This study is a call for a better indicator assessing the level and the evolution of regional inequalities among the 51 Greek (NUTS III) regions during the period 2000-2008. We critique the inappropriate use of Gross Domestic Product (GDP) as a measure of regional welfare, something for which it was never designed. The continued misuse of this index could give a misleading picture of regional inequalities. This necessitates an immediate and ongoing effort to change the indicators that decision makers are using to guide policies and evaluate inequalities. So we need to construct a composite indicator which can include as many as possible aspects of developmental identity of each region that are very difficult to be captured adequately by a single indicator such as GDP per capita, in order to indicate a more globed and representative picture of Greece's regional problem.

"Progress measured by a single measuring rod, has contributed significantly to exacerbate the inequalities of income distribution"

Robert McNamara, President of the World Bank, 1973

EVALUATION OF REGIONAL INEQUALITIES IN TERMS OF COMPOSITE INDICATOR: THE CASE OF GREECE

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ABSTRACT

The purpose of this study is to assess the level and the evolution of regional inequalities among the 51 Greek Nomenclature d' Unités Territoriales Statistiques III (NUTS III) regions during the period 2000-2008. The exclusive use of Gross Domestic Product (GDP) per capita for evaluating the level of regional inequalities may lead to erroneous results. Thus, the study suggests the construction of a Composite Indicator of Development (CID). The CID takes into account not only per capita GDP but also other economic, structural, social and demographic variables. The study investigates econometrically for regional convergence/divergence trends during the period under consideration employing a β-convergence type econometric model. The findings of the study confirm a clear trend of divergence, offering valuable insight for both theory and policy-making.

Key Words: Regional Inequalities, Greece, Composite Indicator of Development, β-convergence.

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ACRONYMS

C.I.D. Composite Indicator of Development

C.I.W.D. Composite Indicator of Welfare and Development

C.S.F. Community Support Frameworks

C.V. Coefficient of Variation

E.U. European Union

G.D.P. Gross Domestic Product

G.N.P. Gross National Product

G.W.R. Geographically Weighted Regression

H.D.I. Human Development Index

I.M.F. International Monetary Fund

N.S.S.G. National Statistical Service of Greece

NU.T.S. Nomenclature d' Unités Territoriales Statistiques

O.E.C.D. Organisation for Economic Co-operation and Development

O.L.S. Ordinary Least Squares

P.P.P. Purchasing Power Parity

R.& D. Research & Development

S.U.R.E. Seemingly Unrelated Regression Equations

U.N. United Nations

W.L.S. Weighted Least Squares

CHAPTER 1
INTRODUCTION

In Greece, regional inequalities are an issue of great concern both for the public opinion and for the politicians and public administration. The scientific debate is often characterized by different estimates, even controversial, not only for the type and level of inequalities, but also for the actions needed to counter them. The fact that the half population of the country live in the wide area of Athens and Thessaloniki and the rest of the country has no major urban population concentrations, gives the impression of a highly unequal distribution of infrastructure, services and development opportunities.

The debate on regional inequalities, even when takes place in a scientific context and based on evidence, is not politically neutral. Therefore, the approach of Greece's regional problem requires accuracy and fairness and mainly understanding that the conclusions of the discussion have specific sign related to the expectations of each region.

The aim of this study is to examine the evolution of regional inequalities, and therefore the trends of convergence or divergence in Greek regions at NUTS III level during the period 2000-2008. The vast majority of studies that have examined this issue used GDP per capita as an indicator of regional welfare. However, an exclusive focus on this index is not very informative and could give a misleading picture of regional inequalities. Recognising the deficiencies related to GDP, the question which arises here is whether it would be feasible to construct a composite indicator which can include as many as possible aspects of developmental identity of each region that are very difficult to be captured adequately by a single indicator such as GDP per capita, in order to indicate a more globed and representative picture of Greece's regional problem.

As a result, a CID is developed in order to take into consideration not only per capita GDP but also other economic, structural, social and demographic variables. Towards the construction of the CID, each variable has been attributed with a specific (different) weight / level of significance. These two indicators -per capita GDP and CID - are used in parallel in order to examine regional inequalities in depth. The results of the econometric investigation, in both per capita GDP and CID terms, confirm a clear trend of divergence during the period 2000-2008.

The subject of the study is topical for two reasons: The first is that is associated with the same problem of regional inequalities which remains one of the major problems of modern economies. In an era of rapid economic transformations which is characterized by increasing internationalization, significant structural changes and unprecedented technological progress, inequalities between countries and within them have not been declined significantly; in some cases they have been increased. A number of regions at national level are not able to effectively deal with changes in their environment and facing today major challenges. These simple observations suggest that deserves to be carefully studied the mechanisms affecting the regional inequalities. The second reason is associated with the small number of respective studies as regards the construction of composite index for the evaluation the regional inequalities in Greece.

The rest of the study is organized as follows. Section 2 arrays some thoughts on regional growth and development. Section 3 provides a short review of the most basic theories of regional growth. Section 4 briefly presents the basic concepts of convergence and outlines the methodologies developed to explore this issue. Section 5 discusses the main measurement shortcomings of GDP and the utility of composite indicators. Section 6 presents the basic factors of regional problem of Greece. Section 7 provides a short review of the empirical studies conducted in Greece over the last years. Section 8 a Composite Index of Development is developed. Also, empirical investigation of regional inequalities is conducted in using both indicators (GDP and CID). Finally, Section 9 summarises the findings to provide some tentative conclusions.

CHAPTER 2
REGIONAL GROWTH AND DEVELOPMENT

2.1. Some Thoughts on Regional Growth and Development: An Introductive Approach

Regional development is an increasingly global issue. Defining exactly what is meant by regional development is more complex than might be commonly assumed. In the existing literature, economic dimensions such as growth, wealth creation and jobs have historically been at the forefront of describing what constitutes regional development (Pike et al., 2006). Sometimes, regional development is equated with the narrower focus upon regional economic development. Although, regional economic growth may be one aspect of regional economic development but it is not the same (Pike et al., 2006).

The (regional) economic growth constitutes a measure of the value of output of goods and services within a time period and shows a positive change in economic sizes of a region and mainly an increase of output of goods (Pike et al., 2006; Polyzos, 2011). Economic growth means simply more output of goods and it is mainly determined by the change of output of goods or income of a regional or national economy. Usually, the more easily determined variable that is used for the quantitative expression of growth is the GDP while for the calculation of growth required the nominal value of GDP which emerges if the inflation is removed from the nominal value (Polyzos, 2011). The economic growth does not suppose a guarantee of social prosperity. Usually, the economic progress and the consecutive increase of income and individual wealth improve the prosperity's level. From the other side, though, the increase of income can lead to overconsumption, wastefulness of natural resources, pollution of environment and finally in degradation of real level of life (Polyzos, 2011). Beside the income, other qualitative factors should be included for the determination of the prosperity's level.

Continuing, the meaning of development is fluid and dynamic and no static. The development has different meaning depending on the season, the region or the country, the economic, social and political conditions that prevail and with the perception of each one separately for the society (Polyzos, 2011). The definitions of development are geographically differentiated. They vary within and between places over time (Pike et al., 2006). The national and, increasingly, supranational focus has evolved to incorporate the regional. The "where" of development has become important with the recognition that development is not just a national level concern for nation states (Pike et al., 2006). So, geography matters as a causal factor in regional development.

Essentially, the economic development differs from the economic growth, as it is not only a production of more output. However, a confusion of terms economic growth and development is often caused, in fact though, the economic growth constitutes a necessary, but no essentially capable, condition on the achievement of development (Polyzos, 2011). The economic development includes structural economic changes of more permanent character and, also, changes in institutional, social and political frame, changes in technology etc., through which the product is produced and distributed. These changes lead to the improvement of economy's effectiveness, the accumulative and self-sustained increase in real income per capita. Moreover, the economic development is referred to the creation of economic and social conditions that allow the completion of individual's personality and the collective activities of the economy (Polyzos, 2011).

The economic focus in regional development has broadened since the mid-1990s in an attempt to address social, ecological, political and cultural concerns (Pike et al., 2006). Henceforth, a new element is presented as a component of regional or more generally development, but it does not always keep pace with its quantitative characteristics and this is the quality of life (Polyzos, 2011). So, reducing social inequality, promoting environmental sustainability, encouraging inclusive government and governance and recognising cultural diversity have been incorporated to varying degrees within definitions of regional development (Haughton and Counsell, 2004 in Pike et al., 2006). Moves towards broader notions of quality of life, social cohesion and well-being have been integrated, sometimes uneasily, with continued concerns about economic competitiveness and growth (Geddes and Newman, 1999; Morgan, 2004 in Pike et al., 2006).

CHAPTER 3
COMPETING THEORIES OF REGIONAL INEQUALITY

3.1. Introduction

The problem of unequal spatial distribution of income, economic opportunities and activities at a national and international level continues to be an important theoretical and practical issue. Normally, efficiently operating regions tend to grow faster than regions with less favorable development conditions, so that an inbuilt tension is created between efficiency and equity among a system of regions, at least in the short run. So, the called spatial or regional income inequality refers to this situation where per capita income is not uniform across spatial economic units (e.g. countries, regions, provinces) and emerges, to a great extent, due to the inability of the less advanced spatial units to close the income gap with the more advanced ones.

The problem of regional inequalities afflicts the economic science for enough decades. The last 20-30 years, this occupation is systematic and has led to the constitution of individual economic sectors, as the urban and regional economy, regional development and regional policy. Despite this fact and the richness of approaches, the regional science is not capable to produce a single, universally acceptable, theory for regional inequalities (Petrakos and Psycharis, 2004). However, the juxtaposition of two basic schools of thought-the convergence versus the divergence school-has been prevailed. The divergence school prevailed in the decades of '40s, '50s, '90s and '00s, while the convergence school prevailed in the decades of ’60s, ’70s and ’80s. Diachronically, an unequal coexistence of these schools of thought is observed, a fact that could raise the question about the existence of theoretical cycles.

The level and evolution of regional inequalities is a topic of great importance for both theory and policy. From the policy point of view, the main priority and objective of the

EU and national regional policies is to promote growth in lagging regions, reducing inequalities (Petrakos and Artelaris, 2008). Consequently, the level of the disparities can be seen as an evaluation of the effectiveness of regional policy measures. From a theoretical point of view, the evolution of regional inequalities can serve as an empirical test among alternative growth theories with sharply different policy implications (Petrakos and Artelaris, 2008).

Following, a brief presentation of the main regional theories is given and aims to shed light on the complexity of regional development: Why do some regions grow faster than others? What are the forces and processes? What are the implications? Rational questions as them, despite they have big importance for the exercise of policies, they have not been answered with a single way from the different schools of thought.

3.2. The Neoclassical Growth Theory of Regional Convergence

In the tradition of the classical economics of David Ricardo, John Stuart Mill and Adam Smith, neoclassical economics is characterized by microeconomic theory developed to examine static rather than dynamic equilibrium within economic systems. In this approach, regional growth determines regional income and economic and social welfare. Regional development within this theory is focused upon the long-run reduction of geographical disparities in income per capita and output. The causal mechanisms in the theory predict that such spatial disparities will reduce and move towards or converge upon an economically optimal equilibrium in the long run (Martin and Sunley, 1998 in Pike et al., 2006). The theory seeks to explain where and why such convergence does not occur and why disparities continue to grow or diverge between regions. Regions are understood as subnational territorial units and have been the main geographical focus of the theory.

In the neo-classical model, regional output growth is dependent upon the growth of three factors of production: capital stock, labour force and technology (Pike et al., 2006). Technological progress is seen as a key contributor to growth due to its influence upon productivity growth rates in the long run. In this basic version of the neo-classical theory, technological change as well as other important determinants such as human capital, savings and population growth rates are “disembodied” or treated independently of capital and labour inputs. Hence, this theory is often referred to as exogenous growth theory. Regional growth disparities are explained in the neo-classical approach by variations in the growth of the main factors of production: the rate of

technological progress and the relationship between capital and labour - the capital/labour ratio (Pike et al., 2006).

Neo-classical growth theory has evolved to understand changes over time. It focuses upon the supply of factors of production and assumes their perfect mobility across and between regions (Barro and Sala-i-Martin, 1992). Under the strict economic rationality and market-based conceptualizations of the neo-classical model, the perfect mobility of factors of production of capital and labour move to regions offering the highest relative rates of return. Firms look for the most profitable locations and labour seeks the highest wages. Capital and labour therefore move in opposite directions. High wage regions lose capital and attract labour. Conversely, regions with low capital/labour ratios have low wages and high returns on investment. Low wage regions lose labour and attract capital. This market adjustment mechanism works over the long run to reduce regional disparities in the capital/labour ratio and regional growth (Pike et al., 2006).

In the neo-classical theory, regional disparities are only ever temporary since spatial inequalities set in motion the self-correcting movements to underpin the eventual convergence of economic and social conditions between regions (Martin and Sunley, 1998 in Pike et al., 2006). In theory, convergence in output growth between regions occurs and an equilibrium position is achieved.

The neo-classical approach describes different types of regional convergence (Pike et al., 2006). Conditional convergence refers to movement towards a steady state growth rate resulting in constant per capita incomes, consumption levels and capital/labour ratios between regions. It is conditional because the savings rates, depreciation rates and population growth rates can differ across countries. Conditional convergence does not necessarily result in equal per capita income levels across countries. Absolute (or unconditional) convergence results when the growth model parameters are equal. Richer countries will tend to grow slower than poorer countries which start from a lower level of development. For absolute convergence, the neo-classical model suggests that per capita incomes will become equalised across countries over time.

Another important neo-classical approach that addresses inter-regional convergence is the theory of comparative advantage (Armstrong and Taylor, 2000). In this approach, nations and regions specialize in economic activities in which they hold a comparative advantage, principally in industries that utilize their abundant factors of production. Trade between nations and regions is based upon differences in such factor

endowments. In a static rather than dynamic framework, specialization and trade promote efficient resource allocation and inter-regional convergence (Armstrong and Taylor, 2000).

Constructively, the growth and convergence process leads to an even distribution of per capita income and irrespective of the initial amount of capital in a region, growth always leads to the same steady state in the long run. Any disturbances of the process are eliminated over time. These results imply that policy has no major role to play as the long-term outcome is optimal and reached automatically (Maier and Trippl, 2009). The underlying message that the economy should develop freely and not be disturbed by policy has been repeated frequently in theoretical literature as well as in policy strategies and documents. As we shall see further down, contemporary views of regional growth offer much less support for this position.

3.2.1. The Critique of the Neoclassical Approach

Criticisms of the neo-classical growth model have focused on several issues. First, its main assumptions are interpreted as unrealistic. Factor mobility is less than perfect (Armstrong and Taylor, 2000). While capital is relatively mobile, labour's economic position, for instance in the housing market, and ties of social reproduction, for instance through family and the education of children, form attachments to places that can often militate against geographical mobility (Pike et al., 2006). Indeed, neo-classical approaches have focused upon such issues in explaining persistent regional unemployment disparities (Armstrong and Taylor, 2000). Perfect information is questionable. Investors and workers are not perfectly informed and able to respond rationally to price signals. Competition is often imperfect too with many markets for goods and services not reflecting the ideal of many buyers and sellers each without significant market power (Robinson, 1964 in Pike et al., 2006). The limitations of the comparative advantage theory comprise its static framework based on inherited factor endowments and its neo-classical assumptions of diminishing returns and technological equivalence between regions and nations (Kitson et al., 2004 in Pike et al., 2006).

Moreover, a basic problem in the above neo-classical explanation is that technological progress is profoundly uneven geographically and technology diffusion exhibits strong distance-decay effects (Malecki, 1997 in Pike et al., 2006). Shifts in the technological frontier have questioned the assumption of constant returns to scale and the productivity relationship described by the capital/labour ratio. Armstrong and Taylor (2000) suggest

the long-run persistence of disparities in regional growth rates may be due to the differential ability of regions to generate their own technology and adapt technology from elsewhere. Linking to the notion of stages of development unfolding over time, the likelihood of inter-regional convergence has been linked to the later stages of national development (Williamson, 1965; Richardson, 1980 in Pike et al., 2006). This convergence is explained by the eventual equalisation of labour migration rates, capital market development, reduction of public policy bias towards core regions and the growth of inter-regional linkages.

Moreover evidence suggests the neo-classical adjustment mechanism typically fails to work or operates only in the very long run and/or in specific time periods. Fundamentally, the very determinants of neoclassical growth theory-capital stock, labour force and technology-are inherently geographically variable (Martin and Sunley, 1998 in Pike et al., 2006). Yet neo-classical theory still predicts conditional convergence even given labour and capital's heterogeneity across space (Barro and Sala-i-Martin, 1992).

3.3. Keynesian Theories of Local and Regional Divergence

Keynesian economics focused upon the under-employment of resources, the demand-side of the economy and the role of the state in managing aggregate demand. Keynesian theories focus upon the reduction of regional growth disparities in their approach to local and regional development. Building upon the critique of neo-classical approaches, the emphasis is upon understanding and explaining regional divergence: the reasons why regional growth disparities persist and are reproduced over time (Pike et al., 2006). Similar to the neo-classical approach, development is equated with the reduction of regional disparities and regions are the geographical focus. In contrast, the theories emphasise the medium rather than the long run. The adjustment mechanism in the Keynesian model focuses upon the role of demand rather than factor supply. Markets are seen as potentially exacerbating or increasing rather than ameliorating or reducing disparities in economic and social conditions. Drawing upon the ideas of John Maynard Keynes (1936), Keynesian theories use the approach and language of neo-classical economics to reach contrary conclusions.

3.3.1. The Process of Cumulative Causation

A major drawback of the neoclassical approach to explaining regional growth disparities, is that it ignores the potential contribution of factors on the demand side of the economy (Armstrong and Taylor, 2000). To remedy this weakness, attempts have been made to modify the neoclassical approach by allowing regions to trade with other regions. This opens up the possibility that regional growth differences may be explained, at least in part, by regional differences in the growth of a region's exports (Armstrong and Taylor, 2000).

A more carefully specified model that stresses and emphasizes the self-perpetuating and cumulative nature of the growth process, was initially proposed by Kaldor (1970), and was subsequently developed further by Dixon and Thirlwall (1975) (Armstrong and Taylor, 2000). Kaldor's analysis of development hinges on four fundamental concepts: (1) increasing returns in the manufacturing sector; (2) effective demand-constrained growth; (3) the agriculture-industry relationship; and (4) internal-external market relations (Targetti, 2005). In terms of development policies, Kaldor believed that: (1) economic development requires industrialization; (2) this in turn presupposes an agriculture revolution; (3) entering into the global market with a temporary stage of protection for newly established industries; (4) this must be accompanied by export-led growth policies (Targetti, 2005).

