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14

The Evolution and Spatial Dynamics of Coastal Cities in Greece

Serafeim Polyzos and Dimitrios Tsiotas
Department of Planning and Regional Development, University of Thessaly, Greece

1. Introduction

The procedure of human evolution has been always connected with the concepts of space and time. Communities that existed in the same chronological period in different geographic locations, such as communities that existed in the same geographic location at different eras, present various patterns of development. This statement indicates, on one hand, the significance of the spatial parameter to the Economic and Regional Analysis and, on the other hand, the directions that the Economic Research should be oriented to, in order to provide more complete outcomes. From the amount of spatial attributes that a geographic location may possess, the present article deals with the coastal one. Coastal areas have played diachronically a leading role to the development of human civilization, ought to their geographical characteristics, focused on to the seaside location , which provides many transportation advantages, such as development of ports (Li, 2003), commodity (trade development) (Cori, 1999) and also environmental advantages, such as mild climate and natural beauty (Yeung, 2001). The purpose of this chapter is to study the evolution and the spatial dynamics of coastal cities, through a spatial, statistical and regional analytic approach, in order to recognize and to interpret the patterns that describe this evolution, under the regional economic and policy perspective.

In particular, the chapter focuses on the case of Greek coastal cities (Polyzos et al., 2011), as it follows. First of all, this choice is considered by the authors to be a challenge, since the case of Greek coastal cities lies under the individuality of not presenting extended population coverage, agglomeration or demographic mega phenomena. This fact differentiates the performance of the Greek coastal system from other cases' and sets an inverse scaling transformation to the until now research findings of this field (Yeung, 2001; Sheng Han and Yan, 1999; Li, 2003; Sekovski et al., 2011). Secondly, the case of studying a recent Greek spatial and economic system is particularly up to date, by the time that Greece is currently being subjected to an economic crisis (considered from many to be an introducing crisis to the European economic system), fact that is expected to reveal some vital axes in order to comprehend the developmental potentials of the Country. Another reason is the authors' Greek parentage, which sets the Greek case to be a familiar research field. Finally, although the research on coastal cities' dynamics presents an efficient scientific matter (Miller & Auyong, 1991; Cori, 1999; Yeung, 2001; Li, 2003), so in Global as in

Mediterranean scale, the analogue Greek research can be characterized springtime, fact that sets the utility of this chapter to be considered introducing.

1.1 Definitions and conceptual framework

The concept of "coastal city" includes two semantic components, at first the significance of "coastal" and secondly the concept of "city". Consequently, a single definition of a coastal city cannot be easily derived, since it suggests a synthetic notion, which depends on the concessions that regard the corresponding components (Sekovski et al., 2011). The coastal component refers to a residential entity's spatial attribute, which depends on the distance and the elevation that this entity possess from the sea. This definition contains, a priori, a degree of subjectivity that is based on the conventions held each time (Klein et al., 2003). In international level, coastal regions suggest a 40-mile wide zone from the coastline (Cori, 1999), but this definition lacks from spatial rigidity. Regarding Greece, the elevation parameter does not suggest a concern, because Greek coastal morphology does not present, in the majority of instances, precipitate and inaccessible shapes, so as the most of the coastal city formations have direct projections to the seaside. The distance parameter was studied for Greece in the past and concluded to a classification (Kiousopoulos, 2008), under which coastal areas can be divided into three (3) categories: (a) the spatial units that have direct contact with the sea (are littoral), (b) spatial units that lack direct contact but are adjacent to littoral (having an easy access to the sea) and (c) these spatial units which are deprived of any contact with the sea.

As far as it concerns the conceptual component of "cities", similar problems of subjectivity arise. In the international literature, there is an inconsistency about the volume of the population threshold that classifies a (coastal) city to be considered "megacity". Some suggestive values for this threshold are recorded to be 1, 8, and 10 million inhabitants (Cross, 2001). Regarding the Greek case, the urban units of "Athens" and "Thessaloniki" fulfill the population criteria of the first mentioned threshold value, so as to be considered "megacities". In the present study "Athens" and "Thessaloniki" are not defined as megacities, so as the component cities of these units can be examined separately, ought to the limited scale effect of Greece.

This acceptance was held due to the previous megacity threshold argument and due to the fact that, if it is considered that these two Greek city clusters of "Athens" and "Thessaloniki" as urban units, then the coastal cities number, with a significant population coverage, is considerably being reduced. Furthermore, the criteria of defining residential units as "cities" are respectively fuzzy. This subjectivity is managed in international and national levels through conventional acts, such as laws. According to the United Nations' perspective for large scale cities, the term "megacities" regards urban agglomerations with at least 10 million inhabitants (Sekovski et al., 2011). In the Greek legislation status, the corresponding conventional act that defines Greek cities and provides a city sizing discrimination is the Act 3643/2006.

1.2 History

The developmental dynamics of coastal cities became significant at the period that urbanization trends appeared, with a result to rearrange the spatial population distribution

status (Roberts, 1989). Urbanization suggested the phenomenon of abandoning the rural areas and settling in cities, under the prospect of exploiting better employment opportunities (Long et al., 2009) and, in general, higher level of life quality, ought to population's agglomeration acts (O' Sullivan, 2003). When urbanization came into prominence (Roberts, 1989; O' Sullivan, 2003), which was placed in the last century (Li, 2003)and presented its peak the period from 1960s to 1980s (Cohen, 2004; Satterthwaite, 2005 (Sekovski et al., 2011)), global population distribution altered and led to the formation of significant urban concentrations, mainly into places that were benefited from environmental, mineral sources, transportation and geographical privileges. These dense residential entities were transformed to cities and further to megacities, consisting considerable population vertices of the universal urban network.

The most rapid urbanization process has been conducted mostly at the past century, so as to be considered, (in this rapid scale) also known as "urban sprawl" (Sekovski et al., 2011), a historical event. In 1900, not more than the 14% of the world's population lived in urban centers, whereas in 2000, it is estimated that more than the 50% of the world's population lived in one of at least 16–17 world's biggest megacities, each having population over 10 million people, with the majority of these to occur in the developing world (Li, 2003). Today, the phenomenon of urbanization is still present, in different or transformed patterns, but it is significantly lower (Sekovski et al., 2011). Because of this procedure, coastal areas suggested attractive destinations for the acts of colonization. At the modern meta-urbanization period, the urban centers were saturated, regarding population density, and another act of population shifting occurred and favored the coastal cities development. These demographic pressures detonated through the act of locomotion from a dense city to a rarer, under the terms of acquiring better life quality (Cori, 1999). Furthermore, these pressures, in conjunction with the consequent continuous need for expansion of urban cores (Beriatos & Papageorgiou, 2010), usually took place through a city's projection along its coastal forehead (Cori, 1999), which rendered the evolution of coastal cities to be considered a multivariable spatial phenomenon.

Greece is a country that is characterized by high coastal concentration and it is estimated that almost the 57% of the country's population live in coastal areas (Polyzos et al., 2011). This considerable coastal concentration oughts its existence to the urbanization procedure, as also to meta-urbanization peripheral shifting. The demographic pressures, observed at the modern meta-urbanization period, were detonated through the act of locomotion from a dense city to a rarer, under the terms of acquiring life quality (Cori, 1999). These detonation trends constituted a parameter in the Hellenic seaside towns' development, during the period 1961 – 2001.

1.3 Spatial characteristics

The developmental significance of coastal areas is strongly correlated with the seaside location. The adjacency of coastal areas to the sea, suggests an attribute that provides a set of advantages to the residential units, which are placed near the sea. The most important facilities that coastal areas provide and direct to respective economical opportunities are transportation (Li, 2003), commodity (Cori, 1999) environmental and cultural (Yeung, 2001; Sekovski et al., 2011), supply and touristic (Sekovski et al., 2011).

