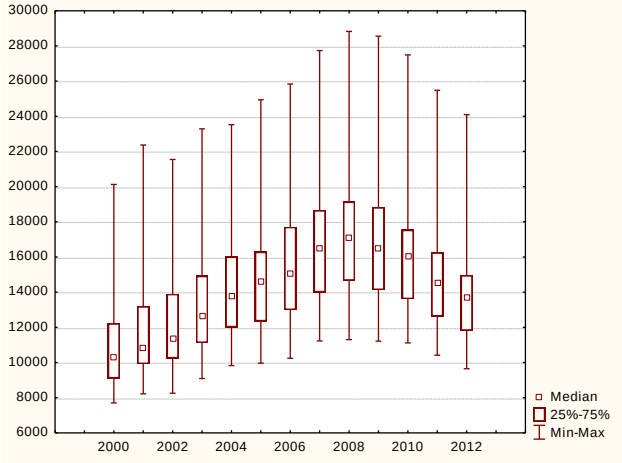
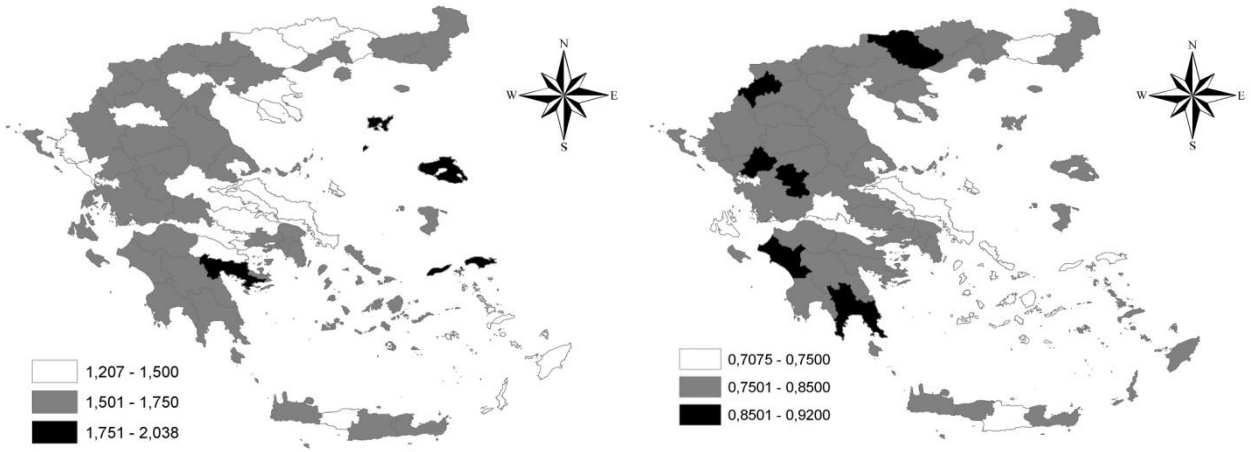


Figure 4. The spatial distribution of per-capita income (euros) in Greek prefecture by year and time interval