Kaldor argued that a region's growth of per capita output is determined by the extent to which regions are able to exploit scale economies and to reap the benefits that accrue from greater specialization (Armstrong and Taylor, 2000). These benefits vary according to the type of productive activity in which a region specializes. This sectoral bias in the benefits to be gained from greater specialization leads to the prediction that regions specializing in processing activities are likely to grow faster than those specializing in land-based activities (Armstrong and Taylor, 2000). The fact of increasing returns of scales in the regions that are specialized in manufacturing activities substantially removes the possibility of equilibrium in a model of economic growth. Additionally, the market's forces and the mobility of production's factors lead to increase despite of reduction of regional inequalities (Artelaris, 2009).

Furthermore, the process is cumulative since those regions able to steal a march on other regions will gain a competitive advantage. This will reinforce regional specialization since the region with the competitive advantage expands its export sector

(importing more land-based commodities from other regions) (Armstrong and Taylor, 2000). Consequently, the theory of cumulative growth is based on the principle of cumulative causation and in parallel, on the theory of export base (Artelaris, 2009). Contrary to the neoclassic model of exogenous growth of Solow-Swan, the inequalities are not forecasted to constitute a transitory but permanent phenomenon, which is going to be intensified and to be continued (Artelaris, 2009).

By way of conclusion, in order to be able to contemplate the processes of convergences and divergences, Kaldor's model has to be altered in two main ways: one involving wages and the other productivity (Targetti, 2005). The assumption that industrial wages are fixed and spent only on agricultural goods should be dropped. Even if a country of the North experiences returns to scale higher than those of a country of the South, the difference in wage dynamics could more than offset the differences in the dynamic of productivity, and the consequent lower labour cost per unit of industrial output in the South could induce trade of a large variety of manufacturing goods and intermediary goods from South to North. The diffusion effect of wage equalization could offset, or even more than offset the divergent process of income growth per capita produced by increasing returns (Targetti, 2005).

As for productivity, its source is not only endogenous (learning by doing and increasing returns to scale), but also exogenous (invention or import of capital goods embodying technical progress) (Targetti, 2005). An important cause of growth of income per capita is identified by the theory of "catching up", which was developed initially by Gerschenkron (1952) and more recently by Abramovitz (1986) (Targetti, 2005). It states that the larger the gap between a country's (or group of countries) level of income per capita and that of the leading country (or countries) at an initial point in time, the higher its (their) rate(s) of growth in income per capita. The follower importing capital goods or receiving foreign direct invstements (FDIs) makes an investment which embodies the latest generation of technical progress; the ratio of new to old capital stock is higher in the economy of the follower than in that of the leader, and consequently the rate of growth of output per person is also higher. As time goes on and the follower catches up with the leader, the gap between incomes per capita declines and the two rates of growth converge (Targetti, 2005).

3.3.2. The Critique of the Keynesian Approach

Although it attempts to integrate a consideration of the demand and the supply-side, export base theory has been criticised as oversimplistic, ignoring significant factors within regions (e.g. entrepreneurialism, public policy) and not providing a systematic explanation of the determinants of demand for a region's exports (Armstrong and Taylor, 2000). Dixon and Thirlwall's (1975) model in Pike et al. (2006) has been criticised too for failing to specify the type of exports in which a region may specialise, assuming the export sector is the only source of regional growth and generating controversial empirical evidence. More generally, Hirschman (1958) argued that polarised or dualistic development between developed cores and underdeveloped peripheries can benefit both growing regions and their hinterlands through 'trickling-down' effects that create demand for the products and labour of lagging regions (Pike et al., 2006). Although the polarisation effects identified by cumulative causation theory can be strong stimuli to regional divergence, Hirschman (1958) argues that they are countered by such trickle-down processes, especially when supported by interventionist regional policy. Deliberate state-led decentralisation of propulsive industries may reverse geographical polarisation. Whether such countervailing forces are sufficient only to keep regional divergence in check rather than to promote regional convergence is open to empirical question (Pike et al., 2006).

3.4. Extended Neoclassical Theories

3.4.1. Endogenous Growth Theory

Dissatisfaction with the role of exogenous technical progress in the neoclassical model has been addressed by the emergence of endogenous growth theory which explicitly seeks to explain mainly the causes of technological progress (Pike et al., 2006). Endogenous growth models try to take the next step and relies on the facts that technological advance comes from things that people do and many individuals and firms have market power and earn monopoly rents on discoveries (Romer, 1994). The dynamics of regional convergence and divergence are the focus of endogenous approaches to regional development and development is conceived as the reduction in regional disparities. The theories attempt to introduce increasing returns into the neo-classical production function. So they give a formal treatment to ideas that had been previously exposed informally. Endogenous growth theories retain core elements of the

neo-classical approach and language (Pike et al., 2006). Endogenous growth theory specifies the relationships of technological change and innovation to the growth process. Technological progress is seen as both cause and effect of economic growth. It is endogenous rather than exogenous to the growth process.

Endogenous growth theory has directly influenced regional development theory. The geographically uneven rates of regional convergence and the spatial clustering of high and slow growth regions are explained by the new economic growth theories. Despite the partly non-rival (non-competing) and non-excludable (non-exclusive) nature of technology and innovation (Storper, 1997 in Pike et al., 2006), the returns from the transition of knowledge are geographically bounded and the costs of transmission increase with distance.

3.4.1.1. The critique of Endogenous Growth Theory

Endogenous theory remains wedded to the standard neo-classical assumptions about economically rational agents fully knowledgeable of alternative choices and the consequences of their decisions. Endogenous theory focuses on the supply-side and gives relatively little attention to the demand-side issues of exports and balance of payments constraints on employment and productivity (Pike et al., 2006). Other problems in relating endogenous growth theory to regional development concern the limited empirical evidence of how increasing returns operate in specific industries and places, the inability to address historical change and to account for shifts and reversals in rates of regional convergence (Martin and Sunley, 1998 in Pike et al., 2006). Finally, from more radical theoretical currents, has been supported that fundamental aim of endogenous theories is the aid and the predominance of neoclassic economic thought, which is abandoned continuously more, because of the weaknesses and the restrictions of basic neoclassic model of Solow-Swan (Artelaris, 2009). The models of endogenous growth theories constitute an extension of neoclassic model and no a crack with it.

3.4.2. Geographical Economics

During the 1980s international trade theory went through a peaceful revolution: the so-called New Trade Theory (NTT) brought increasing returns, imperfect competition, and multiple equilibriums firmly into the mainstream. And though it took a surprisingly long time for the new trade theorists themselves to catch on to the possibilities, circa 1990 it became clear that the revolution in trade theory also made it possible to talk about

questions of economic geography (Clark, Feldman, and Gertler, 2000). The result was what is sometimes called the New Economic Geography.

Drawing upon a new Keynesian critique of the neo-classical approach, «Geographical Economics» or «New Economic Geography» (NEG) focuses upon the role of localities and regions in shaping the trading performance of industries within particular nations. Geographical economics is concerned with national economic prosperity and trade and their implications for uneven local and regional development (Pike et al., 2006). "Development" is interpreted as increased income and prosperity through enhanced regional and national competitiveness (Kitson et al. 2004 in Pike et al., 2006). The models of NEG critique existing neo-classical but rely upon its core assumptions of methodological individualism, perfect information, economically rational individuals, profit maximizing firms and exchange.

The NEG approach extends NTT to produce explanations for the geographic clustering of industries. In the NTT approach, the home-market size is exogenous (determined by the fact that especially labour is presumed to be immobile; clearly capital is allowed some ability to relocate in the NTT model to bring about clustering and exploitation of scale economies to benefit from given home-market effects); while the NEG approach allows the home-market effect to become endogenous, primarily through the mobility of labour, but also through allowing greater mobility of firms which have high levels of intermediate demand (Harris, 2008). Thus with both firms and labour mobility, there is even greater reallocation of economic activities across regions, with those regions having an initial market size advantage finding that falling trade costs and increasing returns-to-scale give rise to a process of cumulative causation (Harris, 2008).

However, the NEG model actually has many possible equilibrium outcomes that are sensitive to counter-prevailing centripetal (or agglomeration) and centrifugal (or dispersion) forces (Harris, 2008). Thus some NEG models predict a persistent "core-periphery" dichotomy (in output levels); others result in differential growth rates and thus divergent paths; while some suggest that there can be initially divergence followed by convergence as centrifugal forces overcome centripetal benefits (Harris, 2008). In other words, the divergence of output and income between cores and peripheries and multiple possible equilibrium positions are likely rather than the long-run convergence proposed by orthodox neo-classical economics (Krugman, 1991 in Pike et al., 2006).

By way of conclusion, spatial inequalities are a fundamental issue that has been too long neglected by economists (Fujita and Thisse, 2009). Economic geography seeks to explain the riddle of unequal spatial development. In summary, NEG models have renewed interest in trade (and hence the export-base), agglomeration and cumulative causation as key factors determining regional growth. Concentration/clustering has a positive effect on productivity because of agglomeration economies (leading to firms at such "core" locations gaining an advantage), and the resultant centralization of highly innovative, knowledge intensive firms (as well as the high-skilled labour they employ) is expected to perpetuate the economic advantage of the core over the periphery, where standardized, routine production facilities tend to dominate (Harris, 2008). The end result is sustained differences in regional development at the core and periphery.

3.4.2.1. The Critique of Geographical Economics

Summarizing, geographical economics focus upon the ways in which its particular approach tends to neglect real people and places in their real historical, social and cultural settings. The approach tends to reduce the region to a receptacle rather than a potential motor of economic activity (Pike et al., 2006). Despite its stated importance, the historical grounding of the model remains unclear and clouded in ambiguity (Martin and Sunley, 1996 in Pike et al., 2006). The emphasis upon simplifying assumptions and formal mathematical modeling produces a partial analysis of the potential diversity of the externalities central to local and regional growth. Geographical economics fails to consider the influence of local institutional, social and cultural structures in facilitating or constraining regional development, for example the innovation and learning and the role of local and regional institutional agency.

Last, the New Economic Geography «is not so new and definitely it is not geography» (Martin, 1999 in Pike et al., 2006). The characterization as Geographical Economics is more equitable and it is the one that will be supposed to be used. In any case, however, a creative communication between the traditional economic geography and Geographical Economics can have particularly positive results for two theoretical currents (Pike et al., 2006). Either way, both disagree with ignore or neglect of factor of space from the traditional economic analysis (Artelaris, 2009).

3.4.3. Competitive Advantage and Clusters

Business economist Michael Porter has developed an influential new economics of competitive advantage to explain the role and dynamics of the geographical clustering of industries within national economies and their potential contribution to productivity growth and trading competitiveness (Porter, 1990, 1998 in Pike et al., 2006). 'Development' is understood as the enhanced competitive advantage of firms, clusters and national economies within international markets. Porter's initial microeconomic analysis argued that competitive advantage could be actively created through the strategic management and upgrading of corporate activities or 'value chains' (Porter, 1985 in Pike et al., 2006). This initial work concluded, however, that 'competitive success cannot solely depend on managerial and company attributes when many successful firms in a given field are concentrated in just a few locations'. Such geographical concentrations or clusters were interpreted as containing a nation's most competitive industries.

The main benefits of clusters for competitiveness comprise, first, boosts to static productivity growth through access to specialised inputs and labour, information and knowledge, institutions and public goods as well as localised complementarities and incentives to performance enhancement (Pike et al., 2006). Second, clusters can foster innovation through clear and rapid perception of buyer needs as well as promoting early and consistent learning about evolving industry trends, technologies and other knowledge vital to ongoing competitiveness. Third, clusters can promote new business formation and innovative inter-organisational forms through inducements and relatively lower barriers to entry as well as new experiments in collaboration and partnering (Pike et al., 2006). Increasing returns and the spillover effects of externalities characteristic of the new endogenous growth theories discussed above are integral to the dynamism and growth potential of clusters. Successful clusters can forge 'first mover' advantages and benefit from externalities and increasing returns to establish their competitive advantage at the expense of other localities and regions.

Clusters can range from a city or state to a country or even a group of neighbouring countries in their geographical scope (Pike et al., 2006). Echoing elements of institutionalism and socio-economic theories, clusters are seen as capable of providing an intermediate organisational form and means of coordination in the continuum between markets and hierarchies.

3.4.3.1. The Critique of Competitive Advantage and Clusters

The popularity and influence of Porter's clusters theory have prompted substantial reflection and criticism. First, the conceptual clarity of clusters has been challenged and, in particular, its linkage to the diversity of existing theoretical approaches to geographical agglomeration. Second, Porter's emphasis upon firm and industry-oriented notions of competition and competitiveness has been questioned in relation to local and regional development. It is not clear whether and how competitiveness can be territorial and defined in terms of localities, regions or nations (Pike et al., 2006). More recent analytical review has sought to identify the interrelated factors that drive local and regional competitiveness. Indeed, given its focus upon the existing workforce, higher levels of competitiveness can be compatible with job loss and greater economic inequality and contrary to local and regional development (Sunley, 2000 in Pike et al., 2006). Although, its proponents argue, enhanced competitiveness and productivity may increase economic growth, prosperity and income.

Third, the scale and levels at which clusters form, operate and extend have not been clearly specified. The key geographical concepts of space, scale, place and territory remain underdeveloped, specifically in Porter's version of the theory. Fourth, Porter's theory gives limited attention to the social dimensions of cluster formation and dynamics (Martin and Sunley, 2003 in Pike et al., 2006). Last, the Porter brand of clusters has become tainted to a degree by commercial promotion and consultancy coupled with fashionable policy transfer and faddish adoption by international, national, regional and local development institutions (Pike et al., 2006). Critical evaluation of the actual impacts of cluster policy upon local and regional development has been limited. Universal models, such as clusters, may only work when adapted to particular local and regional contexts (Hudson et al., 1997 in Pike et al., 2006).

3.5. Concluding Remarks

By looking at the theoretical trajectories followed in regional economics, one of the major tendencies which has accompanied the theoretical development in the field is the need for more realism in sometimes rather abstract conceptual approaches. This tendency is justified by the need to broaden the interpretative capacity of the theoretical toolbox in this research field by searching for theories that are better able to reflect the real world (Capello and Nijkamp, 2009).

Several criticisms of the monopolistic modelling logic underpinning new economic geography have come from economic geography schools of thought as well as both orthodox and heterodox schools of economics (McCann and van Oort, 2009). These critiques focus variously on the immeasurability of some of the notions of increasing returns inherent in the new economic geography frameworks, the static nature of some of its assumptions, the specific focus on the representative firm, the presence only of pecuniary economies and the absence of either human capital or technological spillovers as externalities (McCann and van Oort, 2009). The new economic geography and new growth approaches argue that their analyses do provide insights into spatial economic phenomena which were previously unattainable under the existing analytical frameworks and toolkits. The conceptualizations of endogenous growth, monopolistic competition and increasing returns to scale triggered a new phase of development in economic modeling (McCann and van Oort, 2009).

The 1990s saw the development of more advanced mathematical tools for analysis of the qualitative behaviour of dynamic non-linear systems (bifurcation, catastrophe and chaos theory) together with the advent of formalized economic models which abandoned the hypotheses of constant returns and perfect competition (Capello, 2009). These advances made it possible to incorporate agglomeration economies-stylized in the form of increasing returns-into elegant models of a strictly macroeconomic nature.

The reference is in particular to the models of new economic geography and endogenous growth in which space becomes diversified-stylized. These theories anchored their logic on the assumption that productive activities concentrate around particular poles of development, so that the level and growth rate of income is diversified even within the same region (Capello, 2009). Moreover, these models stylized areas as points or abstract dichotomies in which neither physical-geographical features nor territorial ones play a role. In fact they conceived growth as an endogenous growth generated by the advantages of the spatial concentration of activities, and by the agglomeration economies typical of diversified space theories (Capello, 2009). They counterposed dynamic growth mechanisms with increasing returns and transportation costs, thus reprising the economic-locational processes analysed by location theory.

Though, in these models, the notion of space as territory so favoured by regional economists is inevitably abandoned. This stylized space does not comprise localized technological externalities, nor the set of tangible and intangible factors which, thanks

to proximity and reduced transaction costs, act upon the productivity and innovative capacity of firms; nor the system of economic and social relations constituting the relational or social capital of a particular geographical area (Capello, 2009). Yet these are all elements which differentiate among territorial entities on the basis of specifically localized features. As a consequence, these approaches are deprived of the most interesting, and in a certain sense intriguing, interpretation of space as an additional resource for development and as a free-standing production factor (Capello, 2009).

This new conception of space has partly resolved the problem from which regional development theories have always suffered: their inability to construct formal models which combine specifically territorial features, like externalities and agglomeration economies, with macroeconomic laws and processes of growth (Capello, 2009). However, the introduction of agglomeration advantages in stylized form, through increasing returns, cancels out the territorial dimension. And in so doing it divests these theories of the aspect of greatest important to regional economists: namely space as territory defined as a system of localized technological externalities, or as a set of material and nonmaterial factors which by virtue of proximity and reduced transaction costs act upon firms' productivity and innovativeness (Capello, 2009). Finding a way to incorporate the territorial dimension into theories already able to merge physical-metric, uniform-abstract and diversified space is the challenge that now faces regional economists.

Moreover endogenous growth theory and new economic geography apply the same basic logic, namely to introduce externalities into a general equilibrium model (Maier and Trippl, 2009). The introduction of externalities, which according to endogenous growth theory is necessary in order to understand long-term growth processes and spatial structures, is the main innovation of the new theories (Maier and Trippl, 2009).

In the neoclassical model externalities are seen as isolated phenomena that disturb the market process. Since these effects are not taken into account by the economic agents when making decisions, externalities typically lead to inefficient outcomes (Maier and Trippl, 2009). Consequently, in a neoclassical view policy should attempt to internalize the respective externality. The hypothetical outcome of the economy under neoclassical assumptions -without this externality- serves as a yardstick for calculating the tax or subsidy necessary for internalization (Mishan, 1971; Lin, 1976 in Maier and Trippl, 2009). This requires, however, that no other externality besides the one under

investigation exists in the economy. When this condition does not hold, the result with the one externality internalized may be worse than before.

But the contemporary view of endogenous growth theory and new economic geography departs radically from the neoclassical perspective on externalities. It seems that spatial proximity, knowledge production and innovation, network linkages, infrastructure, environmental effects (Maier and Trippl, 2009) and many other relationships add up to a tissue of externalities that spans the economy. This multitude of unintended side-effects yields a dynamic system where the structure that exists at a certain point in time influences the forces that advance the system over time (Maier and Tripp, 2009). Such a non-linear feedback loop may produce highly complex dynamics of the system.

There are several implications of this step. A kind of Pandora's Box is opened which releases various phenomena that are unknown to the neoclassical model: multiple equilibria, path-dependence and lock-in, sensitivity to initial conditions, small disturbances and indirect effects, sensitivity to marginal changes in parameters, chaotic behaviour and convergence toward strange attractors (Maier and Trippl, 2009). Briefly speaking, externalities lead to non-linearities in the growth process which may generate complex system dynamics including chaotic behavior.