In the majority of the cases, when a coastal residential unit reaches the critical population threshold, the coastal urban concentration leads to the formation of harbors (Polyzos, 2011; Sekovski et al., 2011). Since harbors exist in most coastal cities, maritime transport and the related economic accessory facilities are particularly significant factors for their development. The harbor-based economies of coastal cities, suggest an engine of economic growth, which can be expressed in variable ways, such as composition of employment centers, attraction of investment and trade and creation of production and market places for commodities and consumption (Li, 2003). Of course, the seaside location privilege diachronically entailed the risk of attacks in the history, such as piracies (Birnie, 1987; Anderson, 1995). Today coastal cities suggest a vital source of income for national economies (Li, 2003), fact that is obviously observed even in the case of Greece (Polyzos et al., 2011).

The environmental facile of coastal cities, suggests also a powerful developmental axis. Many coastal cities are located and being developed at places where additional (to seaside) physical facilities, energy source and raw material deposits exist (Decker et al., 2002), factors that are supposed to be essential for the reinforcement of the coastal city's economy. For example, the existence of water supplies and arable lands consist considerable criteria for the location of cities in general. Many coastal cities were either located (when possible) near to river endings, where potable and irrigation water supplies are plentiful so as their hydro-energy exploitation is more accessible. The deltaic end of the Greek "Evros" river represents a characteristic paradigm for the coastal city of "Alexandroupolis" environmental vantage. Regarding raw material deposits, the coastal city of "Kavala" in Greece, which is located in a geographic position plenty of marble deposits, suggest an indicant example. Environmental amenities of coastal cities also operate as an axis of cultural development and education, as an absorbent mechanism of surplus rural population, as well as the nursery for civic spirit and social harmony (Li, 2003). History of Greece can indicate various paradigms of coastal cities (suggestively at regions of "Attica", "Ionian Islands", "Crete", "Dodekanisa" etc.) that consisted cultural centers and cores of science and arts development.

The touristic facility constitutes a fundamental developmental factor to coastal cities and this statement seems to be more significant in the case of Greece, by the time that the country posses a coastline greater than 10.000 km (Cori, 1999). Nowadays, the coastal cities dynamics are mainly directed by the developmental axis of touristic utilization (Cori, 1999; Miller & Auyong, 1991), revealing a considerable amount of profitable potentials for the economy of a country. The touristic development, considered as a respond variable, on depends on other economic variables, such as the increase of peoples' leisure time (at least in developed countries), the communication and transportation improvement (Sekovski et al., 2011), the environmental, cultural and coastal attraction etc., which suggest motivations and render coastal areas to comprise obvious spatial destinations for the conduction of the touristic procedure.

The concept of coastal tourism includes, in its definition, the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and in the offshore coastal waters (Hall, 2001). Coastal tourism is considered one of the faster evolving forms of contemporary tourism, and, in the case of Greece, it seems to be the most promising developmental potential that the country should exploit, in order to overpass its modern economic problems. Moreover, considering the above in a larger scale framework, Greece

and, secondary, Croatia suggests the leading countries in a possible process of west-east shifting of international tourism within the Mediterranean area (Cori, 1999). Greece, in order to take advantage of its liberal touristic dynamics, should coordinate the potentialities of its archeological and artistic heritage with the traditional sea-sun-shore appeal, investing on its small islands, as recommended by Agenda 21, through a combined procedure of economic development with environmental solicitude (Cori, 1999).

This chapter is organized as it follows; section 2 presents the study area and the available data in the case study of Greek coastal cities, section 3 describes the research methods taken under consideration to model the case, section 4 presents the results and the evaluation and, finally, in section 5 some conclusions are given.

2. Methodological approach

2.1 Systemic methodology

The initial approach, into the analysis of coastal cities developmental performance, was based on a systemic point of view. The term "systemic" has a wide conceptual range and refers to this class of methodologies that aspires to model, on a theoretical basis, the structural components of the study object and to describe its operations, under the perspective that it suggests a subsystem of a wider systemic environment. In the case of this paper, the study object refers to a manifold of chosen Greek coastal cities, which are distributed over the geographic area of Greece and suggest a spatial system. The total of coastal cities is grouped, by a geographical division, into administrative clusters, which suggest the Greek prefectures, as defined before the act of "Kallikratis" (Act 3852/2010). Consequently, the spatial units that are studied in this paper refer, on one hand, to each coastal city (spatial monad) and, on the other hand, to the pre-"Kallikrateian" Greek prefectures (spatial units consisting groups of spatial monads).

The theoretic framework of the systemic approach was inspired from the Drivers-Pressures-State-Impacts-Responses (DPSIR) model (Sekovski et al., 2011). The DPSIR model suggests a chain framework of (the five title) concepts that describe, on a step (discrete) way, the input-output mechanism of a socio-economic phenomenon with its geographic dimensions. Given a short description, the Drivers (motivation of acts) lead to pressures on the geographical system, pressures that result to a state (balance status). The conducted operations, targeting to achieve the balance, may have environmental and economic impacts on the wider including system. Finally, the Responses present a set of societal and policy makers' prioritizations, in order to reduce the undesired impacts and, in general, to improve the performance of the system. The schematic framework of the DPSIR model, adopted to the case of Greek coastal cities and to the needs of this study, is presented at figure 1.

2.2 Analytic approach

The analytic approach suggests a supplementary or further analysis of the systemic modeling, which was presented above. It targets to describe, under a quantitative perspective, the parts that synthesize the study system and to quantify the systemic mechanisms. Regarding the case of Greek coastal cities, the quantitative tools that are used for the research derive from the scientific sectors of Spatial Analysis, Regional Economics

and Statistics. The analytic tools, which are used in this study, regard some common Spatial Analytic (Mitchell, 2005), Regional Econometric (Polyzos, 2011; Tsiotas and Polyzos, 2011) and Statistical measures (Blalock, 1972; Hays, 1981; Norusis, 2004) and are described briefly below.

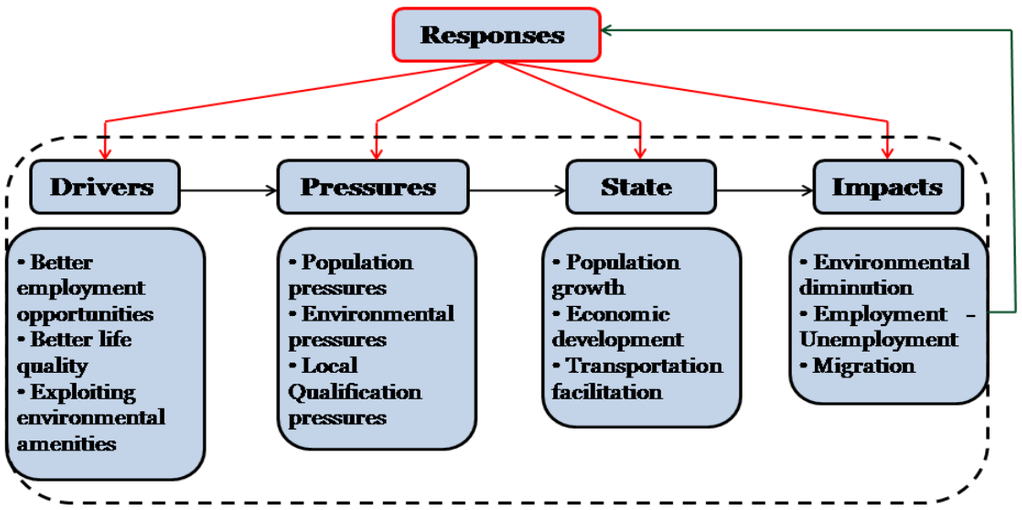

Fig. 1. The DPSIR framework scheme for the case of Greek coastal cities

2.2.1 Spatial analytic tools

The Weighted Mean Center (WMC) (Mitchell, 2005) suggests a plane point that has coordinates (x, y) the average calculation of the coordinates of all the features in the study area, as shown at relation (1), where x_i, y_i is the symbolism of the coordinates and w_i of the weights of a point I (Polyzos et al., 2011).

$$WMC = (\bar{X}, \bar{Y}) \left| \bar{X} = \frac{\sum_{i=1}^{n} w_i \cdot x_i}{\sum_{i=1}^{n} w_i}, \bar{Y} = \frac{\sum_{i=1}^{n} w_i \cdot y_i}{\sum_{i=1}^{n} w_i} \right. \quad (1)$$

WMC is a useful measure for tracking changes in a spatial distribution or for comparing the distributions of different types of features. In this study WMC is used to compare the spatial distributions of the Greek coastal cities appearance for the decades 1961 up to 2001. The WMC's shifting suggests a five step trail (WMC1961, WMC1971, WMC1981, WMC1991, WMC2001,) and is expected to reveal the demographic transformation and the potentials of the coastal cities in Greece.