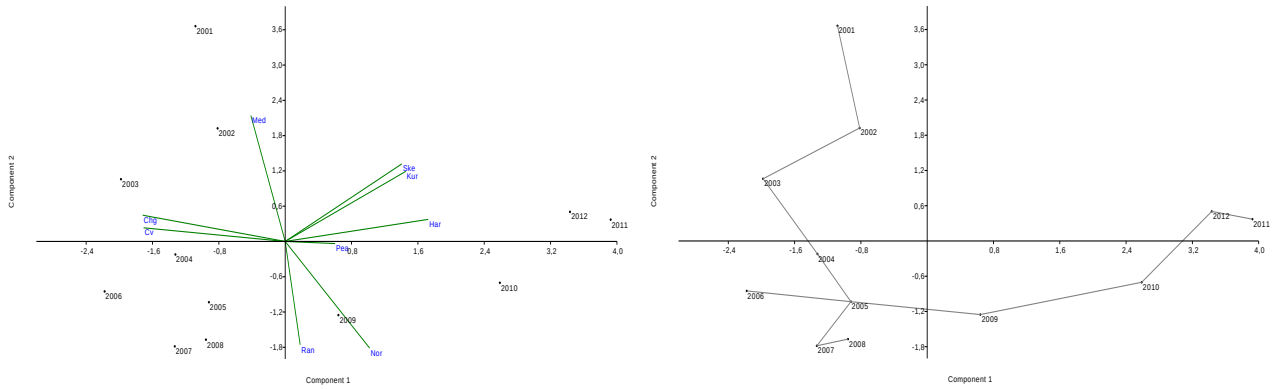
2000 2008 2012



3.2. Principal Component Analysis

Principal Component Analysis illustrated the recent changes in the economic geography of Greek prefectures based on the nine indicators (see table 1) assessing the statistical distribution of per-capita income between 2000 and 2012. The first two PCA axes extracted respectively 50.6% and 28.8% of the total variance (Figure 5). Component 1 shows the opposition between indicators of statistical asymmetry (Har, Ske, Kur) and indicators of economic dynamics and spatial variability (Chg, CV). Component 2 outlines the opposition between absolute range (Ran) and normalized range (Med) measures together with a normality indicator (Nor). Two groups of investigated years are discriminated along the two components. The economic dynamics during the growth phase encompassing 2000-2008 is captured by axis 2 (moving from positive to negative scores on the axis). On the contrary, the economic dynamics during recession are represented along axis 1, moving from negative to positive scores. By evaluating component's loadings and scores jointly, the growth period is characterized by a moderate widening of regional disparities in per-capita income in Greece in turn producing a more homogeneous statistical distribution at the prefectural level. By contrast, the recession period was characterized by a reduced heterogeneity in the spatial distribution of per-capita income, producing less intense disparities in turn associated to an increased asymmetry in the statistical distribution of income, based on higher skewness and kurtosis.

Figure 5. Principal Component Analysis of time trends in per-capita income at the prefectural level in Greece (left: component loading plot; right: component score plot with 2000-2012 time path highlighted)