Obviously, the externalities that we allow to enter our theories challenge the simple prescriptions of neoclassical economics. However, the consequences and implications of this new view of the economy are by no means clear yet. As far as policy is concerned, the new theories can provide much less guidance than the neoclassical model. Statements about automatic tendencies toward equilibrium or convergence, about efficient results of the market process, about the negligibility of small disturbances, and so on, are generally not justifiable under the new theories (Maier and Trippl, 2009). This does not mean that we should stay away from policy. To the contrary, because of possible side-effects of economic processes, path-dependence and lock-in, policy will have to try to correct negative developments. But designing policy appears to be much more difficult under the new theories (Maier and Trippl, 2009).

Closing up, we have to mention new theoretical challenges which are nowadays faced by regional scientists. The first challenge is proposed by the attempt to obtain advantages by a future convergence in different theoretical approaches, a convergence only partially obtained by the new regional growth theories (Capello and Nijkamp, 2009). Another challenge faced by regional scientists is the exploitation deriving from

cross-fertilization of interdisciplinary approaches, a limit already underlined during the 1990s, during the reflections on the health of regional science. Some risks of disciplinary barriers and of closeness to interdisciplinary views on strategic problems are the result of a regional scientists' narrow perspective, but also on some idiosyncratic approaches of mainstream disciplines towards a clearly multidisciplinary science like regional science (Capello and Nijkamp, 2009). Especially in the case of economics, after the (re)discovered interest of mainstream economists in space, and in spatial phenomena, the attitude towards regional science will change in favour of a more cooperative attitude and pronounced interest.

Related to the interdisciplinary challenge, a last important remark is worth mentioning. An interdisciplinary approach should lead scientists to explore new frontiers and achieve new interpretative analytical frameworks (Capello and Nijkamp, 2009). The tendency shown in this respect is a different one, more inclined to exploit passively the new ideas suggested by complementary disciplines. A case in this respect that is worth mentioning is the enthusiastic way in which regional scientists accepted the spatial spillover theory as a theory adding a new interpretation to the explanation of the role of space as a knowledge transition (Capello and Nijkamp, 2009).

CHAPTER 4
METHODS OF MEASUREMENT REGIONAL CONVERGENCE/DIVERGENCE

4.1. The Concept of Regional Convergence/Divergence

The dominant approach in the convergence/divergence literature follows the work of Barro (1991) and Barro and Sala-i-Martin (1992), it is known as the "classical approach" (Sala-i-Martin 1996) and it is derived from the NC paradigm. Three main concepts of convergence have been used in this literature: *unconditional (absolute)* β-convergence, *conditional* β-convergence, and σ-convergence.

The unconditional (absolute) β-convergence occurs (according to the neoclassical exogenous growth model) only when economies present homogeneity in structural, demographic and other factors. 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 (Artelaris, 2009). This kind of convergence generally is tested by regressing the growth in per capita GDP on its initial level for a given set of cross-sectional data. The basic NC β-convergence model, as proposed by Barro and Sala-i-Martin (1992), for the evaluation of convergence or divergence trends across countries or regions, adopts the following form:

$$\frac{1}{T}\ln\left(\frac{Y_{it}}{Y_{it-T}}\right) = \alpha + \ln Y_{it-T}\left(\frac{1-e^{\beta}}{T}\right) + \varepsilon_{it-T}$$

where $Y_{i,t}$ represents GDP per capita of the country or region *i*; T is the period of analysis; β is the coefficient and ε is the error term (Petrakos et al., 2005). 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 (Artelaris et al., 2012). On the other hand, a positive value for the slope β coefficient indicates divergence of GDP per capita across territorial units of analysis, in a given time period (Petrakos et al., 2005).

The convergence process is traditionally characterized by its convergence speed and its half-life. The half-life is the time necessary for the economies to fill half of the variation that separates them from their steady state. The convergence speed can be estimated by the formula $s = -ln(1 + T\beta)/T$ (where T is the length of the time interval) and the half-life by the formula $\tau = -ln(2)/ln(1 + \beta)$ (Petrakos and Artelaris, 2009).

Sala-i-Martin (1996, p. 1326) concluded that the estimated speeds of β-convergence are so surprisingly similar across cross-sectional data sets, that we can use a mnemonic rule: «*economies converge at a speed of two percent per year*..». An annual speed of convergence of around 2% means that it will take about 35 years to be covered the half gap between rich and poor economies and 70 years to cover the 75% (Artelaris et al., 2012). Such a result has important implications for theories of economic growth and economic policy. Sala-i-Martin (1994) suggests that it contains a pessimistic message for the effectiveness of redistributive policy; the rate of convergence is unaltered despite a variety of policy efforts (Boyle and McCarthy, 1997). However, panel data studies find higher rates of β-convergence (Young et al., 2004).

Conversely, if there are important differences in the technological level, in the levels of savings or in the rythms of increase of population, in the measures of democracy, political stability, industry and agriculture shares in the economy, rates of investment, technological change, Research and Development (R&D) and human capital, economies will converge towards different steady-state positions, unique for each region (Artelaris, 2009). The convergence of this type is called conditional β-convergence. In this case, the negative relation between the initial levels of per capita income and the rythms of growth will be maintained, if the differences, that present the economies in these variables, are taken into account. Consequently, the clue on conditional β-convergence does not mean essentially that per capita income of poorer economies will converge with those of richer. Many times over, this type of convergence is able to be compatible

with absolute b-divergence. For this reason, the investigation of absolute β-convergence is indubitably, more important and interesting (Artelaris, 2009).

The second type of convergence (σ-convergence) is a more conventional measure of income inequality and is simply a measure of the dispersion of per capita income between regions at a given point in time. Convergence occurs in this case when the dispersion of per capita income between regions falls over time. In the opposite case, when it is observed increase of dispersion of per capita income, is created divergence, while intermediary case constitutes the existence of stability, which is created by the stability of dispersion of per capita income. A measure of this dispersion is the standard deviation or the Coefficient of Variation (CV) of GDP per capita which is the ratio of standard deviation of a set of regional data over the average figure of the data (Artelaris, 2009).

As pointed out by Sala-i-Martin (1995) and Quah (1995), β-convergence is a necessary but a not sufficient condition for σ-convergence while σ-convergence is sufficient but not necessary for β-convergence (Boyle and McCarthy, 1997). There are cases of coexistence of absolute β-convergence and increasing dispersion of per capita income while a disturbance (shock) can provisionally increase the dispersion of income between the countries/regions, even when they converge the same steady-state position of long-lasting equilibrium (Artelaris, 2009). According to Sala-i-Martin (1996), σ-convergence examines the evolution of income distribution over time, while the β-convergence examines the mobility of income within the division (Artelaris, 2009). Thus, these two concepts of convergence are complementary and usually used together.

The last meaning concerns the convergence at clubs (clubs convergence), which is related with theoretical models of economic growth that produce multiple points of long-term equilibrium (Artelaris, 2009). Convergence of this type is presented when economies with same structural features and relatively similar initial conditions converge to similar levels of their GDP per capita (as an example poor and rich economies converge to low and highly income levels, respectively). It is therefore possible the existence of convergence between different (similar) economies that create a team (club) in a spatial total, without however the existence of convergence with the other clubs (Artelaris, 2009).

Closing up, the frame of methods of analysis process of convergence or divergence is not unique and indivisible. In general terms, segregation between two main approaches is possible. Firstly, we have techniques of econometric analysis (regression approach), as there are techniques of cross-sectional data (cross-section approach), time-series (time-series approach) and panel data that combine cross-sectional data and time-series (panel approach). The second approach includes techniques of analysis that are focused in the study and analysis of phenomenon's distribution (distribution approach), as Markov chain and more generally approaches that use stochastic processes in order to describe the mobility and the form of distributions. It deserves to be marked that the question of convergence or divergence can also be investigated with other type of method, as is the historical analysis (Artelaris, 2009).

CHAPTER 5
THE DISCUSSION ABOUT COMPOSITE INDICATORS

5.1. GDP as an Indicator for Regional Development?

Regardless the method -β-, σ- convergence or club convergence- which is applied for the measurement of regional convergence/divergence, a discussion referring to the variables of measurement and their reliability on the upcoming results has already begun. The vast majority of studies that examine regional inequalities focuses on GDP indicator. The success story of GDP is, it may be argued, fairly surprising. By its "developers", GDP was never meant to become a universal measure for economic welfare. Yet it can be said to having implicitly become that in subsequent years. Although GDP is the primary indicator of a region's wealth, there are a lot of issues questioning its reliability.

5.2. Definition of GDP

GDP [1]a measure beloved by many-economists, business owners, politicians, journalists- *"it is the market value of all final goods and services produced within a geographical entity within a given period of time"* (Goossens, 2007: 10). According to Goossens (2007), it is**:**

- *"Gross"* because the depreciation of the value of capital used in the production of goods and services has not been deducted from the total value of GDP;

[1] The Gross National Product (GNP) is another frequently mentioned measure of economic progress. The difference between GDP and GNP is the production boundaries used. GDP measures all goods and services produced in the country whether by domestic or foreign companies. It excludes goods and services produced in other countries. GNP measures all production by domestic companies regardless of where in the world that production takes place. Because its boundaries coincide with the boundaries used to measure a country's population and employment, GDP is more useful for setting domestic policies and evaluating programs (Costanza et al., 2009).

- *"Domestic"* because it relates only to activities within a domestic economy regardless of ownership (alternatively: *"national"* if based on nationality);
- *"Product"* refers to what is being produced, otherwise known as the output of the economy. This product/output is the end result of the economic activities within an economy.

GDP is the crossing point of three sides of the economy, demand, production and income. These three different crossing points in the economy also translate into three approaches to measuring GDP. Each should theoretically yield the same result, but as different data sources are used to estimate them, they will in practice contain small differences because of statistical measurement discrepancies (Goossens, 2007). The demand side decomposes the expenditure into consumption and investment. Specifically, *"it is typically measured by adding together a nation's personal consumption expenditures, government expenditures, net exports and net capital formation"* (Costanza et al., 2009: 3). While the production approach measures the value added each sector of the economy contributes to the final output, and finally the income approach breaks down the remuneration of production factors different people of institutions receive (Goossens, 2007).

Also, GDP is based on estimates and survey data maintained in a country's System of National Accounts (SNA). These consist of detailed economic census data collected at regular intervals. Thence, annual and quarterly GDP estimates are extrapolated from the census data combined with annual economic survey data such as retail sales, housing starts, and manufacturer shipments (Marcuss and Kane, 2007 in Costanza et al., 2009).

5.3. A Brief History of GDP

In 1665 Sir William Petty produced the first estimate of a national income, namely for England. His work aimed to determine which outlays on warfare could be supported by means of tax revenues (van den Bergh, 2009). Work in the early twentieth century by Nobel Laureates Simon Kuznets for the USA and Richard Stone and James Meade for the UK allowed for the rapid diffusion of the GDP indicator in economic research and politics (van den Bergh, 2009).

GDP played a critical role as a war-planning tool during the Second World War. When GDP methodologies were initially developed in the US and UK in the 1930s and 1940s, the world was in the midst of major social and economic convulsive upheaval from two

global wars and a Great Depression. The point was that the use of GDP estimates would show that the economy could provide sufficient supplies for fighting WWII while maintaining adequate production of consumer goods and services (Marcuss and Kane 2007 in Costanza et al., 2009).

The use of GDP globally as a measure of economic progress was further strengthened as a result of the Bretton Woods Conference. In 1944, in order to avoid a recurrence of such instability caused by unstable currency exchange rates and discriminatory trade practices, leaders of the 44 allied nations gathered in Bretton Woods, New Hampshire, to create a process for international cooperation on trade and currency exchange. The purpose was that the international trade would create jobs in all countries. So, at the time it was conceived, GDP was a useful signpost on the path to a better world (Costanza et al., 2009).

Nowadays, the influence of GDP information in the economy should not be underestimated, as it runs through multiple channels: government, politics, public officers, private businesses, financial markets, investors, media, consumers and international agencies and organisations such as the European Union (EU), United Nations (UN), International Monetary Fund (IMF), World Bank and Organisation for Economic Co-operation and Development (OECD) (van den Bergh, 2009). Moreover, these channels reinforce each other. In the current, continuously, altered economy, there can be identified several indications of the influence of GDP information on economically-relevant decisions.

From the side of politicians, they want to avoid low GDP growth rates because they fear negative voter responses. To some extent this is motivated by the belief that insufficient growth will lead to economic instability characterized by much unemployment. If GDP does not grow according to hopes and expectations, politicians at both national and supranational levels become very nervous, and will not relax until GDP retains its old growth pace.

Therefore, through pessimistic (optimistic) responses by individuals, firms, and governments to forecasts of a low (high) rate of GDP growth, GDP information could create a pro-cyclic effect and reinforce it (van den Bergh, 2009). This resembles the way in which behavior in financial markets is steered by perceptions, leading to herd behaviour which causes expectations to become true. Daily information in various news media about reduced GDP growth only serves to reinforce feelings of consumers,

investors and others that things are going from bad to worse. The current financial crisis is illustrative of this phenomenon. This creates a bleak atmosphere influencing expectations and through it behaviour of economic agents (van den Bergh, 2009). Thus, the consequence from the diffusion of GDP information is a large influence on consumption, investment and policy decisions, with evident repercussions for economic structure and social conditions. Surely, this argumentation from other economists is acceptable but from others is questioned.

5.4. Why GDP is a Convenient but Inadequate Measure of Development? Shortcomings of GDP

Since the 1960s, the use and implicit interpretation of GDP (per capita) as a proxy of regarding an increase in GDP as progress has received much criticism. Soon enough the very fathers of the new accounting woke up to criticize the extent and scope to which GDP had been used. It was not as if Kuznets had woken up to this only in the 1960s. Already in 1934, while advocating its use, he had warned that "*the welfare of a nation can scarcely be inferred from a measurement of national income as defined above*" (Goossens, 2007). The critique of Kuznets has been seconded by many prominent economists, including a number of Nobel laureates (Daniel Kahneman, Robert Solow, Joseph Stiglitz, Amartya Sen and Muhammad Yunus) (Goossens, 2007). Notwithstanding its obvious deficiencies, GDP is a measure globally accepted and followed. Some central shortcomings of GDP are given bellow:

- **Informal Economy:** there are several underground (unobserved, non-observed, unrecorded) economic activities which play a major role in estimating the total economic activity of an economy (Feige and Urban, 2008). But this informal/underground economy goes uncounted in GDP as it only covers activities and transactions that have a market price. This implies that the benefits were already enjoyed but the market costs were not yet part of GDP (van den Bergh, 2009). So, GDP does not recognize the contribution of "non-market production". On the contrary, the huge branch of “black economy” is omitted not at random from the estimation of GDP withholding activities with a serious economic footprint.

- **Leisure:** leisure can certainly be said to contribute to people's welfare. However, from the GDP perspective, there is a clear "opportunity cost" of leisure (Goossens, 2007). But, each unit of leisure is a potential but "lost" increase of GDP.

- **Technology:** GDP only reflects the value of the end product. It abstracts from changes in technology and from dynamics in capital accumulation, to name a few (Goossens, 2007).

- **Human Capital:** investments in education and health are mostly treated as consumption in GDP, rather than investment. Changes *i.e.* in the health conditions of a society are only reflected in GDP in so far as they increase the costs of the health system. In this regard, a more expensive health care system increases GDP although the basis of this cost growth can be in more advanced techniques, increased life-expectancy, inefficiency, lifestyles, prevention or other reasons for more diseases (Goossens, 2007). The output from these expenditures is routinely underestimated in GDP.

- **Income Distribution, Relative Income and Rivalry for Status:** the GDP per capita indicator emphasizes average income and neglects the income distribution, even though an uneven distribution implies unequal opportunities for personal development and well-being (van den Bergh, 2009). Furthermore, individuals or families with low incomes benefit relatively much from an income rise, because of the diminishing marginal utility of income. GDP per capita does not capture these features.

As the GDP completely omits the relative income aspect of welfare, it tends to overestimate social welfare or progress (van den Bergh, 2009). Although an increase in relative income can improve the welfare of an individual, social welfare is not being served by it. The reason is that status is a very scarce good, causing rises in relative income and welfare to resemble a zero-sum game: what one individual gains, others lose (van den Bergh, 2009).

- **Environmental Externalities and Depletion of Natural Resources:** from a sustainable development perspective the presumably single most important "unpriced" realm in GDP are the natural resources (Goossens, 2007). Moreover, if these are being polluted any resulting damage does not enter GDP, but when pollution is being cleaned up this will increase GDP (van den Bergh, 2009). In addition, the capital depreciation associated with environmental change and the depletion of resource supplies is missing from the GDP calculation. As GDP records only the transactions but does not capture the changes in the underlying capital, the deterioration of this capital will go unnoticed for a long time (Goossens, 2007).

- **Crime:** all forms of social breakdown that involve the input of additional police force (crime), an increasing prison population, damages to property or lawyers who manage all these (Goossens, 2007). They should add to GDP as they involve monetary transactions at some point.

Also, it has to be mentioned the precision of GDP, as GDP measures what and where it is produced but it does not measure the local income since some income may go to other national or foreigner regions (Petrakos and Artelaris, 2008). This happens in order to avoid congestion costs and negative externalities and to exploit the incentives provided by the Greek government for the decentralisation of industrial activity. Having no data for the regional counterpart of GNP and, as yet, no data on cross-regional commuting makes it difficult to account for this caveat (Petrakos and Artelaris, 2008).

In conclusion, the shortcomings of GDP seem to outrival its relative benefits. According to McCulla and Smith (2007), the purpose of measuring GDP is to actually answer questions such as "how fast is the economy growing," "what is the pattern of spending on goods and services," "what percent of the increase in production is due to inflation," and "how much of the income produced is being used for consumption as opposed to investment or savings". Essentially, it is important to recognize that GDP is not inherently bad-it measures what it measures. Rather it is being misused as an indicator of something it doesn't measure and was never intended to measure. Therefore, the sense of urgency to move *"beyond GDP"* is driven by the interdependent, global and long-term nature of current challenges such as financial and social crisis and environmental challenges (See Stiglitz et al. 2009; See Appendix I).

5.5. Why do we Need Indicators? And What Type?

5.5.1. Importance of Consensus on Indicators

The plea for moving beyond GDP is not new. But, in what direction should we search for indicators that pick up a rich set of factors that are part of regional development? It depends. One needs indicators for different reasons, in different parts of the policy life cycle. Assessing existing policies or developing new policy options requires indicators showing where a community stands, where it is going and how far it is from where it wants to be. Indicators are necessary in all steps of the policy cycle: to describe the current situation/problem; to analyse the causes; to identify possible solutions and analyse, select and implement policy proposals; to monitor and evaluate the policies and

to communicate the outcomes at all steps of the policy cycle. This requires clear and at the same time multidimensional indicators showing the links among a community's economy, environment, and society.