Central Feature (CF) tool identifies the most centrally located feature in a point, line, or polygon feature class. Distances from each feature to every other feature in the dataset are calculated (weighted) and summed (Mitchell, 2005). The mathematical formula of the central feature is related to the closeness centrality formula (Wang et al., 2011) and is shown at relation (2). The use of this tool is expected to disclose the most vital Greek coastal city in terms of population and centrality (Polyzos et al., 2011).

$$CF = c \in \{c_1,...,c_n\} \left| \min \left(dc_i = \frac{\sum_{i=1}^{n} w_i \cdot \sum_{j=1, i \neq j}^{n} dc_{ij}}{w_i} \right), i = 1,...,n \right. \quad (2)$$

2.2.2 Regional econometric tools

The Theil index constitutes a statistic function for inequality measurement analysis. The index appertains in the entropy measures family and has a comparative utility. The index's mathematical formula is shown at equation (3) (Tsiotas and Polyzos, 2011).

$$T = \frac{1}{n} \sum_{i=1}^{n} \frac{x_i}{\mu} \cdot \ln \frac{x_i}{\mu} \quad (3)$$

whereas x_i stands for the arithmetic value of the observation i for the characteristic (variable) X (i=1,…,n), lnx is the napierian logarithmic function and μ the mean of the n observations x_i (i=1,…,n). Theil index ranges into the interval $0 \leq T \leq \ln n$ (Polyzos, 2011). The Theil index is considered useful in order to reveal the cities that presented the greatest variations in their chronological evolution.

2.2.3 Statistical tools

At the following analysis the statistical methods of bivariate correlations and one-sample T-test are used. The bivariate correlations procedure (Norusis, 2004) computes Pearson's correlation coefficient with their significance levels. The linear correlation formula is a measure of linear association that measures the level, in which two variables are related. The mathematic formula of Pearson's Bivariate Correlations is shown at relation (4),

$$r = \frac{Cov(X,Y)}{\sqrt{Var(X) \cdot Var(Y)}} \quad (4)$$

Where, $Cov(X,Y)$ stands for the covariance of the variables X, Y and $Var(X)$, $Var(Y)$ for the respective variations.

The one-sample T-test procedure (Blalock, 1972; Hays, 1981; Norusis, 2004) tests whether the mean of a single variable differs from a specified theoretic value. The procedure tests the difference between the sample mean and the known or hypothesized value and specifies the level of confidence for the difference. This test is hence used to compare the means between two samples, the coastal and the terrestrial, by assuming that the hypothesized value of the test regards the mean value of the second sample.

The purpose of this test in the case of Greek coastal cities is to compare some characteristics that appear in the coastal and the terrestrial prefectures and to draw conclusions. The mathematic formula of the t-test statistical function is expressed by the ratio $t = \frac{D}{S_D}$ where $D = \bar{X}_1 - \bar{X}_2$ is the difference of the two means (coastal and terrestrial) and S_D is the

standard error of the difference. The one-sample T-test process was considered easier to apply than the corresponding ANOVA, which is also commonly used to compare sample means since the samples are compared in pairs. The constraint of the T-test method and the rest common linear ones assumes that the data is normally distributed, especially with respect to skewness. Consequently, outlying values should be carefully checked and the use of boxplots is applied in order to manage these cases.

3. The case of Greek coastal cities

3.1 Study area and data

The research deals with these cities of the Greek territory (terrestrial and island), which present a population over 5.000 inhabitants, according to the official censuses held the decades 1961-2001. The threshold of the 5.000 inhabitants was selected arbitrarily (Polyzos et al., 2011), taking under consideration the Act 3643/2006 that regards the classification of Greek cities sizing. This Greek cities population filtering was applied sequentially, in every census' data (1961, 1971, 1981, 1991 and 2001), so the available data may differ beyond decades. The cities that presented lower population volume than the threshold were truncated, even though they may were examined in a previous sampling set. This truncation procedure is expected to present, in some occasions, abrupt alternations, but also to reveal more obvious results. Regarding the selection criteria of the study object volume the amount of cities that surpass the population threshold of 5.000 inhabitants and, simultaneously, have direct contact with the sea or have an easy access to the sea were chosen to suggest the sample manifold.

3.2 Population pressure

One of the most significant factors that can elect considerable information for the spatial characteristics and dynamics of coastal cities in Greece is the demographic parameter. The population shifting and, in general, the demographic transformation, which are being observed diachronically, suggest an indicative variable of a place's developmental trends. Worldwide an amount of 70% of the world's population (percentage that suggests, in terms of absolute numbers, a population between 3.8 and 4.5 billion) are considered to live in the coastal zone (Cori, 1999; Li, 2003). The coastal zone is generally defined as a 40-mile wide belt from the coastline (Cori, 1999), but this definition varies and depends fromeach case's scale.

Moreover, it is estimated that up to the year 2015 there will be 36 mega-cities (with population over 10 million inhabitants), from which 30 will occur in the developing countries and 22 in Asia (Li, 2003). In global scale, Algeria and, especially, Greece suggest two characteristic cases of countries that appear considerable coastal density, where most main urban agglomerations are situated at (or near) the coast. In Mediterranean level, the coastal population presents double density than in the rest terrestrial areas. Nevertheless, the future estimations, for the coastal inhabitation of the Mediterranean countries, suggest that coastal population density will probably not grow much further in France, Italy and Greece.

The present study works with the decennial data of the period 1961-2001, which is available from the corresponding censuses. After applying the threshold filtering (criterion) to the

coastal cities manifold, the available decennial sub-manifolds of the Greek coastal cities are presented as pie charts, for the corresponding coastal cities, to the map of figure 2. During the study period, the Greek urban population coverage changed 29,5%, from 56,21% in 1961 to 72,79% in 2001. This fact implies, firstly, the structural changes that the Greek economic model was subjected (the meanwhile period) to, which suggests the country's transposition from the agricultural-based economy model (primary sector) to the services provision economy model (tertiary sector).

Secondly, the meanwhile urban growth can be related to the phenomenon of agglomeration that benefited the two Hellenic metropolitan cities, "Athens" and "Thessaloniki", with respect to the trends observed in the wider Mediterranean level (Cori, 1999). The growing Greek coastal cities coverage of the total country's population in 1961 reaches a coverage of 16,42%, whereas in 2001 this percentage extended to 19,43%. The map of figure 2 also depicts the geographical distribution of the Greek coastal cities population growth. This map is considered useful in the level that it illustrates some geographical formations (or clusters) of this population growth. It seems worth telling that the greatest coastal concentrations in the Greek territory appear into places that do not present morphology of open (non-curved) coast lines, but in those which are attributed with physical protection. This fact comes to an agreement with the previous historical placement.