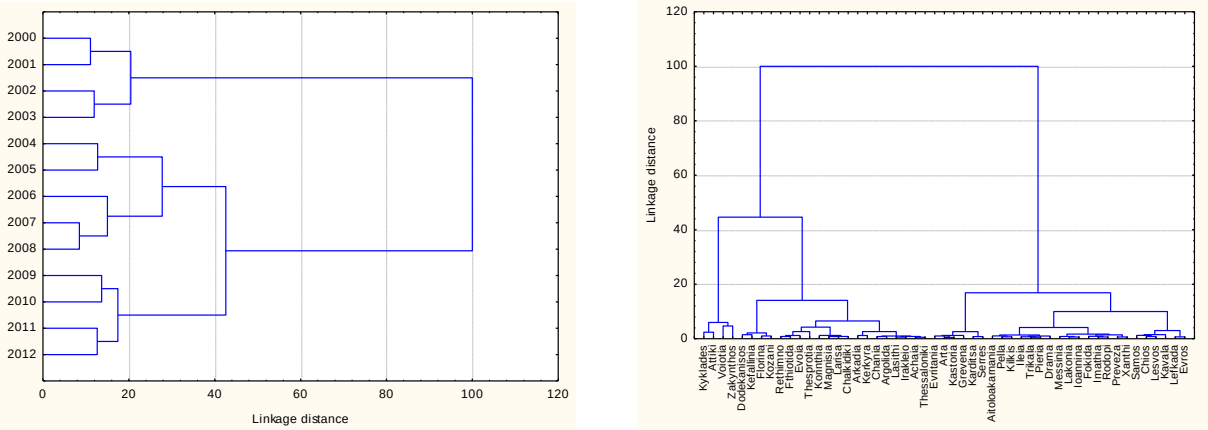


3.3. Hierarchical clustering

Hierarchical clustering produced a classification of the temporal units (years) and spatial units (prefectures) into homogeneous groups (Figure 6a). Ward's clustering dendrogram outlines three groups of years with homogeneous spatial patterns in terms of changes in per-capita income: (i) 2000-2003; (ii) 2004-2008 and (iii) 2009-2012. These evidence clearly highlight the distinction - well outlined by both descriptive statistics and the PCA - between a growth phase and a recession phase with contrasting implications on income disparities at the regional level in Greece. At the same time, the growth phase (2000-2008) was in turn classified into two sub-periods with distinct rates of growth and normalized range dynamics in per-capita income. In 2004-2008 period regional income disparities increased the most as the following analysis reveals.

Based on the classification of temporal units, hierarchical clustering partitioned Greek prefectures in two homogeneous spatial groups using a 50% linkage distance cut-off (Figure 6b). The left group of prefectures in the dendrogram (from Kyklades to Thessaloniki) includes urban, peri-urban, coastal and internal lowland areas with a dynamic economic context, a diversified production base, specialization in tourism. The group includes the main urban areas in Greece (Attica, Salonika, Iraklio, Patra, Larisa, Korinthia, Chania, Rethimno), some important tourism destinations (Kerkyra, Kyklades, Zakynthos, Dodekanisos, Kefallinia, Evoia, Magnisia, Chalkidiki, Lasithi) and economically-viable agricultural districts (Voiotia, Florina, Kozani, Arkadia, Argolida). The right group from Evritania to Evros includes less dynamic, rural and remote prefectures with low accessibility and poorly diversified economic base. Taken together, hierarchical clustering well depicts the economic geography of Greece identifying in the urban-rural gradient and in the coastal-inland gradient the most relevant factors shaping structural disparities in per-capita income, being only partly influenced by short-term economic growth and recession phases.

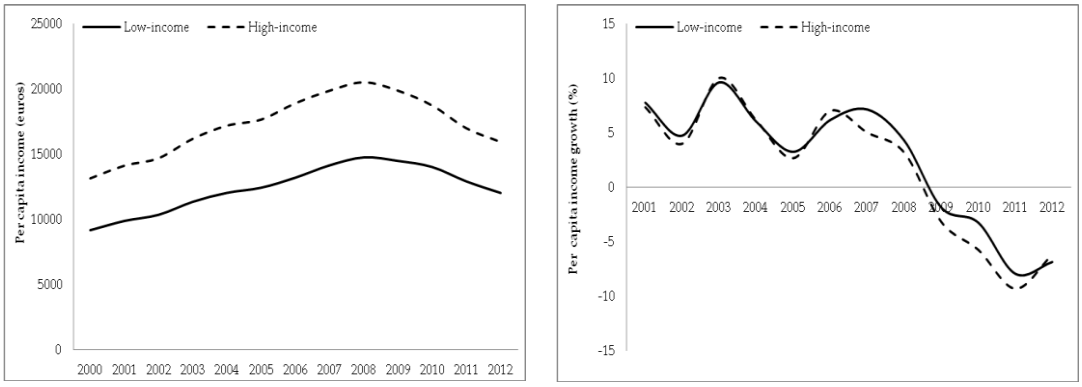
Figure 6. Hierarchical clustering of per-capita income in Greece (2000-2012) by year (left - 6a) and prefecture (right - 6b)



3.4. Exploring the economic performance of high-income and low-income areas

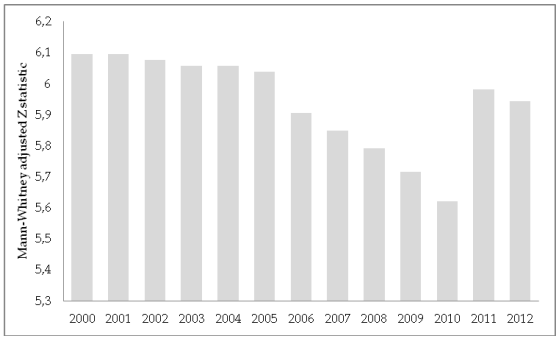
By classifying Greek prefectures into higher-income and lower-income areas according to the criterion presented in the methodological chapter, trends over time in per-capita income clearly outline the increased regional disparities observed between 2000 and 2008 and a reverse pattern for the subsequent years (Figure 7). While being quite comparable in the growth period, per-capita income increased less in higher-income areas than in lower-income areas in the time interval encompassing 2007-2012; this contributed to mitigate regional income disparities in Greece.