Therefore, at first glance there seems no need to seeking for the one and unique indicator in the form of an all encompassing commonly accepted indicator of regional development. Yet the need for consensus on indicators-whichever their usage-is really essential (Canoy and Lerais, 2007). Without that there are no real possibilities for cross-regional comparisons or for analysing how things have evolved over time. Further, commonly accepted indicators create a common language in public debate, provide consistency in policy packages and enable accountability. A plethora of competing indicators will leave too much room for political tinkering and indicator shopping. Consensus on indicators is also useful for the quality development of them, as, the more people use an indicator the better the data collection tends to get (Canoy and Lerais, 2007).

5.5.2. Different Indicator Approaches

However, there are different dimensions in which indicators can differ. Indicators could be employed for forward or backward looking purposes (See Appendix II). There is the distinction between one-dimensional and aggregate indicators, between objective and subjective indicators and between partial and all-encompassing. Besides these general differences in scope and methodology, the phase in the policy life cycle also determines which type of indicator is most suitable, as well as the level at which policies are made (local, national, supra-national) essential (Canoy and Lerais, 2007). While each policy proposal at each phase of its life cycle needs its own indicator. One can criticize GDP for not picking up elements that are important for well-being, but its universal usage and its ability to play a role both in backward looking and forward looking analysis, contributes to its popularity. To effectively meet the future challenges, a broad-based indicator with these features measuring the regional development will be needed essential (Canoy and Lerais, 2007). Yet it remains an open question how to find this and then fully accept it as it will rise many doubts.

5.6. Composite Indicators

As, the world is changing so fast, a need to know as soon as possible when things go wrong is rising time to time. This is where composite indicators enter into the

discussion. Composite indicators are increasingly recognized as a useful tool for policy making and public communications in conveying information on countries' performance in fields such as environment, economy, society, or technological development (Nardo et al., 2005; OECD, 2008).

Essentially, a composite indicator is an aggregated index comprising individual indicators and weights that commonly represent the relative importance of each indicator. It often seems easier for the general public to interpret composite indicators than to identify common trends across many separate indicators, and they have also proven useful in benchmarking country performance (Nardo et al., 2005; OECD, 2008). The composite indicator should ideally measure multidimensional concepts which cannot be captured by a single indicator, *e.g.* competitiveness, industrialisation, sustainability, single market integration, knowledge-based society, etc. However, the construction of a composite indicator is not straightforward and the methodological challenges raise a series of technical issues that, if not addressed adequately, can lead to misinterpreted or manipulated composite indicators which may send misleading or non-robust policy messages. Therefore, careful attention needs to be given to their construction and subsequent use (Nardo et al., 2005; OECD, 2008).

Moreover, it is worth33emphasizing that, although there is a proliferation in the use of composite indicators over the last years, there is no commonly accepted methodology on constructing them (Petrakos and Artelaris, 2008). The main advantages and disadvantages of using composite indicators are presented in Table 5.1 below.

Table 5.1.: Pros and Cons of Composite Indicators

Pros	***Cons***
Can summarise complex or multi-dimensional issues in view of supporting decision-makers.	May send misleading policy messages if they are poorly constructed or misinterpreted.
Easier to interpret than trying to find a trend in many separate indicators.	May invite simplistic policy conclusions.
Facilitate the task of ranking economies on complex issues in a benchmarking exercise.	May be misused, e.g., to support a desired policy, if the construction process is not transparent and lacks sound statistical or conceptual principles
Can assess progress of economies over time on complex issues.	The selection of indicators and weights could be the target of political challenge
Reduce the size of a set of indicators or include more information within the existing size limit.	May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action
Place issues of economy performance and progress at the centre of the policy arena.	May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.
Facilitate communication with general public (i.e. citizens, media, etc.) and promote accountability.	

Source: Saisana and Tarantola (2002).

Hence, composite indicators are much like mathematical or computational models. As such, their construction owes more to the craftsmanship of the modeller than to universally accepted scientific rules (OECD, 2008). The construction of composite indicators involves stages where subjective judgement has to be made: the selection of indicators, the treatment of missing values, the choice of aggregation model, the weights of the indicators, etc (Nardo et al., 2005). These subjective choices can be used to manipulate the results. It is, thus, important to identify the sources of subjective or imprecise assessment and use uncertainty and sensitivity analysis to gain useful insights during the process of composite indicators building (Nardo et al., 2005; See Appendix III).

CHAPTER 6

THE DETERMINANTS OF REGIONAL PROBLEM IN GREECE

6.1. A Short Introduction

Greece, a southern European country, has severely hit by the on-going financial and economic crisis. The economic crisis have widened the internal inequalities measured by GDP per capita over time, resulting to the consolidation of a centre-periphery pattern, characterized by the augmentation of the capital region's (Attiki) size, and the widening of the gap between this region and the rest of the country. Regional policy, implemented through the Community Support Frameworks (CSF), has proved inadequate to reverse the above trends. On the contrary, it seems to have encouraged the pattern of unequal development (Caravelli and Tsionas, 2011).

6.2. The Perceptions of Greece's Regional Problem

Greece is divided into 4 NUTS[2] I units, 13 NUTS II units and 51 NUTS III units. An important feature of Greece is the dominance of the metropolis. The metropolitan region of Athens, with 3.074.160 inhabitants, contains the 30% of the national population (of

[2] Classifications are an important tool for the collection, compilation and dissemination of comparable statistics. The NUTS ("Nomenclature of territorial units for statistics") classification is a hierarchical system for dividing up the economic territory of the EU into territorial units for the purpose of the collection, development and harmonisation of EU regional statistics and for the socio-economic analyses of the regions. So it subdivides each Member State into NUTS level 1 territorial units which are major socio-economic regions, each of this unit is subdivided into NUTS level 2 territorial units which are basic regions for the application of regional policies and these in turn each being subdivided into NUTS level 3 territorial units which are small regions for specific diagnoses. Also, the NUTS classification serves the purpose of framing of EU regional policies. Regions eligible for aid from the Structural Funds (Objective 1) have been classified at NUTS 2 level while areas eligible under the other priority objectives have mainly been classified at NUTS 3 level.

(http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction)

just 10.787.690 million, according to the population census of 2011). Thessaloniki comes second with about 819.770 inhabitants, while Patras, the third largest city of the country, has about 214.580 inhabitants. There are another three cities with about 150.000 inhabitants each, followed by several smaller cities typically serving as regional administration centres, with populations ranging from 20.000 to 80.000 inhabitants. The dominance of Athens (and Thessaloniki) has been consolidated through the fast growth of their suburbs and satellite cities or regions. Arguably, Greece is characterised as the most concentrated urban structure in Europe.

The persistence of regional inequalities in Greece and the strengthening of the leading position of Athens region constitute a serious structural problem. Greece has a number of peculiarities that affect its spatial structure and the level and type of its regional imbalances. The factors that have influenced or continue to influence the regional inequalities in Greece, they could be categorized in historic, geomorphologic, economic and political, such as the centralized structure of public governance.

6.2.1. Historic Factors

In Greece, the metropolitan centre was created in the southern department of the continental country, and this "paradoxical" choice has been influenced considerably by three historical factors: the progressive creation of Greek state, the Asia Minor destruction and the postwar division of Europe in West and East with the transformation of northern borders of country in part of "Iron Curtain" (Petrakos and Psycharis, 2004).

The Greek state was created for the first time in 1828 with borders in the line Amvrakikos-Pagasitikos and received his final form afterwards the Second World War, with the annexation of Dodecanese. In the intermediary interval, the Greek territory was increased progressively, but the constant point of report that offered some sense of safety and stability was always in the southern department of country (Petrakos and Psycharis, 2004). Thus therefore, the progressive configuration of territory created temporally different conditions of departure for the remainder potential urban centres of country, encouraging Athens.

The second, and potentially the most important, from the historical factors was the choice of installation of big part of refugees of Asia Minor destruction in Athens. The increase of population of Athens at 55% in 1923, despite the initial difficulties of installation, created quickly another scale of data for Athens and differentiated it

substantially and definitely from the other cities of the country (Petrakos and Psycharis, 2004). The quality of human potential that was set in and the fact that in that period Athens exceeded the critical size of local economy that allowed it to enter in a track of selfinking growth, both of them functioned accumulatively and created a particularly intense dynamic that was not available in other parts of the country.

The third historical factor concerns a period of 40 years that begins in 1949 and expires in 1989. During this period and as result of «Cold War» and the Greek civil war, the northern borders of country were hermetic closed, as well as the three neighbouring countries had Socialist regimes. The closure of borders for so many years vitiated all the important cities of Northern Greece, while their productive activities could be addressed only in the Greek market and consequently they lost the advantage of proximity with the markets of neighbouring countries (Petrakos and Psycharis, 2004). The progressive opening of the borders after 1989 creates for the frontier prefectures of the country chances of development of cross-border transactions and enhancement of their economies. However, the abrupt change of a chronic shaped situation includes and certain dangers that should be faced.

6.2.2. Geomorphologic Factors

Greece is characterised by a highly fragmented physical and economic space, due to the existence of hundreds of inhabited islands and the limitations imposed by its mountainous territory. Petrakos and Christodoulakis (1997) argue that Greece has had to cope with a uniquely unfavourable situation not found elsewhere in Europe. That is, Greece's location in South-eastern Europe placed it far away from major markets and major European market centres. In addition, it is characterised by unique border conditions, as it has common borders with one EU country (Bulgaria) and, until recently, had limited economic (or any other) relations with its neighbours (Albania, FYROM, Bulgaria and Turkey) (Petrakos and Psycharis, 2006). Furthermore, the country's borders were real barriers to communication and trade with neighbouring countries. These conditions distorted economic relations, with serious long-term implications for the economic structure and performance of the country. Thus, the fragmentation increases transportation and accessibility costs, requires major investment in infrastructure and inhibits the internal integration of the economy. Hence, the limited accessibility to internal and external markets has created a productive structure dominated by small inward looking firms serving local markets and having limited

capacity to adapt and compete in national or international markets, resulting in diachronic demographic shrinkage of these regions (Petrakos and Psycharis, 2006).

Generally, the population of the country tends to concentrate in the flat and coastal regions, while the mountainous regions diachronically have suffered from an important reduction of their population. The transfer of populations to the flat and coastal regions is connected with (a) the change of productive model of the country during the 20th century, (b) the progress of science and technology and (c) the more favourable climatic conditions which prevail in the flat regions (Petrakos and Psycharis, 2004).

6.2.3. Political Factors

Undeniably, there has been adopted the stance by a lot of supporters, mainly in the region, that the regional problem of Greece is due to the indifference and the centralized structure of public governance. The structural inadequacies of public sector in Greece constitute one of the most basic suspensible factors for the achievement of high rythms of economic and social development. This implies that the regional problem is primarily a political problem and consequently the development of a region is a subject of political will. If there is the appropriate political will, substantially regional inequalities would not exist. However, this opinion is neither equitable nor contributes in the comprehension of the factors that create or accentuate the inequalities (Petrakos and Psycharis, 2004).

It is evidential that despite of the inflow of important resources from the EU, the social and economic inequalities between the regions and the different territorial units in their interior constitute the basic structural characteristic of growth's model of the country. Despite the important steps to the economic and social convergence with the remaining European member states, eight from the thirteen regions of the country have per capita GDP levels of less than 75% of the EU average.[3] Also, the intraregional inequalities are particularly intensive in the regions with islander character, in the mountainous and removed regions as well as in the big urban centers.

The reasons of this insufficiency are due to structural and functional inadequacies of Greek government in all levels. Briefly, these pathogenic are detected in the following factors[4]: i) The centralized structure of administration and the accumulation of enormous volume of executive nature of operations in the ministries lead to inefficiency

[3] http://kallikratis.ypes.gr/Contents.aspx?lang=gr&CatId=260&View=20
[4] http://kallikratis.ypes.gr/Contents.aspx?lang=gr&CatId=260&View=20

to the confrontation of citizens' daily problems and extract important energy and resources from the strategic planning and policymaking in their sector of responsibility. ii) The frequent covering of competences and operations creates enormous administrative cost, confusion and disaffection in the citizen and diffusion of administrative responsibility.

Therefore, the fragmentation of the local and regional administration in large number of small relatively municipalities, prefectures or regions did not allow the effective exercise of policies (Petrakos and Psycharis, 2004). The limited organisational possibilities of local government 1st and 2nd degree because of their small demographic and territorial size are unable to contribute substantially in the strategic planning and materialisation of local developmental policies, and also in the achievement of essential economies of scale for the provision of basic services for the citizens.[5] Nowadays, the overwhelming majority of local authorities does not have the essential economic and administrative severalty, while depends exclusively from the financing of the government.

The new Architecture of Government and Decentralised Administration -the "Kallikratis" Project- constitutes the recent (Greek Parliament 2010-Law 3852/10) reform of administrative division of the country and the re-definition of limits of its self-government units. From 01/01/2011, the number of Municipalities of the country, according to unbiased criteria (geographic, demographic, developmental, social, economical, functional, cultural, historical and land-planning) of conjunctions, is limited drastically from 1034 to 325. It is achieved the reorganization of the Regional decentralization and regional authorities with a recommendation for the first time directly elected Regions. The regions are derived from the integration of existing government secondary institutions, i.e. the current 54 prefectures, the extended 3 prefectures and the 19 county -a total of 76 administrative units- progressing to regional governments in numbers proportionate to the current 13 administrative Regions.[6] The imperative territorial, administrative and mainly functional recomposition of the country aims to the enhancement of democratic planning, the strengthening of developmental possibilities, the reduction of inequalities, the access of citizens in qualitative services as well as the enhancement of democratic accountability and control.

[5] http://kallikratis.ypes.gr/Contents.aspx?lang=gr&CatId=260&View=20
[6] http://kallikratis.ypes.gr/Contents.aspx?lang=gr&CatId=260&View=20

6.2.4. Economic Factors

6.2.4.1. Economies of Scale and Agglomeration

The international bibliography interprets satisfactorily that certain regions attract more activities and are developed faster from others. The interpretation pins their rapid growth on their size. Regions having big urban centres benefit from the existence of economies of scale and agglomeration and consequently offer important cost estimating advantages of installation in new enterprises (Petrakos and Psycharis, 2004). Thus, the enterprises tend to be installed in big urban agglomerations benefiting from their advantages. Their choice, however, increases more the size and attractiveness of big cities, a fact that attracts more enterprises. However, the existence of a big urban centre in a region or an area does not allow the development of other relative nearby, because either the required population does not exist in order to supports it, or both of them would be addressed in the same national or regional markets (Petrakos and Psycharis, 2004).

In the case of Greece, empiric studies tend to support that the size of the cities is an important factor which determines the rythms of their demographic change. Also, the size appears to influence positively the level of development, in combination, however, with a *"distance of safety"* from the two metropolitan centres of Athens and Thessaloniki (Petrakos and Psycharis, 2004). Applying the results of Krugman and Venables (1995) in a regional context, proximity to large markets (or metropolitan regions) facilitates growth only if differences in development levels and structures are not too pronounced (See Ioannides and Petrakos, 2000). Otherwise, it leads to a penetration of product markets by the more dynamic enterprises of the more advanced region. These differences may explain why Peloponnese has failed to take advantage of its proximity to Athens, but Athens has taken advantage of its proximity to Peloponnese (Ioannides and Petrakos, 2000). It appears that distance from Athens has enabled Thessaly and Crete to offset the "curse" of proximity to the metropolis and to develop minimum urban infrastructure. The success of Crete in overcoming geographical isolation, by developing effective transportation and by taking advantage of its potential in tourism is a noteworthy lesson (Ioannides and Petrakos, 2000).

Characteristic example of proximity, also, constitutes the fact that the prefecture of Attiki has *"exported"* a significant part of its manufacturing capacity to the surrounding *"satellite"* prefectures of Voiotia (and partly of Evvoia) to the North and Korinthia to

the South (Petrakos and Psycharis, 2006). This manufacturing capacity relates to industrial firms established a short distance outside the borders of Attica, but with management, ownership, labour force and resources all coming from. The incomes which create as enterprising profits or as wage of labour and other production's factors elude to a large extent to Athens and consequently they have limited contribution to the local development (Petrakos and Psycharis, 2004).[7] This diffusion of Attiki's industrial activity falsifies the statistical data, causing a significant problem in both the evaluation of regional inequalities and the design of proper regional policies (Petrakos and Psycharis, 2006).

Consequently, it appears that the effect of distance is dependence of size. Relatively small prefectures or small cities are *"frozen"* more easily in large distances and are *"burned"* more easily in short as they belong to the sphere of influence of the metropolitan centres. Contrary, bigger cities or prefectures have stronger resistance in the large distance (Petrakos and Psycharis, 2004).

6.2.4.2. Productive Structure and Human Resources

In the increasingly globalized environment, the recent financial and economic crisis will reflect the structural characteristics of individual regions, revealing the inability of regions with a high share in traditional sectors of low competitive advantage to attract investments and create/maintain job opportunities (Caravelli and Tsionas, 2011). Greek prefectures which have an important share of secondary and tertiary sector of production and specialisation in sectors of capital-intensive and technology-intensive are expected to have more favourable prospects of development. On the contrary, prefectures with a high share of the primary sector and low share of secondary and tertiary, or prefectures with specialisation in traditional industrial sections are expected to come up against more unfavourable prospects of development (Petrakos and Psycharis, 2004).

Boosting growth on a regional/local level by channeling production to innovative sectors could best deal with the *"equity versus efficiency dilemma"* widely discussed in the literature. For many Greek regions, this might imply promoting the green economy

[7] This analysis highlights the important dimension that can exist between the *regional product* and *regional income*. Anything is produced in a prefecture or a region does not create necessarily incomes for its residents, if the productive process uses production's factors from other regions (Petrakos and Psycharis, 2004).

in industrial sectors (including energy), encouraging "quality" farm production, or innovative tertiary activities in rural areas (i.e. rural or alternative tourism), depending on the existing structure of the local economy. This appears to be the only strategic option which would compensate for losses in traditional industrial production, construction, (mass) tourism and transport where a high dependence in these sectors exists (Caravelli and Tsionas, 2011).

From the other side, regions that concentrate important sizes of scientific dynamic and erudite labour force, have a comparative advantage in attracting or developing productive activities and adapting rapidly in the differential data of economy. Prefectures with a favourable productive structure (a critical share of manufacturing in economic activity as well as technology or capital intensive enterprises), high quality human resources and natural resources suitable for the development of tourism, have a combination of features which will probably ensure favourable results in the future.