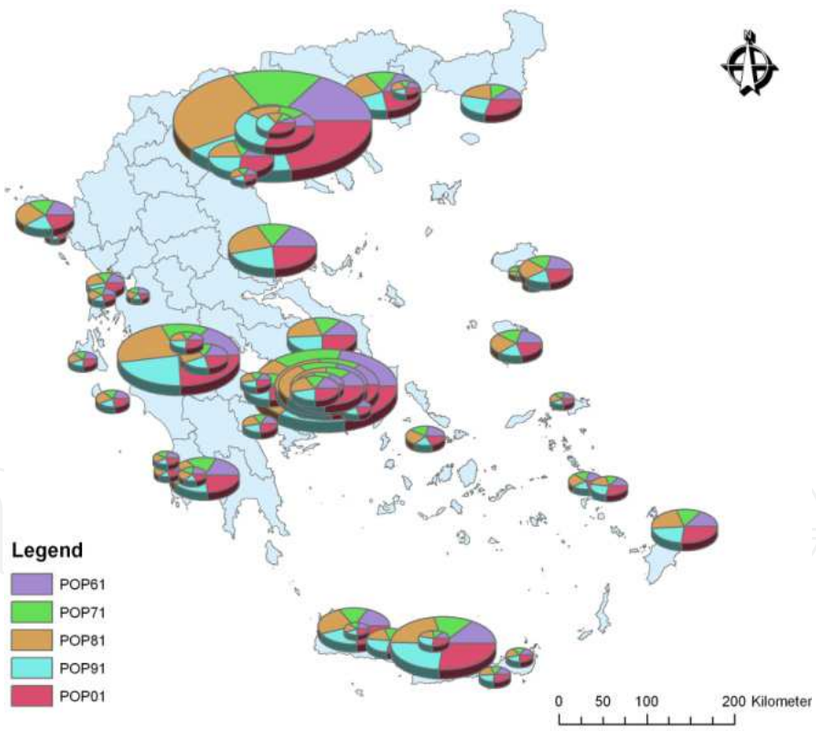

Fig. 2. Comparative pie charts of the coastal cities population distribution for the period 1961-2001.

Figure 3 maps the spatial locations of the Greek Geographical Mean Center (GMC) and the group of Weighted Mean Centers (WMC), which were calculated for the period 1961-2001. This map also depicts the geographical locations of the two Greek metropolitan cities

"Athens" and "Thessaloniki". The comparison of the locations between GMC and the group of WMC (GWMC) can acquire demographic interpretation, since the only difference between the two respective mathematical formulas calculations regards the consideration of the weights. In other words, the consideration of the population weights in the GMC formula turns the second into the WMC and the spatial distance of GMC and WMC suggests a macroscopic transformation (shifting), ought to the demographic parameter. This shifting is expected to reveal the demographic spatial trends of the Greek coastal cities for the period 1961-2001.

The horizontal shifting of the GMC to the GWMC to the East side can get two justifications. Firstly, the fact that the Eastern seaside forehead of Greece is greater than the Western suggests a geographic inequality, which is reasonably illustrated by the attraction of the GWMC to the East. Secondly, this horizontal shifting seems to follow the direction of the location of Athens that presents the greatest urban formation in Greece, having population over 5.000.000 inhabitants. The vertical shifting of the GMC to the GWMC reveals the tractive behaviour of "Athens" to the GWMC. Nevertheless the vertical shifting is considered shorter in length than the horizontal, ought to the fact that the anti-diametric location of the second greater, in population ranking, Greek city, "Thessaloniki", plays a makeweight role to this spatial attraction.

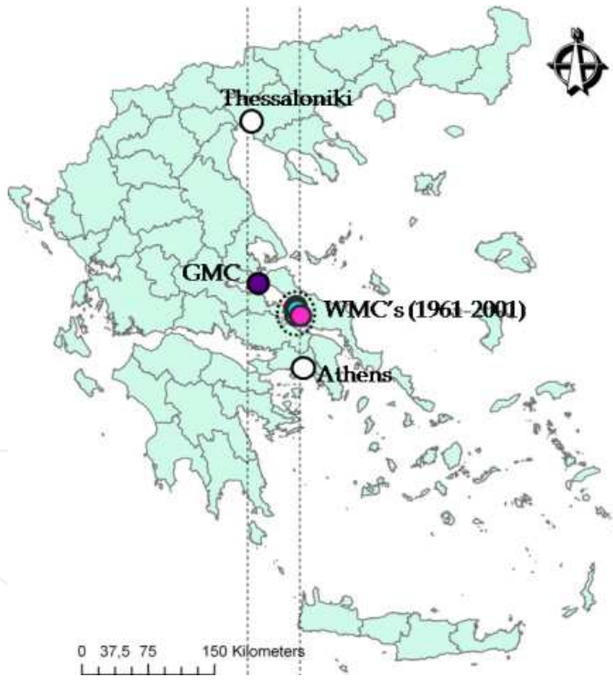

Fig. 3. Map displaying the locations of the Greek Geographical Mean Center (GMC) and the group of Weighted Mean Centers (WMC), for the period 1961-2001.

Moreover, the existent data can be further edited so as to form the diagrams of figure 4, which present the National Greek and Coastal population, after applying a summation to the population data of decennial samples (populations of cities that overpass the threshold criterion). These diagrams illustrate the decennial population growth distributions, calculated under the basis of considering (or not) the case of Athens. In both cases, it can be

observed that the Greek coastal cities population presents a growing decennial procedure, almost under a linear attitude, but this growth seems to be inconsistent to the respective performance of the National population's evolution. This observation indicates, on one hand, the fact that the capital city of Athens benefited the majority of this period's (1961-2001) population growth and, on the other hand, the fact that the Greek coastal inhabitation process stood indifferent to the eruptive urbanization phenomena of the period 1960-1980.

It is probably remarkable to focus on the inverse performance of the population growth that is observed in the period of 1971 (figure 4). At that time, the National population increased, in opposition to the National population without Athens, which was decreased. This difference between National population and National population without Athens, indicates, obviously, that the provincial population shifted towards the metropolitan city of Athens, verifying the existing urbanization theories (Roberts, 1989; O' Sullivan, 2003; Sekovski et al., 2011). Nevertheless, the coastal population of this period, despite the fact that it does not suggest an immiscibly urban topology, has grown up, on a contrary to the current National provincial impoverishment. This systemic inconsistency reveals a latent population growth mechanism for coastal areas that presents an indifferent behavior to the National urbanization trends, which were recorded the decades 1971-1981.

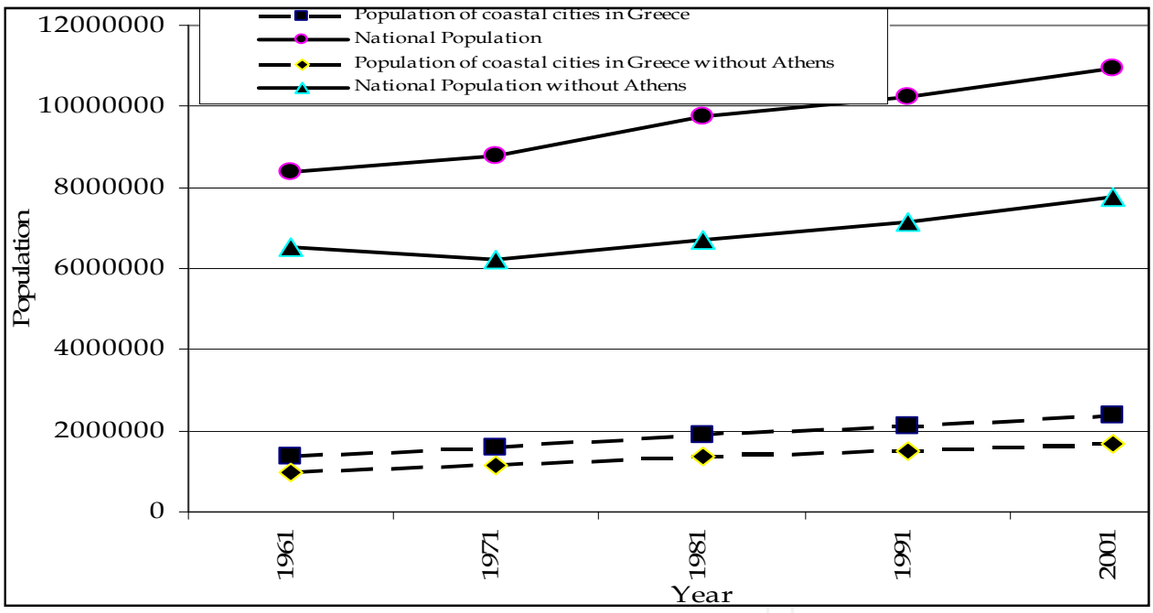

Fig. 4. Comparative diagrams of National Greek and Coastal population, including and not including the case of Athens.