Figure 7. Per-capita income trend over time in lower- and higher-income prefectures (left: absolute level by year; right: percent change by year)



The statistical distribution of per-capita income at the prefectural level in Greece shows significant differences (Mann-Whitney U test, $p < 0.001$) between higher-income and lower-income prefectures for all years examined (Figure 8). However, the lowest values of the U test - indicating less significant differences between the two statistical distributions analyzed - were recorded at the end of the growth period, from 2006 and 2010. These evidence confirm that the impact of economic growth in terms of spatial income patterns was rather similar in more and less dynamic areas of the country, with more evident differences observed during recession.

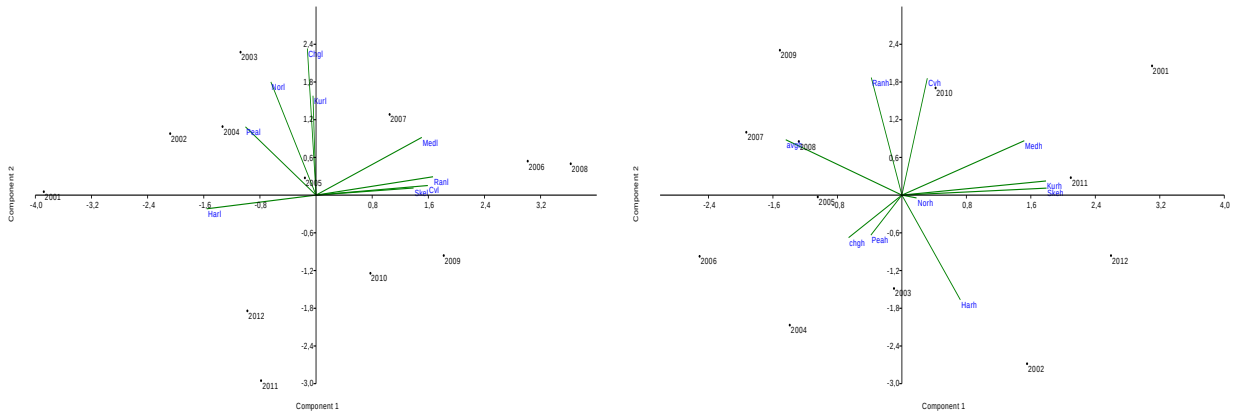
Figure 8. Mann-Whitney non-parametric statistics testing for differences between per-capita income (euros) in higher- and lower-income prefectures in Greece by year (all statistics are significant at $p < 0.001$)



A PCA applied separately to the sub-samples of Greek prefectures indicate a quite distinct growth pattern in higher-income (n = 23) and lower-income (n = 28) areas. In lower-income prefectures, PCA extracted 76.1% of the total variance along the first two axes which represent the economic path towards spatial heterogeneity (Ske) and divergence (Ran) in per-capita income during 2000-2008 (component 1) and the recession phase - characterized by a decreased asymmetry in the income spatial distribution - along component 2. In higher-income prefectures, PCA extracted 63.8% of the total variance along the first two axes indicating a more complex and mixed spatio-temporal pattern. Component 1 represents an asymmetry axis characterizing the

first and the last observation years (e.g. 2001, 2011, 2012). Component 2 illustrates a variability gradient, with the highest and lowest differentiation in per-capita income observed respectively in 2010 and 2003. Taken together, our results indicate that the lower-income sub-sample showed a spatio-temporal pattern coherent with what was found at the country level. The higher-income sub-sample showed a more heterogeneous pattern with fast-growing regions (especially coastal and island prefectures where the economic structure is centred on tourism) and moderately-growing regions (the urban area of Athens, Salonika and Iraklion together with few prefectures with industrial specialization and/or high-income agriculture).