6.2.4.3. The Internationalisation of the Economy and the European Integration

The rise in consumer and producer services at the expense of the productive sector of the Greek economy has not however implied a shift towards modern, high value added sectors, based on innovation and knowledge activities (Caravelli and Tsionas, 2011). The internationalisation of Greek economy, that the last years takes place via the mechanisms of European integration initially decreased and then eliminated the protective complex of industry and increased, through the international competition, the opportunities and mainly the other dangers that enterprises faced (Petrakos and Psycharis, 2004). The repercussions of economic integration were not uniformly distributed in the Greek space.

During the period 1985-1995, intense phenomena of industrial crisis were presented. The negative influence of European integration on the productive system of Greece has become apparent in regions with a serious concentration of large-scale industrial capital which lacked a significant tertiary sector to counterbalance the loss in productive potential (Petrakos and Saratsis, 2000). The process of economic integration exerts pressures selectively hitting the most significant (and most exposed) clusters of economic activity. The rapid tertiarisation of the two metropolitan areas offers employment alternatives which are not available in the remaining areas and which are comparable with the productive profile of European metropolitan region (Petrakos and Saratsis, 2000). On the other hand, the areas which attract a large proportion of

economic activities and modern sectors, such as finance and other new economy activities (notably Attiki and Central Macedonia) are those to be first and more severely hit by international economic crises. The deepening of European economic integration in the period 1985-1995 influenced negatively the developmental prospects of the country, however, in its interior, the repercussions were different, while the prefectures that suffered the more losses were the most developed so that led to a peculiar regional convergence going down (Petrakos and Psycharis, 2004).

6.2.4.4. The Influence of Economic Cycles

Also, it has to be mentioning the dependence of regional inequality on economic cycles. Berry (1988) maintains that regional inequalities expand or contract during the economic cycle, depending on whether the economy is in an expanding or declining phase (Petrakos and Saratsis, 2000). This position, which directly links high rates of economic growth with increased inequalities, has some points in common with the growth pole theory of Perroux (1970) and the cumulative causation theory of Myrdal (1957) (Petrakos and Saratsis, 2000). In particular, Petrakos and Saratsis (2000) give empirical evidence of the fact that, regional inequalities in Greece decreased in the decade of the 80s as result of the prolonged recession which hit the economy in that decade. On the contrary, the recovery of the economy in the 90s increased regional inequalities, since it began in the more advanced regions of the country. Thus, one aspect is that inequalities are considered to be a phenomenon with pro-cyclical character.

The inverse relationship between economic growth and regional inequalities is not supported by all authors. Dunford (1993) presents evidence at the European level indicating that regional disparities tend to increase during periods of recession and decrease during economic expansion, being in that sense a phenomenon with anti-cyclical behaviour. Thus, a number of studies on EU economic cycles, show that regional disparities tend to rise in periods of severe recessions and fall in periods of economic growth (referred to in Petrakos, 2009). At the same time, the view of many researchers that the restrained policy framework imposed within the Eurozone in periods of crisis leads to chronic structural imbalances, which preserve regional inequalities, increasingly gains in importance (Caravelli and Tsionas, 2011). This view draws on the experience of the crisis of the 80s which induced the adoption of a series of Stability Programmes as well as the current crisis (from 2008 onward) which has

imposed austerity measures under the rules of the Stability and Growth Pact and the ECB: by prohibiting discretionary macroeconomic policies such measures have led to chronically low domestic demand and public investments, perpetuating the supply deficit problem (which results in low international competitiveness and a high import/export ratio) and failing to generate convergence at the EU and national level (Caravelli and Tsionas, 2011).

6.2.4.5. Regional Development Policies

Greek regional policy in the post-war period has been considered responsible for the gradual establishment of the polar development pattern, expressed by the strengthening of selected polar points in space, already enjoying significant economies of agglomeration due to the concentration of people and economic activity there. In the 1980s there was a shift in emphasis towards the model of localized endogenous development, following changes in the European regional policy model, aiming at the dispersion of responsibility to geographically lower administrative levels (Christofakis, 2001). This would be implemented through the adoption of the principles of "subsidiarity" and "partnership" of the Structural Funds (Caravelli and Tsionas, 2011).

This was reflected in the Integrated Mediterranean Programmes-IMP (1986-1993) the initiation of which coincided with the first stabilization programme adopted by the Greek government in 1986. This programme was the means to implement monetary stability, set at the centre of the government's macroeconomic policy until about mid-1990s, aiming at the curtailment of growing inflation, public debt and deficit. Austerity measures resulted in the dramatic rise in unemployment rates and production deficits. Clearly, public spending and income (including regional) distribution were the areas mostly hit by these measures (Argeitis, 2005).

The 1st CSF (1989-1993) aimed at the reduction of regional inequalities by boosting small and medium enterprises and improving regional transport network in order to upgrade rural regions. The 2nd CSF (1994-1999) emphasized the improvement of large-scale infrastructure works aiming at encouraging the country's linkages with the international economy rather than encouraging development at the regional level. The 3rd CSF (2000-2006) focused on raising productivity and competitiveness and boosting employment at the regional level, through investments in human capital and information technology. This programme initiated special development criteria for mountainous and island regions -these are the "integrated development programmes", designed to be

applied in selected zones of the country-side, aiming at boosting rural development- but also focused on the improvement of metropolitan regions, its ultimate aim being the strengthening of regional external linkages (Christofakis, 2001).

Despite the greater emphasis towards promoting development at the regional/local level in both the 1st and the 3rd programmes, results concerning convergence and socioeconomic cohesion on the intra-national level and between Greek and EU regions have not been satisfactory. Yet, concentrating resources on large-scale projects in specific regions, for avoiding dispersion of resources to small-scale inefficient works, is a precondition of the current memorandum -signed between the Greek government and its lenders- for the continuation of financial flows to Greece (Caravelli and Tsionas, 2011).

The current 2007-2013 CSF gives further emphasis in the regional and local dimension of development, as it was designed to be implemented mainly through regional and local entrepreneurial programmes. This implies that local actors should acquire the necessary knowledge in planning and managing local programmes in order to integrate them in the best possible way with regional programmes (Christofakis, 2001).

Furthermore, there is a clear shift in emphasis towards the improvement of regional competitiveness, under the pressures of increased globalization, by boosting investment in research and innovation in order to promote the development of knowledge-based sectors at the regional level (European Commission, 2007). Given the delay in the implementation of the ESPA programme -greek initials for National Strategic Reference Framework (NSRF) for the programming period 2007-2013- that the current debt crisis has brought about, the traditional low absorption rate in Greece and the country's new administrative division, the efficiency of the current programme in boosting regional growth and reducing disparities remains to be seen (Caravelli and Tsionas, 2011).

CHAPTER 7
REGIONAL CONVERGENCE / DIVERGENCE IN GREECE: THE EMPIRICAL LITERATURE

7.1. Discussion on the Regional Convergence/Divergence in Greece: Literature Review

What does the economic literature tell us about Greek regional convergence trends over the longer term? The recent Greek and international bibliography includes an important number of articles and studies that attempt to ascertain on the one side the convergence's or divergence's tendencies of Greek prefectures or regions and on the other side the factors that have shaped the current level of inequalities. Therefore, the academic debate about the level of regional inequalities and, consequently, the policies that are necessary to cope with the regional problem, is characterised by many different opinions, estimations and approaches, producing a rather controversial picture for the regional inequalities in Greece.

A few studies show a narrowing of regional inequalities and a convergence process to be in motion. More specifically, Giannias et al (1997) for the period 1961-1991 report a reduction in the dispersion of a number of welfare indicator at the Greek NUTS II level using the coefficient of variation. Liargovas et al (2003) investigate convergence and divergence among Greek regions since 1960 up to 2000. Their analysis is based not only on GDP per capita but also on a large number of social variables. So, regional inequalities are examined through the development of a Quality of Life index. Liargovas et al. (2003) use alternative approaches for the estimation of real convergence or divergence among the 13 Greek regions. The first one is based on the coefficient of variation and the second one on quality of life rankings. Initially, a weak trend of diachronic convergence in levels of wealth between regions for period 1960-2000 is

confirmed but the reduction of inequalities is not continuous from 1960 to 2000. In the decade 1980-1990, an inversion of tendency takes place with result the increase of inequalities in the quality of life for all almost the variables.

Christopoulos and Tsionas (2004), using a model that allows for the presence of technological gaps, annually detected strong evidence of conditional β-convergence of 9% roughly in the productivity growth of NUTS III regions over the period 1971-1995. Furthermore, Michelis et al (2004), focusing their analysis on the 1981-1991 time period and NUTS III regions, notice the existence of both σ-convergence and β-(unconditional and conditional) convergence for a wide variety of variables. These variables include GDP per capita, per person employed GDP, per person employed taxable income and a composite index based on per capita electricity consumption, number of automobiles, telephones and the number of per capita bank deposits. Both unconditional and conditional convergence speeds 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 the industrial sector during the period 1984-1998 for NUTS III, use the approach of Geographically Weighted Regression (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 range between 1.8% and 5.6% per year.

On the other hand, some other studies show evidence of divergence rather than convergence among Greek regions. Siriopoulos et al (1997) rejected both β-convergence (unconditional and conditional) and σ-convergence hypothesis for NUTS III regions during the period 1981-1991. The same results are obtained by Siriopoulos and Asteriou (1998). They have examined regional convergence in Greece using the tools of β-convergence and concluded that there is economic dualism between northern and southern Greece. More specifically, they have estimated conditional and unconditional β-regressions for the period 1971-1996. Their unconditional regressions show estimates of the parameter β which are positive but statistically insignificant at conventional levels. When they conditioned on a north versus south dummy variable and the shares of GDP in manufacturing and industrial sector for each region, they reached the same conclusion. Therefore they concluded that there is economic dualism

in Greece in the sense that northern and southern regions of Greece are converging only with themselves but there is no convergence across the two groups.

Benos and Karagiannis (2008) reach a general conclusion of divergence, in per capita GDP terms, among the Greek regions and prefectures for period 1971-2003. They only confirm convergence in the case of Greek prefectures and only of the form of absolute β-convergence (is not confirmed σ-convergence) with speed of order of 2,5%-3,5% annually. For the time period 1981-2004, Petrakos and Artelaris (2008) do not find tendencies of convergence in the case of Greek prefectures conducting the analysis in per capita GDP terms and composite index which incorporates variables of prosperity.

Lately, Caravelli and Tsionas (2011) attempt to investigate the regional inequalities in Greece, by empirically testing the impact of a number of basic determinants on regional growth and divergence, for the period 1995/1997-2007/2009. In interpreting empirical results, and beyond the model, factors like the deepening of European economic integration, globalization and economic crises are also evaluated. From the empirical analysis of this paper, it has confirmed the persistence over time of regional inequalities in Greece and the polar development model which the country has followed in the whole post war period. This was shown by the rising divergence of all (other than Attica) regions from both the national average and the capital region.

From the other side, more ambiguous results have been emerged by a few other inquiring studies. Petrakos and Saratsis (2000) examining regional inequalities in Greek prefectures for the time period 1971-1991 on the basis of β-convergence and σ-convergence analysis, indicate the coexistence of convergence's and divergence's tendencies realising phenomena of pro-cyclical character (i.e. regional inequalities increasing in periods of economic expansion and decreasing in periods of economic recession). This conclusion is also verified by Petrakos et al (2005), in per capita GDP terms, on the time period 1981-2000, with the use of a Seemingly Unrelated Regression Equations (SURE) model and time-series data for eight EU member-states with complete regional GDP per capita time series, in NUTS II level. Lyberaki (1996), Petrakos and Rodriguez-Pose (2003) and Petrakos et al (2004) indirectly strengthen the opinion of pro-cyclical character of inequalities pointing out that inequalities among the Greek regions and prefectures began to increase in the dues of '80s decade, precisely at the period when the country converged with EU average. Petrakos and Tsoykalas (1999) attribute the phenomenon in the maintenance or strengthening of the dynamism

of the two major metropolitan centres -Athens and Thessaloniki- and main developmental institutions of the country.

To the ascertainment about the existence of tendencies of polarisation in the Greek space, Fotopoulos et al (2002) and Tsionas (2002) reach to this conclusion. Fotopoulos et al (2002) examining regional disparities for NUTS III regions in the period 1970-1994, has showed the presence of both unconditional (about 2% per year) and conditional β-convergence (its speed depends on explanatory variables) and a weak evidence of σ-convergence. However, a more detailed analysis of spatial income distribution (Markov chains) did not reveal evidence of real economic convergence.

Similar results are reported by Tsionas (2002). Tsionas (2002) has examined regional convergence in Greece using β and σ-convergence concepts as well as Markov chain analysis for a NUTS III classification in the period 1971-1993. The estimates of β (unconditional) indicate convergence at the rate of 4% in the first sub-period (1971-1981) and close to 2% in the second sub-period (1982-1993). Also results from σ-convergence indicate a tendency towards less disparity for the most part of the period 1971-1993. Markov chain analysis, however, provides strong evidence in favour of club formation, duality and polarization for Greek regions for the entire period of analysis. It also indicates the presence of structural change in the regional distribution of income. However, structural change was not strong enough to stop the polarization process.

Moved in this logic, Alexiadis and Tomkins (2004) using time series techniques for NUTS II regions over the period 1970-2000, have rejected convergence hypothesis for all samples indicating the existence of club convergence. Especially, they indicate the emergence of three teams of convergence in per capita GDP terms. The first team includes the metropolitan prefectures of Attiki and Thessaloniki, the second team includes the not frontier prefectures of continental Greece and the third team includes the frontier and islander prefectures of Greece. Also, Petrakos and Artelaris (2009) investigate whether the inclusion of a weighting mechanism in β-convergence analysis, giving more weight to larger regions and less to smaller ones, can result in sharply different implications. For this reason, both unweighted Ordinary Least Squares (OLS) and population Weighted Least Squares (WLS) β-convergence models have been estimated and compared to each other and to σ-convergence measures in the analysis of regional (intra-national) convergence in 10 EU countries at NUTS III level over the period 1990-2000. When regression models properly weight regions for their relative

size, the spatial adjustment in most countries is associated with a clear process of intra-national β-divergence rather than convergence found with the OLS approach. This finding is compatible with the results of σ-convergence analysis (both unweighted and weighted).

Finally, Artelaris et al. (2012) assess the evolution of inequalities, in per capita GDP terms, among the NUTS III regions of Greece. Since the application of the widely-used measures of β-convergence and σ-convergence may provide a misleading picture, their study examines the possibility for the emergence of regional convergence clubs. The econometric investigation for the emergence of regional convergence clubs uses the WLS estimation method in order to overcome a major drawback of the conventional OLS estimation method i.e. the overlooking of the relative importance (size) of each region in the national setting and the equal "treatment" of regional observations. The analysis covers the period 1995-2005 and uses data derived from the National Statistical Service of Greece (NSSG). The findings of the paper do not verify trends for the emergence 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 regional problem in Greece.

The findings in regard to the existence of tendencies of convergence-divergence between the Greek regions and prefectures should be evaluated keeping in mind two basic parameters (Artelaris et al., 2012). The first parameter concerns the change of system of measurement of GDP from 1995 and later. As a result, the comparisons for the periods before and afterwards 1995 should be carried out but they also be faced with relative reserve. Over and above such debated scientific findings, -a side-effect of the use of different scientific techniques and statistic data covering different time periods and different geographical levels -a major measurement problem is evident concerning the level of economic development in each area. This problem is, to a great extent, the symptom of the limited accuracy of economic data provided by the NSSG. This concern the second parameter, the discrepancy between the official elements of GDP (based on the measurements that are carried out by the NSSG) and the real (based on the empiric observation) situation. The discrepancy is detected in the cases of the prefectures of Attiki (including the city of Athens) and Thessaloniki.

7.2. A New Methodological Framework for the Estimation of Regional Inequalities

Greece has significant internal and external spatial disparities, a lack of adjacency to the single European market, a highly fragmented economic and physical space and an unbalanced distribution of regional population and activities. The vast majority of studies, that have examined the regional inequalities in Greece, use GDP per capita as an indicator of regional welfare. However, an exclusive focus on this index is not very informative and could give a misleading picture of regional inequalities. Although GDP is the primary indicator of a region's wealth, there are a lot of issues concerning its reliability. So more developed indicators of economic disparity produce a picture of significant disparities that, over time, have remained high.

Petrakos and Psycharis (2004) provide a new methodological framework for the estimation of regional inequalities in Greece, based on the observation that the regional distribution of GDP per capita fails to reveal reality. As a first step, they correct the GDP figures of Attiki in level of region and prefecture while, in a second step, they estimate a Composite Index of Welfare and Development (CIWD)[8]. The CIWD is built using information from about 21 economic, demographic and geographic variables with equal weights (stated income, savings, sectoral GDP, active population, urban population, human capital, centrality, tourism, inter alia). Data have been obtained by different sources such as National Statistical Service of Greece and the Allmedia database. Technically, this indicator is constructed as an average of standardized values of each variable. The procedure of standardization is necessary to construct a proper composite index since all variables are not measured in the same units. The distance from the group leader is used for standardization, which assigns 100 to the leading region. Hence, all variables have a potential range between 0 and 100. The former represents the theoretical minimum possible value and the latter represents the

[8] CIWDi = Σi (Xi)/N, where Xi is the standardised value of variable Xi και N is the total number of the variables. The standardized value of Xi can be estimated by the formula(Petrakos and Psycharis, 2004):

$Xi = 100[x_i - x_{min}]/[x_{max} - x_{min}]$

The standardisation is necessary in order that all variables receive prices in the interval (0, 100) and consequently they will be summable. The basic problem of this method is that all variables that are added up for the construction of CIWD, they have the same weight and consequently there is not special evaluation of each one's significance in the configuration of the developmental profile of prefectures and regions (Petrakos and Psycharis, 2004).

theoretical maximum possible value. The more developed and prosperous the region is, the higher the value of the CIWD.

Thus, two different versions of CIWD are presented for the year 2000: the first includes the corrected per capita GDP figures for Attiki, Voiotia and Korinthia, while the second is based on the figures that statistical sources give. Evaluating, generally, the regional inequalities based on the CIWD, it is observed the following: Firstly, it is explicit and relatively intense the dominance of metropolitan centre of the country, not only in terms of population, but also in terms of level of prosperity and development. This ascertainment is in effect either in the indicator is imported the corrected size, or not, the result is substantially the same. This ascertainment confirms the lead of Athens and reverses the mistaken picture that indicators give based on GDP. Also it is explicit the dominance of eastern department of the country and the islander against the westerner and the northern frontier area. Therefore, the picture of evolution of regional inequalities in the country is not favourable. When the regional inequalities are measured with more complex and relatively valid way and no with per capita GDP, they are characterized by a diachronic stability on high values and a limited mobility of prefectures of low level to the above sections of hierarchy, despite the exercise of regional policies.