A further quantitative approach of the population pressure of Greek coastal cities regards the study of the coastal population density performance. The concept of population density is a general measure that indicates the intense of inhabitance that a spatial unit presents. A common unit expression for this measure is given in inhabitants per square kilometer (inhabitants/km^2) (Cori, 1999), but for the purpose of this study the measure is modified and used as coastal population density. The notion of coastal population density is defined, for the present study, as the percentage of the coastal city population to the total urban

population by the ratio $CPD_i = \frac{CP_i}{TP_i}$, where CP_i is the coastal population of prefecture i and TP_i is the total urban population of prefecture i, regarding the amount of cities that surpass the population threshold of 5.000 inhabitants.

The calculation process of the CPD for each Greek coastal prefecture and for every decennial data produces the bar plots of figure 5, which indicate the prefectures that experienced the greatest coastal population density at the period 1961-2001. The bar plot of figure 5 is composed by five components, in respect to the decennial coastal data. This component division leads to the classification (for the data period) of the coastal cities densities into five corresponding ordinal categories, from 1 up to 5 (minimum to maximum significance). The 5th category (describes densities into the interval 4-5) includes the prefectures that present very dense coastal inhabitation and, consequently, the fundamental developmental parameter for them seems to be exclusively the coastal attribute. Such prefectures are mainly

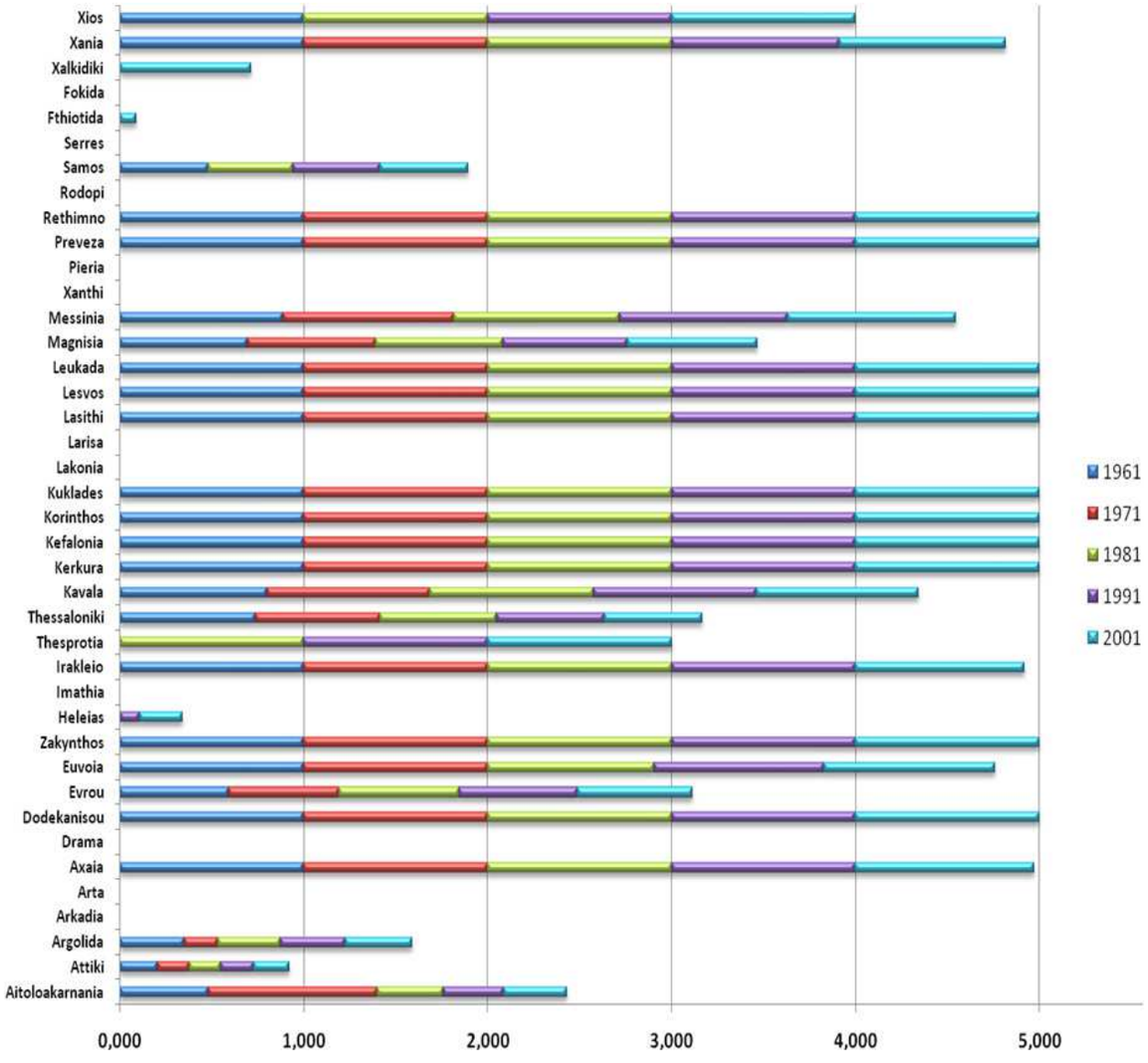

Fig. 5. Bar plots for the decennial coastal population density in Greece.

islands and are the prefectures of "Xania" (island/Crete Region), "Rethymno" (island/Crete Region), "Preveza" (non island/West Greece), "Messinia" (non island/Peloponnesus), "Leukada" (island/Ionian islands), "Lesvos" (island/East Aegean), "Lasithi" (island/Crete Region), "Kuklades" (island/Central Aegean), "Korinthia" (non island/Peloponnesus), "Kefallinia" (island/Ionian Islands), "Kerkura" (island/Ionian Islands), "Kavala" (non island/Northern East Greece), "Irakleio" (island/Crete Region), "Zakinthos" (island/Ionian Islands), "Euvoiaa" (island/Central Greece), "Dodekanisos" (island/East Aegean) and "Achaia" (non island/Peloponnesus).

The calculated results of the figure 5 can form a map, so as to demonstrate the spatial (geographical) distribution of the corresponding coastal population densities. Such a map is presented at figure 6. The measuring subject in this map regards the mean coastal population density that the Greek prefectures presented, during the period 1961-2001. The prefectures that are exclusively terrestrial and do not present a coastal part are excluded from the map illustration.