Figure 9. Principal Component Analysis run on indicators of per-capita income spatial distribution in Greece by year



4. Discussion

The persisting disparities derived from the asymmetric growth of wealthier and emerging regions seem to be exalted or recomposed in the recent decades according to a number of external factors linked to the economic structure, the socio-demographic context and more general territorial conditions (D'Uva and De Siano, 2011; Lee, 2012; Storper, 2014). In many cases, traditional gaps consolidated and new disparities emerged as the results of a polarized development driven by the unbalanced spatial distribution of the economic capital, human skills and natural resources, among others (Dunford, 2008; Felice, 2010, Kroll and Kabisch, 2012).

The present study provides insights in the analysis of local development in a divided European country such as Greece exploring the performances of 51 prefectures in two recent periods with contrasting development paths (economic growth: 2000-2008 and recession: 2009-2012). This study introduces an exploratory perspective in the analysis of economic disparities by investigating the spatio-temporal dynamics of per-capita income, a highly sensitive indicator to

external shocks (D'Agostino and Scarlato, 2015). The spatial dynamics of per-capita income has been interpreted as a possible measure of regional resilience, investigating as well some selected characteristics of the districts that have experienced the best results along distinct economic phases (Taulbut and Robinson, 2015). By considering an enough detailed spatial unit of analysis and a key economic indicator into a diachronic, exploratory approach, the paper emphasizes the short-term role of growth and recession in shaping regional disparities in Greece.

Despite criticisms concerning the relevance of the administrative districts as homogeneous economic areas, the spatial unit selected in the present study (51 prefectures) demonstrated to be enough detailed to illustrate the main geographical gradient shaping regional disparities existing in Greece (see evidence from hierarchical clustering) showing at the same time appreciable features that fill the need for data integration, reliability and relevance to regional issues (Zuindeau, 2006). Coastal-inland and urban-rural gradients reveal as key factors shaping disparities in per-capita income, indicating at the same time different development paths considered as primary targets for integrated socioeconomic developmental policies (King et al., 2001; Pellegrini, 2008; Patacchini, 2008).

Results highlight the increasingly complex, post-recession economic geography of Greece offering contrasting evidence on actual convergence/divergence processes in the country (Arbia and Paelinck, 2003; Proietti, 2005; Patacchini and Rice, 2007; D'Uva and De Siano, 2011). Our data indicate that the income gap among regions increased moderately during the expansion phase (2000-2008) and reduced quite rapidly in the most recent years possibly due to the impact of recession. In the growth phase, identified in the time interval encompassing 2000 to 2008, per-capita income grew especially in urban and peri-urban prefectures, coastal/island regions and in internal lowland with intensive agriculture. The reverse spatial pattern was observed in the subsequent recession phase (2008-2012) with the lowest income decrease observed in marginal, disadvantaged and internal rural regions. These dynamics have had contrasting - and possibly counterintuitive - impacts on the disparities between structurally-rich and poor areas in Greece pointing out how the economic growth has exalted the divide between rich and poor regions and how the recession has finally reduced this gap. These evidence suggest how 2008 was a coherent turning point between a slow divergence in higher- and lower-income areas to a more heterogeneous - and possibly mixed regime - with economically-wealthier districts being more exposed to recession and disadvantaged regions being less affected by crisis (Prodromidis, 2014).

While in other countries recession has undoubtedly created favourable conditions for a process of divergence between wealthier regions - better protected from the adverse crisis' impact

- and economically weaker districts (Lee, 2012), our results are in partial disagreement with these evidence indicating how poor and marginal regions with the productive base mainly centred on agriculture, low-specialized services and fragmented industrial activities may be more resistant to external shocks in the short-term. Further investigation is needed to verify if the same pattern will be observed in the medium-term and if changes in the regional production base or spatial redistribution policies - if any - will impact positively the country's competitiveness without depressing further rich and dynamic regions.

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