Also, Petrakos and Artelaris (2008) examine empirically the level and evolution of regional inequalities at Greek regions in NUTS III level, for the period 1990-2004 using the Composite Indicator of Development and Prosperity (CIDP) which has been developed in order that many dimensions of (regional) quality of life and well-being be included. This composite index is used in parallel with the traditional indicator of GDP per capita in order that regional inequalities could be examined properly. Two interesting conclusions can be drawn by their empirical analysis estimating with the cross-sectional model of unconditional β-convergence derived from the neoclassical theory (Barro and Sala-i-Martin, 1995), in matrix form. Firstly, the level of regional disparities of the composite indicator is much higher than that of GDP throughout the period. This means that the GDP indicator may underestimate the real degree of inequalities across regions. Secondly, there is strong evidence that there is not a catching up process in motion. The evolution of regional inequalities is not decreasing but they are either increasing or stable according to the approach employed.

Following this logic, Panas and Ninni (2004) try to calculate the Human Development Index (HDI) in the level of NUTS III of Greece for the years 1991 and 1999 respectively, applying precisely the same methodology of United Nations Human Development reports as a model. The primary objective of the study is to investigate the human development differences and disparities between Greek regions and to present a first step in developing a way of assessing human development at regional level in Greece. This approach allows advancing the analysis of problems of human development of each prefecture separately, thing that would be difficult observing only the HDI in the level of the country. With this thoughtful, they calculate for the first time the HDI for each prefecture of the country. Another objective of the study is to classify simultaneously the prefectures based on the indicator HDI.

The HDI measures the average achievement in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. Preparative to each variable is expressed with bigger precision, for every variable from this three variables, a new variable is manufactured. So the composite index HDI is the numeric medium of these three indicators [indicator of expected life, indicator of education and indicator of GNP expressed in Purchasing Power Parity (PPP) US $] and it has numeric character that ranges between 0 and 1[9]. When the value of the indicator is smaller than the 0.5 then the specific prefecture has a low level of human development, when the value of the indicator ranges between 0.5 and 0.8, then the prefecture has medium human development and finally, a prefecture that presents HDI bigger than the 0.8 is characterized by high human development. An interesting utility of the application of methodology of composite index is the possibility of comparison of classification of prefectures, according to the HDI and per capita GNP/P of each prefecture. So it is observed that there is wide difference in the classification of prefectures depending on whether their criterion of classification is the GNP/ or the HDI.

$$HDI = \frac{1}{3}\left(\frac{Z - Z_{min}}{Z_{max} - Z_{min}}\right) + \frac{1}{3}\left(\frac{E - E_{min}}{E_{max} - E_{min}}\right) + \frac{1}{3}\left(\frac{\log(Y) - \log(Y_{min})}{\log(Y_{max}) - \log(Y_{min})}\right)$$

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CHAPTER 8
COMPOSITE INDICATOR OF DEVELOPMENT

8.1. Developing a New Measure-Composite Indicator of Development (CID)

The aim of this chapter is to estimate the tension of convergence/divergence in Greek regions at NUTS III level during the period 2000-2008. The vast majority of studies that have examined this issue used GDP per capita as an indicator of regional welfare. Recognising the deficiencies related to GDP, the question which arises here is whether it would be feasible to construct a composite indicator for the prefectures of the country, which can include as many as possible aspects of developmental identity of each region that are very difficult to be captured adequately by a single indicator such as GDP per capita, in order to get as much as possible, a safer picture of Greece's regional problem.

The construction of a CID is introduced as the average of standardized values of individual variables:

$$CID_i = (\sum_i X_i)/N$$

where X_i is the standardized value of variable X και N is the total number of the variables. The standardized value of X_i can be estimated by the formula:

$$X_i = \left(\frac{X_i - X_{min}}{X_{max} - X_{min}}\right) * 100$$

The procedure of standardization is necessary to construct a proper composite index since all variables are not measured in the same units. Hence, all variables have a potential range between 0 and 100. The former represents the theoretical minimum possible value and the latter represents the theoretical maximum possible value. The more developed and prosperous the region is, the higher the value of the CID.

The CID is built using information from about 8 variables in standardized values and for each one of them the values of prefectures ranging from 0-100. The data have been obtained by Hellenic Statistical Authority. The variables that were chosen are the following: GDP per capita (Euros per inhabitant), rate of secondary sector (% GDP), rate of tertiary sector (% GDP), deposits per capita (Euros per inhabitant), household electricity consumption per capita (KWh per inhabitant), rate of employed population (% labor force), population density (inhabitant per sq. km) and rate of urban population (% population). These variables have been selected based on the adequacy of the statistical data. Some other variables were rejected because they were considered unreliable, e.g. the declared income because of the widespread tax evasion in the country and the number of academic schools where the less developed regions of the country tend to have a larger number of schools that coincide for students mainly because of the corrosion of population of these regions with significant migration of residents to the large cities.

8.2. A Short Presentation of the Variables

As far as concerns the variable of GDP per capita, we observe that the most affluent prefecture of the country for this specific time period is Voiotia with bigger GDP per capita value. The prefectures of Cyclades and Korinthia follow in the general ranking. The rest part of the gap between the first and the last position of the first five affluent prefectures is filling from the prefectures of Attiki, Zakynthos and Dodecanese. The following positions have been taken by the prefectures that have large urban centers or are characterized as significant tourist destinations. The prefectures of East Macedonia and Thrace as of Peloponnese, Epirus and Central Greece capture the last positions of this ranking. However, this ranking doesn't give accurately the picture of the economic activity of Greece's prefectures, because it doesn't take under consideration the satellite development of the industry of the productive complex of Attiki. This bias which is embedded in the data seems to affect only the first positions of the ranking and not all the prefectures. But, in this way, it seems to affect the level and the type of inequalities so for that reason needs to be improved.

Concerning the variable of employed population, we observe that the largest percentage of employment is noticed on Attiki and Korinthia. Next coming are the prefectures of Crete, Cyclades and Dodecanese and also the prefectures of Central Macedonia.

More specifically, for the variable of deposits per capita, it is observed that for the period 2000-2008, in the first positions are constantly Attiki, Kefalonia, Chios and Cyclades. It is obvious that tourist identity of island prefectures contributes to the high deposits per capita, while in the lowest positions are the prefectures of Rhodope, Ilia and Aetolia-Acarnania.

The variable of household electricity consumption per capita is a natural indicator, which measures indirectly the income of a region. The assumption here is that high-income households will have bigger houses and more electrical household appliances, thus will consume more electricity power. In the first positions of prefectures' ranking, are Arta, island prefectures like Lefkada and Cyclades, and then following Attiki, Thessaloniki and Kozani.

The correlation between economic and demographic phenomena raises the question of causation. A first thought is that in space the economic phenomena (economic opportunities) cause the demographics (immigration). On second glance, however, the demographic phenomena (population concentration) affecting the economic (agglomeration economies and high productivity), and in this way a circle of interaction works, which is positive for certain regions (increase of agglomeration economies and high productivity) and negative for others (shrinkage, decrease of agglomeration economies and productivity). So to the extent the high population concentration is a prerequisite for the existence of external economies of scale in industry and services, the high population density implies higher productivity and thus higher income. The data confirm the metropolitan structure of the country, as the highest rate of the population located in two prefectures-Attiki and Thessaloniki)-which have a population density more than ten times and more than three times the national average.

Also, the distribution of prefecture's or region's population in urban is directly related to the structure of the economy and the prospects of its development. Higher rates of urbanization are associated with greater potentials of development's activities of secondary or tertiary sector of the economy. Given that productivity in industry and services is greater due to the intensive use of capital and technology, urban populations tend to correlate with higher incomes and higher levels of development. In prefectures' level, we observe that the most the most urbanized (outside Attiki and Thessaloniki) are those who have large cities, such as Magnesia, Larissa, Achaia, and Heraklion.

The production structure of a region affects its growth prospects. Prefectures specialized in emerging and dynamic economic sectors will secure more and better jobs than prefectures specialized in declining or problematic sectors. In secondary sector the situation is the following: Athens is not specialized in secondary sector, since the latter is a small percentage of around 15.4% of prefecture's GDP in the period 2000-2008. Prefectures with a great contribution of secondary sector to prefectural GDP are (apart from the satellites of Attiki: Voiotia, Korinthia) Kozani, Kilkis, Magnesia, Thessaloniki, Arkadia, Xanthi and Imathia. Judging by the relatively high contribution rate of the tertiary sector to prefectural GDP of almost every prefecture, we consider that Greece is specialized in trade and services. Prefectures having high contribution rates of tertiary sector to local GDP are those hosting large cities and important tourist destinations. In the first position is Attiki but in the last is its satellite, Voiotia.

8.3. Empirical Convergence Analysis

An exclusive focus on GDP is not very informative and could give a misleading picture of regional inequalities. We are going to investigate econometrically the convergence/divergence issue in NUTS III over the period 2000-2008 in terms of GDP and CID. These two indicators are used in parallel in order that the tension of convergence/divergence may be examined in depth and then we will juxtapose the results.

The basic NC β-convergence model, as proposed by Barro and Sala-i-Martin (1991, 1992), for the evaluation of unconditional β-convergence or divergence trends across countries or regions is usually tested on the following cross-sectional model adopting a logarithmic form as the use of logarithms "smooth" the effect of outliers:

$$\ln\left(\frac{y_{iT}}{y_{i0}}\right) = \alpha + \beta \ln(y_{i0}) + \varepsilon_i$$

where Yi,t represents GDP per capita of the country or region *i*; T is the period of analysis; β is the coefficient and ε_i is the error term. This kind of convergence generally is tested by regressing the growth in per capita GDP on its initial level for a given set of cross-section data. Unconditional β-convergence is observed when a negative and significant relation is found between the growth rate of income per capita and the initial level of income.

8.4. Econometric Investigation: in per capita GDP terms

In our case, we want to apply a log-log regression model, first we have to transform the variables to logarithms. To do that we change the variables of pcGDPgr and pcGDP into log(pcGDPgr) and log(pcGDP). The first cross-sectional model is:

$$\log(\text{pcGDPgr}) = a + \beta \log(\text{pcGDP00}) + \varepsilon_i$$

Where pcGDPgr is the average growth rates of per capita GDP in the [2000, 2008] period for the 51 prefectures; pcGDP00 is the per capita GDP levels at date 2000; ε_i is the error term ($\varepsilon \sim N(0,s^2)$) and a and β are parameters to be estimated.

However, if we take a look on the convergence literature, a major drawback of convergence analysis is that the standard β-convergence models looking at regional disparities over time, treat all observations as equal, overlooking the relative population size of each region (Petrakos and Artelaris, 2009). Petrakos, Rodriguez-Pose, and Rovolis (2005) raise this issue, giving a theoretical example in order to illustrate this problem. From this example it is evident how the performance of a minuscule region in terms of size can alter the diagnosis of the econometric model on convergence or divergence. This inability of β-convergence models to take the relative size of observations into consideration may therefore lead to unrealistic or misleading results. Sala-i-Martin (2003) and Firebaugh (2003) support the view that if the goal of a study is to explore issues related to people's income and to draw inferences about inequality, then the use of weighted measures is more appropriate (Petrakos and Artelaris, 2009). In other words, unweighted measures can capture the effect of changing income ratios but miss the effect of changing population shares, while weighted ones capture both.

Due to the problem mentioned above, we decide to apply a WLS estimation method, in which OLS is applied to weighted values of pcGDP00 and pcGDPgr with the relative size (Relative population = Population of prefecture i / Population of country) of prefectures of the year 2000. The weighting variable is RELPOP00. With this weighting mechanism we seek for a convergence analysis to be more meaningful and realistic. This adjustment is considered to be an important one because NUTS III regions vary in terms of population.

With the EVIEWS 7.0, we are running a Linear Regression Model with the use of weighted OLS method (WLS). The results are presented in Table 8.1 below:

Table 8.1.: Unconditional β-Convergence (NUTS III), 2000-2008 in per capita GDP terms

Dependent Variable: LOG(pcGDPgr)
Method: Least Squares
Sample: 1 51
Included observations: 51
Weighting series:RELPOP00
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.953349	1.036218	2.850123	0.0064
LOG(pcGDP00)	0.232964	0.108380	2.149510	0.0366

Weighted Statistics			
R-squared	0.201212	Mean dependent var	5.123529
Adjusted R-squared	0.184910	S.D. dependent var	13.19776
S.E. of regression	0.101181	Akaike info criterion	-1.705384
Sum squared resid	0.501643	Schwarz criterion	-1.629626
Log likelihood	45.48728	Hannan-Quinn criter.	-1.676434
F-statistic	12.34290	Durbin-Watson stat	1.932187
Prob(F-statistic)	0.000962		

Unweighted Statistics			
R-squared	-0.789096	Mean dependent var	5.096125
Adjusted R-squared	-0.825608	S.D. dependent var	0.098500
S.E. of regression	0.133088	Sum squared resid	0.867908
Durbin-Watson stat	2.044383		

Source: Own elaboration

From the table we can draw the conclusions. WLS estimators show that the β coefficient is positive and statistically significant at 5%-as P=0.0366<0.5-providing evidence in support of the regional divergence hypothesis. Even though, R^2 [10]and Adjusted R^2 values are relatively low, suggesting a weak relation between, the dependent (pcGDPgr) and independent (pcGDP) variable, we can detect a positive relation between them.

Also, heteroskedasticity was detected-as it is a common problem of cross-section data-with the use of White test and its presence was found. A correction method of heteroskedasticity (See Appendix IV) available in EVIEWS is Heteroskedasticity-Consistent Standard Errors and Covariance proposed by White (1980), we chose this method without having any significant changes in the values of parameters.

[10] The coefficient of determination R^2 is a statistical measure of how well the regression line approximates the real data points. R^2 takes always positive values and it should be between 0 and 1, with 0 denoting that model does not explain any variation and 1 denoting that it perfectly explains the observed variation (Halkos, 2006).

8.5. Econometric Investigation: in CID terms

In order to examine for unconditional β-convergence/divergence in terms of CID, we follow the same logic as previously. But, before moved on, we have to note that we decide to go one step further and attribute a weight/a level of significance to each variable of composite indicator. More specifically, the "weights" attributed to each variable are the following: 20% for GDP per capita (Euros per inhabitant), 15% for rate of secondary sector (% GDP), 15% for rate of tertiary sector (% GDP), 10% for deposits per capita (Euros per inhabitant), 10% for household electricity consumption per capita (KWh per inhabitant), 10% for rate of employed population (% labor force), 10% for population density (inhabitant per sq. km) and 10% for rate of urban population (% population).

The second cross-sectional model has the following form:

$$\text{Log(CIDgr)} = a + \beta \log(\text{CID00}) + \varepsilon_i$$

Where CIDgr is the average growth rates of weighted CID in the [2000, 2008] period for the 51 prefectures; CID is the weighted CID levels at date 2000; ε_i is the error term ($\varepsilon \sim N(0,s^2)$) and a and β are parameters to be estimated. With the EVIEWS 7.0, we are running again a Linear Regression Model with the use of WLS method. The results are presented in Table 8.2:

Table 8.2.: Unconditional β-Convergence (NUTS III), 2000-2008 in CID terms

Dependent Variable: LOG(WCIDgr)
Method: Least Squares
Sample: 1 51
Included observations: 51
Weighting series: RELPOP00
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.664651	0.136018	34.29436	0.0000
LOG(WCID00)	0.010101	0.031968	0.315970	0.7534

Weighted Statistics			
R-squared	0.007732	Mean dependent var	4.710696
Adjusted R-squared	-0.012519	S.D. dependent var	11.98208
S.E. of regression	0.059197	Akaike info criterion	-2.777458
Sum squared resid	0.171711	Schwarz criterion	-2.701700
Log likelihood	72.82517	Hannan-Quinn criter.	-2.748508
F-statistic	0.381807	Durbin-Watson stat	1.748022
Prob(F-statistic)	0.539499		

Unweighted Statistics			
R-squared	-0.061544	Mean dependent var	4.716678
Adjusted R-squared	-0.083208	S.D. dependent var	0.077393
S.E. of regression	0.080549	Sum squared resid	0.317919
Durbin-Watson stat	2.125928		

Source: Own elaboration

From the table we can draw the following conclusions. WLS estimators show that the β coefficient is positive and not statistically significant-P=0.7534. There is again a trend of divergence, even though now this relation between the dependent and independent variable is not statistically significant. Also, heteroskedasticity was detected too with the use of White test and it was corrected with Heteroskedasticity-Consistent Standard Errors and Covariance method.

8.6. Juxtaposition of the Econometric Models

Both of regression models, in order to β-convergence analysis be more realistic, weight prefectures for their relative size. The spatial adjustment is associated with a clear trend of β-divergence in both terms of pcGDP and CID. More specifically, in per capita GDP terms, it is observed divergence statistically significant, similarly, in CID terms, it is observed divergence but not statistically significant. Probably, we could have a statistically significant divergence if the weight/significance attributed to the variables

of composite indicator was different. However, subjectivity on the construction of the composite indicator fosters risks as the results could be manipulated.

CHAPTER 9
CONCLUSIONS

The purpose of this study was the econometric investigation of β-convergence between the prefectures of Greece in terms of CID. With the construction of CID, the purpose is to show that when the measurement of inequalities in Greece is based on GDP per capita, could lead to a serious underestimation of country's regional problem, due to the specificities that are caused by the spatial distribution of GDP, but also by the same GDP as indicator. Whereupon, our desire is that the estimation of CID will indicate a more globed and representative picture of the regional problem.

This composite index is used in parallel with the traditional indicator of GDP per capita in order that regional inequalities are examined properly. Additionally, in the process of econometric investigation, the population was used as a weighting variable in order to each observation obtained the importance and seriousness that deserves based on the relative population weight of the prefecture is referred to. In this way, both weighted β-convergence models, in terms of pcGDP and CID, have been estimated with the WLS method and compared to each other in the analysis of regional convergence in 51 prefectures over the period 2000-2008. The results of both econometric investigations indicate a clear trend of divergence during the period 2000-2008.

The results of the empirical analysis are consistent with the predictions arising from the theoretical model developed within the framework of Keynesian theories of regional divergence. The analysis confirmed the theory of cumulative causation although the time period is relatively short. Economies of scale and agglomeration lead to the cumulative concentration of capital, labour, and output in certain regions at the expense of others, so it is observed an uneven regional development which is self-reinforcing rather than self-correcting. The cumulative causation process results in a spatial differentiation into growth regions and declining region. The spread' effects to poor

regions (e.g. peripheral regions supply the dynamic center) are offset by backwash effects (capital and labour flows from lagging to developed regions).

The findings of this study are able to contribute to a better understanding of the regional problem in Greece. The strong historical, geomorphological, political, and economic factors that have influenced the level and type of inequalities appear to still have such power, so as do not allow regional policy practitioners to achieve a significant reduction in inequalities.