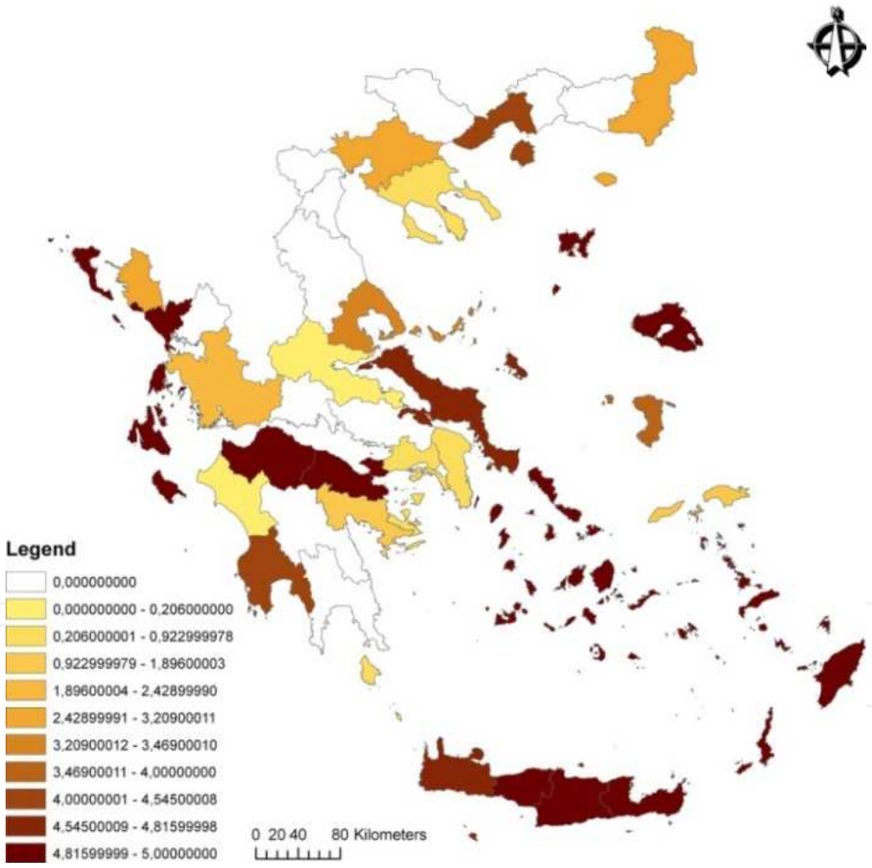

Fig. 6. Mean Population density of coastal prefectures in Greece

The spatial distribution of the mean coastal population density in Greece (per prefecture) depicts a further status of population growth clusters, which can probably reveal some developmental cores for the country. As it can be observed from the map, diachronically (referring to the period 1961-2001) the most dense, in population, coastal prefectures in

Greece appear to lie under a grouped structure that is distributed to all geographical directions. At the West Greece this cluster forms an arc that includes the "Ionian" islands and the prefecture of "Preveza". One of the fundamental economic axes that can justify these prefectures dense population is probably the maritime commercial and transportation activities of these prefectures, in conjunction with the fact that their geographical position provides an easy access to Italy.

In the Region of Peloponnesus, the dense coastal prefectures cluster forms two cores. The first is located at the prefecture of "Messinia" and the other figures a dipole of the prefectures "Achaia-Korinthia". The prefecture of "Messinia" always presented a strong agricultural economy and, considering the fact that this place lacks of a significant commercial harbour, it can be assumed that probably the intense coastal inhabitation of this prefecture has rural motivations and trends, ought to environmental amenities of such areas. The dipole "Achaia-Korinthia" probably oughts its density to its component prefectures strategic significance in transportations. The prefecture of "Achaia" has a great (for the Greek state) harbour and the one of "Korinthia" suggests a connection (the only before the year 2005) or the region of Peloponnesus with the prefecture of "Athens" and the rest terrestrial Greece.

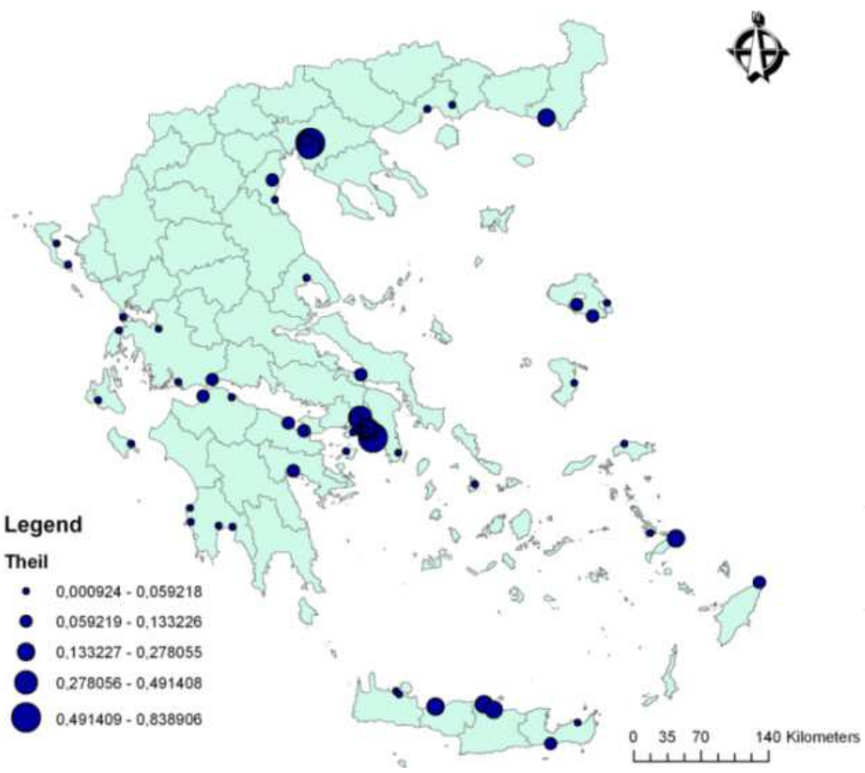

Fig. 7. Spatial distribution of the coastal cities Theil index for the period 1961-2001.

The rest clusters are located in the Northern Greece at the prefecture of Kavala (with considerable mineral wealth), in the central Greece at the prefecture of Evoia (closeness to Athens) and in the Aegean at the prefectures of "Lesvos" (sailing and agricultural based economy, as also closeness to Turkey), at the region of "Kyklades" (touristic, sailing,

agricultural and mineral based economy), at the region of "Dodekanisa" (touristic, sailing, agricultural and cultural heritage economy) and at the region of Crete (agricultural, touristic, sailing and cultural heritage economy).

A further analysis on the population pressure can be applied with the use of the Theil index. The calculation of the Theil index provides results that reveal the cities, which presented the greatest variations in their chronological evolution, as shown in figure 7.

Figure 7 illustrates these cities, which throughout the study period (1961-2001) presented the most abrupt changes in their population. This map reveals the strong fluctuations (positive in the majority as presented earlier) of the city clusters of "Athens" and "Thessaloniki" that are characterized of the most intense meanwhile conurbations. A second cluster of cities of medium to notable variations is comprised of the cities of the province, the most significant of which are located in the prefectures of the region of Crete, in the islands of Southern Aegean and the Northern East Greece. Finally, a third cluster of cities of the terrestrial central body of Greece is formed (the so called developmental axis "S"), where the capital cities of the respective prefectures present relatively abrupt changes of their population sizes (Polyzos et al., 2011).

3.3 Local qualification pressure

Tourism suggests a fundamental developmental axis for Greece, ought to its elongated coastline, which is greater than 10.000km (Cori, 1999), to its sunshine weather and to its thousands of islands that have various morphologies. The seaside location of Greek coastal cities provides intuitive documentation for the economic base of these cities, indicating that both these cities and their respective prefectures present specialization in touristic activities and services. The purpose of this section aspires to request quantitative evidence that justifies this empirical approach and to proceed to a further analysis on the productivity orientation of the Greek coastal cities. The available data regard the calculation results of the Local Qualification Index of the Greek prefectures, referring to the economic sectors of agricultural, manufacture, construction and touristic productivity for the year 2006 (Polyzos, 2011), can produce the box plots of figure 8. The data is further categorized, for the purpose of this study, to non coastal and coastal groups so as to produce box plots that can be submitted to comparison.