An excessive concentration of population and activities is observed in Athens and secondarily in Thessaloniki and then in the big urban centres. Agglomeration or external economies affected by demographic phenomena lead to the emergence of these growth poles. This implies that economic development begins from the poles of concentration of economic activity (Athens and Thessaloniki) and of course this intensifies inequalities since its spread to the rest of the country is by no means automatic. Voiotia is the richest region in per capita GDP terms. However this is a paradox since Attiki is the most developed region in Greece (See Petrakos and Psycharis, 2004). Attiki has "exported" a significant part of its industrial activity to Voiotia and Korinthia in order to deal with negative externalities (i.e. major congestion and environmental degradation problems) and to exploit the incentives provided by the Greek State for the decentralization of industrial activity. Having no data for the regional counterpart of GNP, this might distort the picture obtained. Of course, Voiotia, is not the most developed region in Greece, in CID terms. In any case, the widening gap in per capita GDP and CID between the richest part of the Greece (i.e. Athens and Voiotia) and other prefectures shows a tendency of underestimation of the regional problem in the country by the official State creating rational anxieties and concerns.

Especially at the dawn of the new economic environment, characterized by a deep economic recession erupted in 2008, -the last year in our analysis- a further interesting question arises concerning the possible over-time correlation between regional inequalities and macro-economic performance. It is particularly interesting to see whether this trend of divergence continues to exist from now on or the inequalities are going to follow the new economic conditions being in that sense a phenomenon with pro-cyclical behavior which implies that in periods of recession the metropolitan regions are hit harder than the remaining regions of the country and inequalities are thus reduced.

Given that the economic crisis does not affect all areas in the same way or to the same extent, interventions of a vertical nature are a necessary supplement to horizontal policies and strengthen their efficiency. The preservation of important industrial centres in the periphery is not a moral obligation of the centre to the periphery, but a necessary policy for the conservation of the country's industrial base, its development potential and its spatial balance (Petrakos and Saratsis, 2000). Essentially, the each of the chosen interventions should be applied with consistency, continuity and, above all, efficiency. Taking into account that a significant part of the planning (but also of the resources) relating to regional policy originates from the European Union, then the domestic value added at the policy level is mainly concerned with the speed and efficiency of its application, an area in which, reality is well behind both the expectations and the needs of the country (Petrakos and Saratsis, 2000).

Certainly, when we talk about regional convergence and reducing inequalities, two points need clarification. Firstly, no one seeks or expects an equalization of incomes or opportunities between the regions, nor the policy's objective can be such. Secondly, when referring to reducing inequalities as policy's objective, it should be clear that it refers to a convergence upward (rather than downward) where all prefectures are developed, but the less favoured are developed more rapidly.

Closing this study, we have to say that the regional problem of Greece contributes to limiting the country's possibilities to escape the economy's development trap, by inhibiting the exploitation of the periphery's resources. Struggling to release from the bonds of economy's development trap, some regions of the country are based either on a favorable productive structure and a high quality human capital or on exploitable tourist resources. The rest will have to find or create comparative advantages that allow them to compete successfully in the new environment. This, mainly, is the role and responsibility of regional policies.

APPENDIX

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APPENDIX I - The importance of "Report by the Commission on the Measurement of Economic Performance and Social Progress"

APPENDIX I

The importance of "Report by the Commission on the Measurement of Economic Performance and Social Progress"

Increasing concerns have been raised since a long time about the adequacy of current measures of economic performance, in particular those based on GDP figures. Moreover, there are broader concerns about the relevance of these figures as measures of social well-being, as well as measures of economic, environmental, and social sustainability.

Reflecting these concerns, President of the French Republic, Nicholas Sarkozy, has decided to create the Commission on the Measurement of Economic Performance and Social Progress, to look at the entire range of issues. The Commission's aim has been to identify the limits of GDP as an indicator of economic performance and social progress, to consider additional information required for the production of a more relevant picture, to discuss how to present this information in the most appropriate way and to check the feasibility of measurement tools proposed by the Commission (Stiglitz et al., 2009).

Stiglitz's, Sen's, and Fitoussi's report assesses GDP and recommends other ways to measure the efficiency of economic and social welfare policies. In their opinion, *"GDP is not wrong as such, but is wrongly used"*-a reference to the use of GDP as an all-encompassing indicator of well-being (Stiglitz et al., 2009). Commission's work is not focused on France, nor on developed countries. In particular, the output of the Commission has been made public, providing a template for every interested country or group of countries.

To organise its work, the Commission organized itself into three working groups, focusing respectively on (Stiglitz et al. 2009): first, the classical GDP issues and how it might be extended or modified; second, sustainable development and the environment, and how economic performance and social progress relate to them; and third, the quality of life, including metrics to find out how people actually feel about their lives and their own well-being.

The main messages that arise from the report are the following (Stiglitz et al. 2009). Firstly we need to move towards better measures of economic performance to better reflect the structural changes which have characterized the evolution of modern more

complex economies. Another key message, and unifying theme of the report, is from production to well-being: the time is ripe for the measurement system to shift emphasis from measuring economic production to measuring people's well-being. And measures of well-being should be put in a context of sustainability. Changing emphasis does not mean dismissing GDP and production measures. But emphasizing well-being is important because there appears to be an increasing gap between the information contained in aggregate GDP data and what counts for common people's well-being. This means working towards the development of a statistical system that complements measures of market activity by measures centred on people's well-being and by measures that capture sustainability. Such a system should not just measure average levels of well-being within a given community, and how they change over time, but also document the diversity of peoples' experiences and the linkages across various dimensions of people's life.

But, also, an important message which arises from the report is that the definition of well-being is multi-dimensional. The Commission has identified the following key dimensions that should be taken into account. At least in principle, these dimensions should be considered simultaneously (Stiglitz et al., 2009): (1) Material living standards (income, consumption and wealth); (2) Health; (3) Education; (4) Personal activities including work; (5) Political voice and governance; (6) Social connections and relationships; (7) Environment (present and future conditions); (8) Insecurity, of an economic as well as a physical nature. All these dimensions shape people's well-being, and yet many of them are missed by conventional income measures.

Furthermore, through the report is pointed out that the objective and subjective dimensions of well-being are both important. Quality of life depends on people's objective conditions and capabilities (Stiglitz et al., 2009). So, steps should be taken to improve measures of people's health, education, personal activities and environmental conditions that can be shown to predict life satisfaction. The challenge is to improve upon what has already been achieved, to identify gaps in available information, and to invest in statistical capacity in areas where available indicators remain deficient and the quality-of-life indicators in all the dimensions covered should assess inequalities in a comprehensive way (Stiglitz et al., 2009).

Also, sustainability poses the challenge of determining if at least the current level of well-being can be maintained for future generations. The assessment of sustainability is complementary to the question of current well-being or economic performance, and must be examined separately. Thus, the sustainability assessment requires a well-identified dashboard of indicators that inform about the change in the quantities of the different factors that matter for future well-being (Stiglitz et al., 2009). There are two versions to the stock approach to sustainability. One version just looks at variations in each stock separately, assessing whether the stock is increase or decreasing, with a view particularly to doing whatever is necessary to keep each above some critical threshold. The second version converts all these assets into a monetary equivalent. This monetary index of sustainability has its place in such a dashboard but, under the current state of the art, it should remain essentially focused on economic aspects of sustainability (Stiglitz et al., 2009).

Finally, for the reasons mentioned above, placing a monetary value on the natural environment is often difficult, so, the environmental aspects of sustainability deserve a separate follow-up based on a well-chosen set of physical indicators which will monitor the state of the environmental pressures (Stiglitz et al., 2009). In particular, there is a need for a clear indicator of increases in atmospheric concentrations of greenhouse gases associated with proximity to dangerous levels of climate change. Climate change is also special in that it constitutes a truly global issue that cannot be measured with regard to national boundaries. Physical indicators of this kind can only be identified with the help of the scientific community.

APPENDIX II - The Most Well-Known Indicators

APPENDIX II

The Most Well-Known Indicators

➔*Measure of Economic Welfare (MEW)*

James Tobin and William Nordhaus called for an index reflecting consumption rather than production as this comes closer to representing welfare. They propose to calculate the Measure of Economic Welfare (or Net Economic Welfare) as follows (Goossens, 2007):

MEW = GNP - economic 'bads' (pollution control, repairs) - regrettable necessities (police services to combat crime, defence) + household, illegal production, unreported activities and leisure

Thus, the MEW includes for one a 'reclassification' of GNP to reflect consumption. Secondly, it makes adjustments for some of the 'bads' and 'regrettables' as well as adds some nonmarket activities into the measure in return. However, Tobin and Nordhaus realized that it is hard to estimate how well individual and collective happiness are correlated with consumption. Therefore the authors themselves call MEW a 'primitive and experimental' measure of welfare (Goossens, 2007).

However, MEW is worth mentioning as some important measures (ISEW, GPI) followed shortly, and were conceptually based on MEW.

➔*The Index of Sustainable Economic Welfare (ISEW) and the Genuine Progress Indicator (GPI)*

The ISEW and GPI are designed to more closely approximate the sustainable economic welfare or progress of a nation's citizens. The sustainable economic welfare implied here is the welfare a nation enjoys at a particular point in time given the impact of past and present activities. In view of the notion of sustainable economic welfare, the ISEW or GPI of the former would presumably be lower in the past to reflect the cost experienced at the time of structural adjustment, but higher in the present to reflect the ensuing benefits (Lawn, 2003).

The resulting equation for ISEW is (Goossens, 2007):

ISEW = Personal consumer expenditure - adjustment for income inequality + services from domestic labour - costs of environmental degradation - defensive private

expenditures + non-defensive public expenditures + economic adjustments - depreciation of natural capital.

The Index of Sustainable Economic Welfare (ISEW), [in 1995, a group called Redefining Progress issued a revised methodology and changed the name of the measure to the Genuine Progress Indicator (GPI) (Costanza et al., 2009)], is a measure that begins not with GDP as their base, but with the extraction from the national accounts of the transactions deemed directly relevant to human well-being (Lawn, 2003). In developing the ISEW, the creators built on work by Zolotas on the Index of Economic Aspects of Welfare (EAW) and Nordhaus and Tobin's Measure of Economic Wealth (MEW). In particular Daly and Cobb wanted an index that accounted for both current environmental issues and long-term sustainable use of natural ecosystems and resources (Costanza et al., 2009). Further adjustments are made to account for the many benefits and costs of economic activity that GDP ignores. Accordingly, the ISEW and GPI include a number of social and environmental benefits and costs that invariably escape market valuation (Lawn, 2003).

While GDP is a measure of current income, GPI is designed to measure the sustainability of that income, essentially measuring whether progress is a result of living off the interest of community capital or spending it down. "Both the GPI and ISEW use the same personal consumption data as GDP but make deductions to account for income inequality and costs of crime, environmental degradation, and loss of leisure and additions to account for the services from consumer durables and public infrastructure as well as the benefits of volunteering and housework. By differentiating between economic activity that diminishes both natural and social capital and activity that enhances such capital, the GPI and its variants are designed to measure sustainable economic welfare rather than economic activity alone" (Costanza et al., 2009).

➔*Human Development Index (HDI)*

Since 1990, the United Nations Development Program has used the Human Development Index (HDI) in its annual Human Development Report. The purpose of the report is to show how well the management of economic growth and human development is actually improving human well-being in the nations of the world. The inaugural report defines human development as the “process of enlarging people's choices...to live a long and healthy life, to be educated, have access to resources needed for a decent standard of living, ...[to have] political freedom, guaranteed human rights

and personal self-respect" (Costanza et al., 2009). However, the authors acknowledge the difficulty of quantifying the last three components, and the index focuses on "longevity, knowledge and decent living standards" as proxies for people's ability to live long and prosperous lives.

- Longevity is measured using life expectancy at birth. This also serves as a proxy for other aspects of well-being such as adequate nutrition and good health.
- Knowledge is measured using literacy rate and school enrollment, which are intended to reflect the level of knowledge of the adult population as well as the investment in the youth.
- Access to a decent standard of living is measured using GDP adjusted to reflect purchasing power parity and the threshold effect using a logarithm of real GDP per capita.

Performance in each dimension is expressed as a value between 0 and 1 by applying the following general formula:

Dimension index = (actual value - minimum target value) / (maximum target value - minimum target value)

The HDI is then calculated as a simple average of the dimension indices. The HDI was created to re-emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth (Goossens, 2007).

➔*Ecological footprint (EF)*

The Ecological Footprint (EF) is a resource accounting tool which measures the extent to which the ecological demand of human economies stays within or exceeds the capacity of the biosphere to supply goods and services. The EF measures how much land area is required to sustain a given population at present levels of consumption, technological development and resource efficiency (Goossens, 2007).

The main components of the EF are land used for crops, animal products, fisheries, forest products, built up land and the land needed to absorb and sequester CO_2 emissions from fossil fuels. The EF measures the final consumption attributable to the residents a country/region, whether or not the impacts of that consumption occur inside or outside the boundaries of that country/area (Goossens, 2007). The Footprint of a country should be understood as a measure of its consumption, and its worldwide

environmental impact. For this reason, a country's EF can be significantly larger than its actual biocapacity.

The concept of EF is useful for developing and assessing future scenarios related to different policy options. It provides a tool for evaluating success or failure of policies and gearing them into a more sustainable direction. For practical reasons, it is easier to measure the carbon footprint than the total ecological footprint (due to data availability and reliable measuring techniques). At this stage, the carbon footprint might therefore be a more appropriate tool to use within policy-making than the EF. Reducing the carbon footprint is therefore an important policy direction to follow. However, this must be done in a careful, footprint-neutral manner, and not simply by transferring demand from one EF component to another (Goossens, 2007).

➔*Happy Planet Index (HPI)*

The Happy Planet Index, introduced in July 2006 by the New Economics Foundation and measured for 178 countries, is an index of human well-being and environmental impact. The indicator shows the ecological efficiency with which the well-being is delivered. It is based on two objective indicators, life expectancy and ecological footprint per capita, and one subjective indicator 'life satisfaction' (Goossens, 2007). Multiplying longevity and the subjective life satisfaction, you get the 'degree to which people live long and happily in a certain country at a given time', also called Happy Life Years (HLY).

The data sources for this indicator are:

- UN Human Development Reports for ‘life expectancy’;
- the World Database for Happiness for ‘life satisfaction’; and
- the Global Footprint Network for the ‘Ecological footprint’.

The formula for calculating the final HPI is:

*Happy Planet Index = (Life expectancy * Life satisfaction) / Ecological footprint*

The HPI is a measure of the environmental efficiency of supporting well-being in a given country. It strips the view of the economy back to its absolute basics: what we put in (resources), and what comes out (human lives of different length and happiness). It reflects the average years of happy life produced by a given society, nation or group of nations, per unit of planetary resources consumed (Goossens, 2007).

➔*Environmental Sustainability Index (ESI)*

The Environmental Sustainability Index (ESI) benchmarks the ability of nations to protect the environment over the next several decades. The ESI is a composite index tracking a diverse set of socioeconomic, environmental, and institutional indicators that characterize and influence environmental sustainability at the national scale (Goossens, 2007). The ESI covers natural resource endowments, past and present pollution levels, environmental management efforts, contributions to protection of the global commons, and a society's capacity to improve its environmental performance over time into 21 indicators of environmental sustainability (Esty et al., 2005).

These indicators permit comparison across a range of issues that fall into the following five broad categories (Esty et al., 2005):

- Environmental Systems
- Reducing Environmental Stresses
- Reducing Human Vulnerability to Environmental Stresses
- Societal and Institutional Capacity to Respond to Environmental Challenges
- Global Stewardship

Although imperfect, the ESI helps to fill a long-existing gap in environmental performance evaluation. The ESI also provides a way for ranking countries and identifying those governments that are at the leading edge with regard to any particular issue (Goossens, 2007). The higher a country's ESI score, the better positioned it is to maintain favorable environmental conditions into the future. These countries have managed the challenges of development with some success. The lowest ranking countries face numerous issues, both natural and manmade, and have not managed their policy choices well. This information is useful in identifying 'best practices' and may help to guide thinking on what it will take to make policy progress. The ESI can also serve as a tool for achieving global-scale policy goals. The collection of indicators and variables that form the ESI provide (Esty et al., 2005):

i. a powerful tool for putting environmental decision making on firmer analytical footing;

ii. an alternative to GDP and the Human Development Index for gauging country progress; and

iii. an useful mechanism for benchmarking environmental performance.

➔*Environmental Performance Index (EPI)*

Our focus is on environmental sustainability and the current policy performance of individual nations. While there is no "correct" answer to the proper scope of an environmental index, we believe that a set of 25 indicators offers a comprehensive yet focused perspective on society's environmental challenges. The Environmental Performance Index (EPI) includes a set of environmental indicators in key issue areas that should be of interest to policymakers in every country, and that can also be addressed through appropriate policies (Esty et al., 2008).

The EPI provides benchmarks for current national pollution control and natural resource management results by identifying specific targets for environmental performance and measuring countries' achievements to these goals (Goossens, 2007). Cross-country comparisons are facilitated through the issue-by-issue and aggregate rankings. The EPI thus provides a powerful tool for improving policymaking and shifting environmental decision-making onto firmer analytic foundations.

The EPI builds on measures relevant to two core objectives (Esty et al., 2008):

1. reducing environmental stresses to human health (the Environmental Health objective); and

2. protecting ecosystems and natural resources (the Ecosystem Vitality objective).

To do so, the EPI tracks 16 indicators in 6 policy categories: environmental health, air quality, water resources, biodiversity and habitat, productive natural resources and sustainable energy (Goossens, 2007).

EPI tracks actual results related to a core set of environmental issues that many governments have prioritized. In addition to providing policymakers with decision making guidance, the EPI advances environmental protection by providing a way to gauge the seriousness of environmental threats, the direction of pollution and natural resource trends on the national, regional, and international levels, as well as the efficacy of current policy choices (Esty et al., 2008).

As a result, promising connections between the environment and other policy areas are going unrealized. This difficulty in moving forward with environmental improvements has been traced, in part, to an inability to identify the most pressing environmental

problems, quantify the burdens imposed, measure policy progress, and assure funders in both the private and public sectors of the worth of their investments (Esty et al., 2008). These limitations mean that pollution control and natural resource management issues have been systematically under-funded and lag behind other global challenges.

➔*Regional Quality of Development Index (QUARS)*

In the year 2000 the campaign Sbilanciamoci! published the first report on regional development quality (QUARS). The report challenged established indicators, first of all the GDP. Unlike GDP, QUARS does not only represent a single quantitative dimension of development, but it is an index of variables that represent quality of development. QUARS consists of 45 environmental, social and economic variables in seven groups (Goossens, 2007):

1. Environment: assessment of the environmental impact of production, distribution and consumption and proper steps taken to mitigate negative impacts.
2. Economy and labour: working conditions and income guaranteed by the economic system and redistribution policies.
3. Rights and citizenship: social inclusion of young people, the elderly, underprivileged people and immigrants.
4. Equal opportunities: absence of gender-based discrimination in economic, political and social life.
5. Education and culture: participation in the school system, quality of the service, education of the population, cultural demand and supply.
6. Health: quality and efficiency of the service, proximity, general health of the population.
7. Participation: political and social participation of citizens.