The box plot diagrams of figure 9 sketches out the distributions of the LQ index (per sector) for the coastal and non coastal cases. The Agriculture box plots indicate a slightly better (presenting higher values) performance of the Greek terrestrial prefectures, in comparison with the coastal. This performance seems reasonable if considering the terrestrial ease in transportation, maintenance, and support, regarding the agricultural equipment. The question of the significance of difference over the performance between coastal and non coastal prefectures will be answered at the following T-tests.

The Manufacture box plots reveal a relationship between the coastal and non coastal prefectures that is not easy to come into obvious conclusions. Perhaps the only safe information, which can be derived from this diagram, derives from the observation that the non coastal box plot presents a more narrow distribution than the coastal and less number of outlier values. This higher concentration of the non coastal manufacture distribution displays a better overall performance for the non costal case, but this

conclusion cannot be justified rigorously. A similar unclear picture also describes the case of Constructions. The mean values of the box plots seem to lie under a condition of significant equality, but the non coastal prefectures distribution present a positive asymmetry, fact that indicates a stronger agricultural sectorial performance than the coastal case.

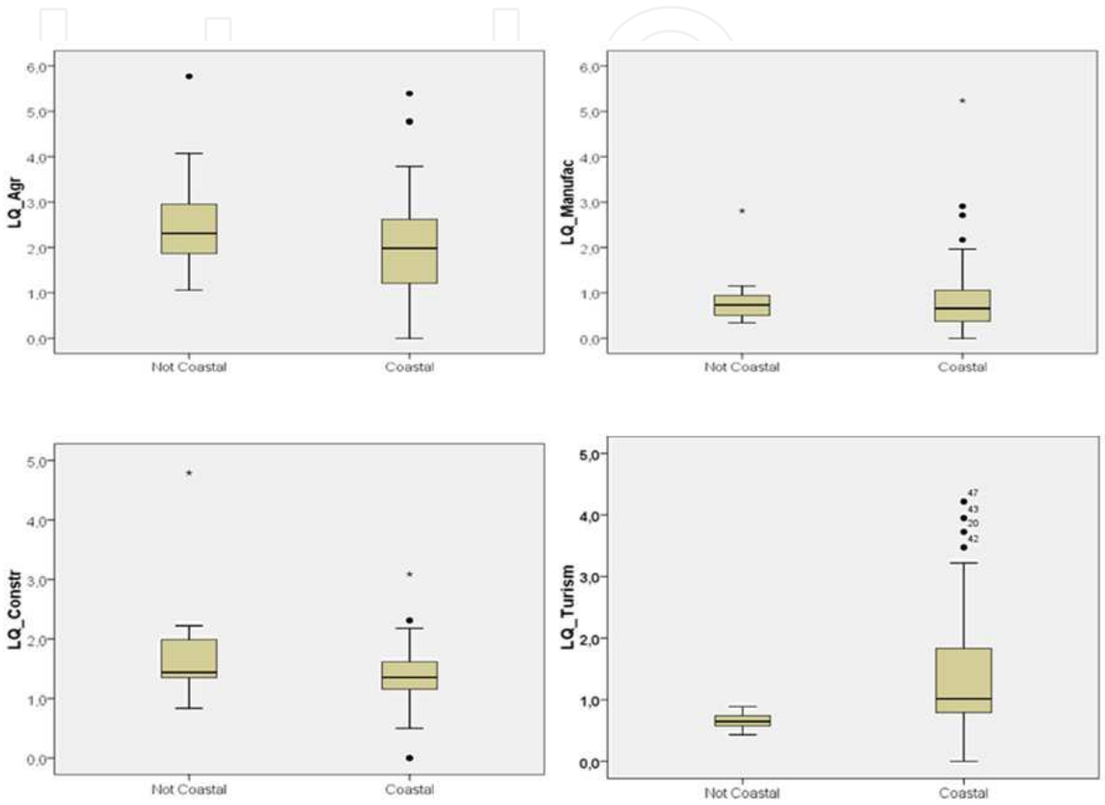

Fig. 8. Box plots of the Local Qualification Index for coastal and non coastal prefectures (data of year 2006).

Finally, the Tourism diagrams present a clearer picture that indicates the difference between coastal and non coastal prefectures about their touristic productivity performance. Coastal cities reveal an obvious higher mean value than the non coastal, as long as a wider distribution with a positive asymmetry, factors that indicate higher touristic economical potentials of the coastal cities, for the majority of cases. The appearance of the non coastal prefectures is presented very shrink, fact that denotes the limited touristic potentials of the terrestrial Greek regions. In order to obtain answers to the question of equality, between the means of coastal and non costal prefectures, a T-test was applied for each sector case, under the conditions that they were described at the methodology section. The results of the T-tests are shown at table 1, where the symbol *X* in the *LQ*(*X*) symbolism refers to an abbreviation coding *A*≡agricultural, *M*≡manufacture, *C*≡construction and *T*≡touristic. Also the *C* and *NC* symbols regard to the coastal and non coastal classes.

	LQA_NC = 2.62					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the	
LQA_C	-3,057	42	0,004	-0,6060	-1,006	-0,2060
	LQA_NC = 2.62					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the	
LQM_C	0,285	42	0,777	0,0407	-0,247	0,3290
	LQA_NC = 2.62					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the	
LQC_C	-5,291	42	0,000	-0,4567	-0,630	-0,2825
	LQA_NC = 2.62					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the	
LQT_C	4,749	42	0,000	0,7427	0,427	1,0584

Table 1. T-test results for the comparison of the means between coastal and non coastal samples for the Local Qualification Index.

The test results, presented in table 1, exclude the cases of Agriculture, Constructions and Tourism Local Qualification to present equal mean values. Moreover, the negative edge values of the confidence intervals in the Agriculture and Constructions cases conclude that there is a significance negative difference between the coastal and non coastal case (diff=LQX_C-LQX_NC). Consequently, in the Agriculture and in the Constructions cases the coastal prefectures present smaller developmental dynamics. Oppositional, in the Tourism case, the advance of coastal prefectures performance is obvious, even through a single graphic observation. The T-test table results indicate that the case of Manufacture can, statistically, justify equality between coastal and non coastal mean values. Nevertheless, the performances on Manufactures between coastal and not coastal cases cannot be considered the same due to the ranges of their distributions.

In order to proceed to a further analysis, to provide supplementary evidence and to validate the previous discussion results, the Binomial Correlations were calculated between the mean coastal population density and the Local Qualification Indices values. The correlation results are presented at table 2.

From the results of table 2 only the correlation between the mean coastal population density and the Tourism LQ appear a considerable value that is also significant. The other correlation results do not present worthy information, except perhaps the one that can be mined from the correlation signals. The signal interpretation of the table 3 reveals the fact that the mean coastal population density and the rest LQ indices are negative correlated. This result provides an essential documentation to assert that coastal prefectures are privileged to benefit higher potentials in tourism.

		mean_D	LQ_Agr	LQ_Manufac	LQ_Constr
mean_D	Pearson Correl.	1	-0,319*	-0,103	-0,048
	Sig. (2-tailed)		0,019	0,461	0,730
	N	54	54	54	54
LQ_Agr	Pearson Correl.	-0,319*	1	0,043	0,081
	Sig. (2-tailed)	0,019		0,758	0,562
	N	54	54	54	54
LQ_Manufac	Pearson Correl.	-0,103	0,043	1	0,090
	Sig. (2-tailed)	0,461	0,758		0,516
	N	54	54	54	54
LQ_Constr	Pearson Correl.	-0,048	0,081	0,090	1
	Sig. (2-tailed)	0,730	0,562	0,516	
	N	54	54	54	54
LQ_Turism	Pearson Correl.	**0,608****	-0,204	-0,321*	0,037
	Sig. (2-tailed)	0,000	0,138	0,018	0,789
	N	54	54	54	54

Table 2. Binomial correlation results between the mean coastal population density and the Local Qualification Indices values.

3.4 Coastal cities prosperity

A similar procedure to the Local Qualification analysis is applied at the following, in order to provide an answer to the question if the Level of Prosperity in coastal prefectures can be considered greater than the terrestrial ones. The available data of this case regard the calculation results of the Index of Wealth for the prefectures of Greece, for the year 2006, as presented by Polyzos (2011). The analytic process is composed by the same with the previous analysis steps. Firstly, the data available are presented graphically to the box plots of figure 9, in order to provide some information for the distribution, and, secondly, the mean values of the box plots are tested for statistical significance equality.

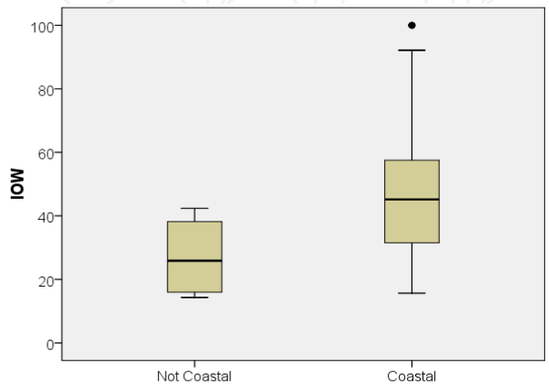

Fig. 9. Box plots of the Index of Prosperity for coastal and non coastal prefectures (data of year 2006).

The correlation between the mean coastal population density and the index of wealth was calculated, but found neither to be considerable in value (0,482) nor to statistical significance. A single observation of the box plots of figure 9 seems to be adequate to indicate the inequality in the level of wealth that benefits the coastal prefectures. The application of the comparing means procedure provides documentation to the visual comparison results of figure 9. The mean comparison results are presented in table 3.

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the	
IOW_C	13,103	42	0,000	48,642	41,151	56,134
IOW_T	8,224	10	0,000	27,375	19,958	34,792

Table 3. T-test results for the comparison of the means between the coastal and non coastal samples for the Index of Wealth in Greece.

Table 3 indicates, in quantitative terms, the significant inequality between the coastal and non coastal case of the Index of Wealth in Greece. The edge values of the confidence intervals do not have covering areas, fact that suggests their inequality. Consequently, the obvious inequality of means $\mu_{IOW\_C} > \mu_{IOW\_NC} \Leftrightarrow 48,6 > 27,4$ can provide the essential documentation to conclude that the Greek coastal prefectures enjoy greater wealth than the terrestrial ones.

4. Conclusions

This chapter dealt with the population transformation of Greek coastal cities, held during the last 50 years. Coastal cities over 5.000 citizens were studied, by using spatial, econometric and statistic measures and models. During the study period, the Greek urban population coverage changed in an amount of 29,5%, from 56,21% (presented in 1961) to 72,79% (in 2001). By observing the trends in the Mediterranean level (Cori, 1999), a similar transposition in the demographic status can be concluded. Urban population of coastal countries presented an amount of 50% growth during the period 1950-2005, percentage which is higher in comparison with the corresponding Greek, probably due to significant urbanization rates of South Mediterranean countries and Turkey. The growing Greek coastal cities cover the 16,42% of the total country's population in 1961, whereas in 2001 they reached to represent approximately 2.100.000 inhabitants, with a coverage of 19,43% in total population. The augmentative trends appear to be strong during the first two decades of the study period, but they diminish from 1981 and forward. This fact implies, firstly, the structural changes that the Greek economic model was subjected (the meanwhile period) to, which suggests the country's transposition from the agricultural-based economy model (primary sector) to the services provision economy model (tertiary sector). Secondly, the meanwhile urban growth can be related to the phenomenon of agglomeration that benefited the two Hellenic metropolitan cities, "*Athens*" and "*Thessaloniki*".

One of the general conclusions, which was extracted by this study, verified the general demographic transformation that the Greek cities (in general) were subjected to and moved from the phase of intense urbanization (during the decades of 60's and 70's, where the

centers of the Metropolitan cities of "*Athens*" and "*Thessaloniki*" grown) to the phase of suburbanization (in the decade of 1980's and after, where the suburban zones of the two metropolitan Hellenic cities expanded). The above transformation also affected the Greek coastal cities and moved their status into a new balance, described by the strengthening of mainly the "*Attica*" prefecture's cities-satellites, which suggests the phenomenon of counter-urbanization and secondly the south-eastern insular regions of Greece.

Nevertheless, the non-metropolitan coastal population growth procedure in Greece seems to stay indifferent to the eruptive urbanization phenomena of the period 1960-1980, presenting an equable increase. This observation leads to the conclusion that the Greek coastal population growth suggests a product of a mature chronicle augmentative process. This state of maturity implies the result that coastal infrastructures, which were constructed in order to host the population augmentative process, were obviously developed through a natural, unpressured and unbiased procedure, in comparison with the intense metropolitan urbanization cases (which led to an unscheduled and without plan construction of these cities). Consequently, the infrastructure of coastal areas are, more probable, supposed to present a receptor of investments and of further developmental acts, so as to provide a developmental bus for the country's economical crisis management.

Regarding the Local Qualification dynamics, Greek coastal cities present better developmental performance than the terrestrial ones in the Tourism case, lower in Agriculture and in the Constructions and statistically equal in the Manufacture case. The Tourism case performance seems to be expected, since Greece is a country with a vast amount of coast lines, a significant maritime environment, a sunshine weather and a voluminous amount of islands (with various morphologies), parameters which suggest attractors of touristic development. On the other hand, this obvious ascendancy of the coastal tourism elects questions about the unexploited field of development that the forest and agro tourism activities can provide to the national economy. However, the coastal case of tourism, although it consists the fundamental axis of touristic Greek development, it has to be further subjected to standardized procedures and policies, as also to scheduled orientation through education, in order to suggest the dominant developmental tool, which may be able to recover the country from the economic crisis. The cases of Agriculture and Constructions do not perform in coastal prefectures better than in terrestrial, ought, firstly, to the lack of arable areas and to transportation ease and facilities. The equal performance of coastal and terrestrial prefectures in Manufactures elects the creativity potentials of the Greek nation that it appears to be adaptable to geographical specifications.

On the other hand, the overall level of wealth in coastal prefectures resulted to be higher than the terrestrial ones. This conclusion seems critical for the decision making policy consideration, especially during the current period of crisis that Greece is subjected to. On one hand, through a microscopic perspective, this result reveals some directions for the citizens, in order to request better employment and living conditions and, on the other hand, through a macroscopic perspective, it should motivate the terrestrial economic development (such as agro tourism for example), without impoverish the healthier coastal.

It is commonly accepted that the long-lasting neglect of the regional perspective is able to create economically, social and environmental problems, which may decrease any positive

result that is achieved until now and is reflected to the improvement of certain macroeconomic national sizes. For this reason, a total re-planning of regional policy should be practised in Greece, combined with actions that will totally alternate the territorial balances.

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Urban Development

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Cities are growing as never before and nowadays, it is estimated that at least 50% of the world's population lives in urban areas. This trend is expected to continue and simultaneously the problems in urban areas are anticipated to have an increase. Urbanization constitutes a complex process involving problems with social, economic, environmental and spatial dimensions that need appropriate solutions. This book highlights some of these problems and discusses possible solutions in terms of organisation, planning and management. The purpose of the book is to present selected chapters, of great importance for understanding the urban development issues, written by renowned authors in this scientific field. All the chapters have been thoroughly reviewed and they cover some basic aspects concerning urban sustainability, urban sprawl, urban planning, urban environment, housing and land uses. The editor gratefully acknowledges the assistance of Dr Marius Minea in reviewing two chapters.

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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