The composite indicator is based on the normalized scores for each indicator which equal the difference for each region in relation to the mean value, divided by the standard error (Goossens, 2007). This method is more robust when dealing with outliers than the building of a linear scale, but it does not entirely solve the problem. After normalisation the mean values of each indicator are aggregated to "macro-indicators" (Goossens, 2007). The mean value of the "macro-indicators" is the final QUARS. The

choice of the variables, decided after a consultation process, assigns implicitly the weights given to the different aspects of sustainability.

➔*Regional Competitiveness Index (RCI)*

The final RCI is composed of a total number of 69 indicators, chosen by a starting set of 81 candidate indicators. The statistical analysis showed as most consistent pillars Institutions, Quality of Primary and Secondary Education, Labor Market Efficiency, Market Size and Innovation (Annoni and Kozovska, 2010). For each pillar, RCI sub-scores are computed as a simple average of the transformed/normalized indicators. Scores at the pillar group level (sub-indexes) are computed as an average of the corresponding sub-scores. The overall RCI score is the result of a weighted aggregation of the three sub-indexes.

RCI represents the first measure of the level of competitiveness at the regional level covering all EU countries. It takes into account both social and economic aspects, including the factors which describe the short and long term potential of the economy. The RCI provides a synthetic picture of the level of competitiveness of Europe at the NUTS2 level representing, at the same time, a well balanced plurality of different fundamental aspects (Annoni and Kozovska, 2010).

➔*The Index of Economic Well-being (IEWB)*

In the fall of 1998 the Centre for the Study of Living Standards (CSLS) introduced a new indicator of sustainable development for Canada, appropriately called the Index of Economic Well-being (IEWB). The Index has stimulated much interest among researchers and policy analysts, particularly at the international level. The Index of Economic Well-being originated in a research paper of Lars Osberg did for the MacDonald Commission in the mid-1980s (Osberg and Sharp, 2001). This paper was motivated by the beliefs that commonly used indicators of economic welfare, such as GDP per capita, were not truly capturing trends in economic well-being.

In modern democracies, current measures – such as trends in per capita disposable income - may not necessarily be a good guide to popular perceptions of trends in economic well-being. Knowing that all statistics summarize a complex reality, and that there are wide variations among the public in which aspects of social reality are considered to be of greatest importance (Osberg and Sharp, 2001).

In recent years, the compilers of the national accounts have often protested that their attempt to measure the aggregate value of marketed economic output was never intended as a full measure of economic well-being (Osberg and Sharp, 2001). Nevertheless, it has often been used as such, and the GDP accounting exercise has attracted a great deal of criticism as being a misleading indicator of economic well-being. Dissatisfaction with the GDP as a measure has led to a number of proposals for substitute measures.

Summarizing the economic well-being of a complex society inevitably requires a series of ethical and statistical judgments. There are many different dimensions to well-being, which are valued to different degrees by different observers. With a single index number it may be difficult to disentangle the relative importance of value judgments in the construction of the index. Furthermore, in thinking about the appropriate public policy response, it is not particularly useful to know only that well-being has gone "up" or "down", without also knowing which aspect of well-being has improved or deteriorated (Osberg and Sharp, 2001).

➔ *Corruption Perceptions Index (CPI)*

The Corruption Perceptions Index (CPI) is a composite index that assesses and compares perceived levels of corruption among public officials and politicians in a wide range of countries around the world (http://www.beyond-gdp.eu). The CPI was the first successful attempt to measure and compare corruption levels in a wide range of countries, and has continued to do so since 1995. It has proven that corruption can be measured with a sound methodological instrument and has opened the way for further corruption research of all kinds. Many countries have used the CPI as a starting point for launching reforms, and the worldwide anti-corruption movement has used it as a powerful tool to advocate for change.

The CPI draws on corruption-related data from surveys of experts and business people carried out by a variety of independent institutions external to Transparency International (TI) (http://www.beyond-gdp.eu). The interviewed experts and business people are both residents and non residents of the countries evaluated. A minimum of three surveys have been conducted for each country included in the CPI, which increases the reliability of each individual figure and lowers the probability of misrepresenting a country. The CPI gathers data from sources that span the last two years. All sources measure the overall extent of corruption (frequency and/or size of

bribes) in the public and political sectors and all sources provide a ranking of countries. The CPI scores countries on a scale from 0 to 10, with 0 indicating high levels of perceived corruption and 10 indicating low levels of perceived corruption. To qualify for inclusion in the CPI, data must be well documented, provide a ranking of countries and measure the overall extent of corruption (http://www.beyond-gdp.eu). This condition excludes surveys mixing corruption with other issues such as political instability or nationalism.

➔*KOF Index of Globalization*

The KOF Index of Globalization measures the economic, social and political dimensions of globalization. The KOF Index can be used to observe the change in globalization in a large number of countries over a long period of time. The economic dimension of the KOF Index measures an actual trade and investment volume on the one hand, as well as the extent to which countries apply trade and capital movement restrictions to protect their own economies on the other hand (KOF, 2011). The social dimension of globalization reflects the extent of the dissemination of information and ideas, whereas the political dimension shows the degree of political cooperation between countries. The KOF Index measures globalization on a scale of 1–100 and the expressions of the underlying variables are divided into percentiles. This reduces the impact of extreme data points, which results in fewer fluctuations over time (KOF, 2011).

➔*Quality of Life Index (QLI)*

The Economist Intelligence Unit has developed a new "quality of life" index based on a unique methodology that links the results of subjective life-satisfaction surveys to the objective determinants of quality of life across countries (Goossens, 2007). The nine quality-of-life factors and the indicators used in the survey are: material well-being (PPP GDP per capita), health (life expectancy at birth), political stability, family life (divorce rate), community life, climate and geography, job security (unemployment rate), political freedom, and gender equality (Goossens, 2007).

➔*Gross National Happiness (GNH)*

Gross National Happiness (GNH) is frequently mentioned as an alternative measure of progress. It was originally suggested by the King of Bhutan in the early 1980s as a more appropriate measure for his small kingdom than GDP (Costanza et al., 2009). It was not

an actual index, but a principle for guiding Bhutanese development in a fashion consistent with the country's culture and spiritual values rather than by focusing on increasing economic activity (Costanza et al., 2009). Bhutan has established a Gross National Happiness Commission but a specific methodology for measuring GNH has not yet been defined.

➔*Green GDP*

Green GDP is an index of economic growth incorporating the environmental consequences of that growth, including the depletion of natural resources and degradation of the environment (Goossens, 2007). However, ecological or health damage caused by industrial pollution may take years to appear. Furthermore, pollution may not harm locally, close to the enterprise causing the pollution, but may damage more distant areas.

Green GDP is to account for the non-market benefits of nature. However, the practicality and validity of green GDP are being complicated by the need of putting prices and values on the nature aspects that society benefits from and by the need of calculating the units/quantities consumed (Goossens, 2007). Therefore it is preferred to account ecosystem services rather than ecosystem components or processes. In most cases however, the green GDP is calculated based on the user costs of exploiting natural resources and on the value for the social costs of pollution emissions (Goossens, 2007).

➔*Genuine Savings (GS)*

Genuine Savings (GS) was developed for the World Bank and is defined as "the true level of saving in a country after depreciation of produced capital; investments in human capital (as measured by education expenditures); depletion of minerals, energy, and forests; and damages from local and global air pollutants are taken into account" (Costanza et al., 2009). Gross National Savings measures how much the country is investing in future consumption. Genuine savings (or adjusted net savings) measures net investment ('true savings') in produced, natural and human capital. Building on the concepts of green national accounts, it recalculates national savings figures by accounting for depreciation of produced assets, depletion of natural resources, the value of global environmental pollution (including loss of welfare in the form of human sickness and health), and investments in human capital (spending on education is seen as saving rather than consumption as it increases human capital) (Goossens, 2007).

While saving rates do not describe a nation's income, they are important indicators for the development of the national capital stocks determining long-term growth potential.

APPENDIX III - Steps towards the Construction of Composite Indicators

APPENDIX III

Steps towards the Construction of Composite Indicators

An *"ideal sequence"* of ten steps which are presented in the following Table (), from the development of a theoretical framework to the presentation of a composite indicator must be followed by the each modeler (OECD, 2008). Each step is extremely important, but coherence in the whole process is equally vital. Choices are taken in one step could have important implications for others. Therefore, the composite indicator constructor has not only to make the most appropriate methodological choices in each step, but also to identify whether they fit all together well (OECD, 2008).

1. Developing a Theoretical Framework

What is badly defined is likely to be badly measured.

A well defined theoretical framework is the starting point in constructing composite indicators. The framework should clearly define the phenomenon which is going to be measured and its sub-components, selecting individual indicators and weights that reflect their relative importance and the dimensions of the overall composite (OECD, 2008). This process should ideally be based on what is desirable to measure and not on which indicators are available.

By the end of Step 1, the constructor should give the reader a clear definition of what is being measured by the composite indicator (OECD, 2008). It should refer to the theoretical framework, linking various sub-groups and the underlying indicators. Also, if the multi-dimensional concepts are divided into several sub-groups, a nested structure of the various sub-groups of the phenomenon will be needed. At last, a list of the selection criteria for the underlying indicators should be identified. The selection criteria should work as a guide to whether an indicator should be included or not in the overall composite index. It should be as precise as possible and should describe the phenomenon being measured, *i.e.* input, output or process (OECD, 2008).

2. Selecting Variables

A composite indicator is above all the sum of its part.

The strengths and weaknesses of composite indicators largely derive from the quality of the underlying variables. So, by the end of Step 2, the constructor should have checked the quality of the available indicators and discussed the strengths and weaknesses of

each selected indicator (OECD, 2008). While the choice of indicators must be guided by the theoretical framework for the composite, the data selection process can be quite subjective as there may be no single definitive set of indicators. So, a summary table on data characteristics should have been created, *e.g.* availability (across country, time), source, type (hard, soft or input, output, process). However, a lack of relevant data may also limit the developer's ability to build sound composite indicators. The idea that using what is available is necessarily enough, is wrong, as poor data will produce poor results (OECD, 2008).

3. Imputation of Missing Data

The idea of imputation could be both seductive and dangerous.

Missing data are present in almost all composite indicators, and they can be missing either in a random or in a non-random fashion. However, there is often no basis upon which to judge whether data are missing at random or systematically, whilst most of the methods of imputation require a missing at random mechanism (Nardo et al., 2005; OECD, 2008). When there are reasons to assume a non-random missing pattern, then this pattern must be explicitly modeled and included in the analysis. This could be very difficult and could imply ad hoc assumptions that are likely to deeply influence the result of the entire exercise.

There are three general methods for dealing with missing data, i.e. case deletion, single imputation or multiple imputation (Nardo et al., 2005; OECD, 2008). The first, also called complete case analysis, simply omits the missing records from the analysis. However, this approach ignores possible systematic differences between complete and incomplete samples and produces unbiased estimates only if deleted records are a random sub-sample of the original sample (Missing Completely At Random assumption). Furthermore, standard errors will generally be larger in a reduced sample, given that less information is used (Nardo et al., 2005; OECD, 2008). The other two approaches consider the missing data as part of the analysis and try to impute values through either single imputation (e.g. mean/median/mode substitution, regression imputation, expectation-maximisation imputation, etc.) or multiple imputation (e.g. Markov Chain Monte Carlo algorithm).The advantages of imputation include the minimisation of bias and the use of "expensive to collect" data that would otherwise be discarded (Nardo et al., 2005; OECD, 2008). According to Dempster and Rubin (1983) in Nardo et al. (2005): *"The idea of imputation is both seductive and dangerous. It is*

seductive because it can lull the user into the pleasurable state of believing that the data are complete after all, and it is dangerous because it lumps together situations where the problem is sufficiently minor that it can legitimately handled in this way and situations where standard estimators applied to real and imputed data have substantial bias.".

By the end of Step 3, the constructor should have a complete data set without missing values *(e.g.* by means of single or multiple imputation). So, the missing values should have been estimated and a measure of the reliability of each imputed value so as to explore the impact of imputation on the composite indicator results should have been provided (OECD, 2008). Also, the presence of outliers in the dataset, the selected imputation procedures and the results should have been documented and explained.

4. Multivariate Analysis

Analysing the underlying structure of the data is still an art.

Multivariate analysis is helpful in assessing the suitability of the dataset and guiding subsequent methodological choices *(e.g.,* weighting, aggregation) during the construction phase of the composite indicator. In the analysis, the statistical information can be grouped and analysed along at least two dimensions of the data set: individual indicators and countries (Nardo et al., 2005; OECD, 2008).

The analyst, in Step 3, must check the underlying structure of the data by means of suitable multivariate methods, *e.g.,* principal components analysis, factor analysis, coefficient Cronbach Alpha, cluster analysis, identify groups of indicators or groups of countries that are statistically "similar" and provide an interpretation of the results. Also, the analyst must compare the statistically-determined structure of the data set to the theoretical framework and discuss possible differences (OECD, 2008).

Concisely, Principal Components/Factor Analysis and Coefficient Cronbach Alpha can be used to group the information on the indicators. The goal of Principal Components Analysis (PCA) is to summarise a set of individual indicators while preserving the maximum possible proportion of the total variation in the original data set. Factor analysis (FA) is similar to PCA, but is based on a particular statistical model (OECD, 2008). With these multivariate analysis techniques is achieved that largest factor loadings are assigned to the individual indicators that have the largest variation across countries, a desirable property for cross-country comparisons, as individual indicators

that are similar across countries are of little interest and cannot possibly explain differences in performance (OECD, 2008). However, correlations do not necessarily represent the real influence of the individual indicators on the phenomenon being measured. Also, these techniques are sensitive to modifications in the basic data (data revisions and updates, *e.g.* new countries) and the presence of outliers, which may introduce a spurious variability in the data. Moreover, it is important to avoid carrying out multivariate analysis if the sample is small compared to the number of indicators, since results will not have known statistical properties (OECD, 2008). The Cronbach Coefficient Alpha (c-alpha) is an alternative way to investigate the degree of correlation among a set of variables and measures the internal consistency in the set of individual indicators, *i.e*. how well they describe a uni-dimensional construct. Thus it is useful to cluster similar objects. However, correlations do not necessarily represent the real influence of the individual indicators on the phenomenon expressed by the composite indicator. But this method is meaningful only when the composite indicator is computed as a scale (*i.e.* as the sum of the individual indicators) (OECD, 2008).

Closing, Cluster Analysis (CA) can be applied to group information on countries based on their similarity on different individual indicators. This type of analysis can serve multiple purposes, and it can be seen as (Nardo et al., 2005; OECD, 2008): (i) a purely statistical method of aggregation of the indicators, ii) a diagnostic tool for exploring the impact of the methodological choices made during the construction phase of the composite indicator, (iii) a method of disseminating information on the composite indicator without losing the information on the dimensions of the individual indicators, and (iv) a method for selecting groups of countries for the imputation of missing data with a view to decreasing the variance of the imputed values. However, because CA is purely a descriptive tool, it may not be transparent if the methodological choices made during the analysis are not motivated and clearly explained (OECD, 2008).

5. Normalisation of Data

Avoid adding up apples and oranges.

Normalisation is a required prior to any data aggregation as the indicators in a data set often have different measurement units, so, it is necessary to bring them to the same unit, to avoid adding up apples and pears. There are a number of normalisation methods available, such as ranking, standardization, min-max, distance to reference country, categorical scales, indicators above or below the mean, cyclical indicators, balance of

opinions, percentage of annual differences over consecutive years (Nardo et al., 2005; OECD, 2008).

The selection of a suitable normalization method to apply to the problem, however, is not trivial and deserves special care. The normalization method should take into account the data properties and the objectives of the composite indicator (Nardo et al., 2005; OECD, 2008). Robustness tests might be needed to assess their impact on the outcomes. The issues that could guide the selection of the normalization method include: whether hard or soft data are available, whether exceptional behavior needs to be rewarded/penalised, whether information on absolute levels matters, whether benchmarking against a reference country is requested, whether the variance in the indicators needs to be accounted for (Nardo et al., 2005). For example, in the presence of extreme values, normalisation methods that are based on standard deviation or distance from the mean are preferred. Special care to the type of the normalisation method used needs to be given if the composite indicator values per country need to be comparable over time (Nardo et al., 2005).

By the end of Step 5, the constructor should have selected the appropriate normalisation procedure(s) with reference to the theoretical framework and to the properties of the data, made scale adjustments, if necessary, transformed highly skewed indicators, if also be necessary, and documented and explained the selected normalisation procedure and its results (OECD, 2008).

6. Weighting and Aggregation

The relative importance of the indicators is a source of contention.

Central to the construction of a composite index is the need to combine in a meaningful way the different dimensions, which implies a decision on the weighting model and the aggregation procedure (Nardo et al., 2005; OECD, 2008). Different weights may be assigned to indicators to reflect their economic significance (collection costs, coverage, reliability and economic reason), statistical adequacy, cyclical conformity, speed of available data, etc. Several weighting techniques are available, such as weighting schemes based on statistical models (e.g. factor analysis, data envelopment analysis, unobserved components models), or on participatory methods (e.g. budget allocation, analytic hierarchy processes) (Nardo et al., 2005; OECD, 2008). While some analysts might choose weights based only on the statistical quality of the data, thus higher

weight could be assigned to statistically reliable data (data with low percentages of missing values, large coverage, sound values). Others might reward (or punish) components that are deemed more (or less) influential, depending on expert opinion, to better reflect policy priorities or theoretical factors (Nardo et al., 2005; OECD, 2008). Weighting models need to be made explicit and transparent. Moreover, regardless of which method is used, weights are essentially value judgments.

The issue of aggregation of the information conveyed by the different dimensions into a composite index comes together with the weighting. Aggregation methods also vary. Different aggregation rules are possible. Sub-indicators could be summed up (e.g. linear aggregation), multiplied (geometric aggregation) or aggregated using non linear techniques (e.g. multi-criteria analysis) (Nardo et al., 2005). Each technique implies different assumptions and has specific consequences.

The linear aggregation method is useful when all individual indicators have the same measurement unit, provided that some mathematical properties are respected. Furthermore, linear aggregation implies full (and constant) compensability, i.e. poor performance in some indicators can be compensated by sufficiently high values of other indicators (Nardo et al., 2005). Geometric aggregation is appropriate when strictly positive indicators are expressed in different ratio-scales, and it entails partial (non constant) compensability, i.e. compensability is lower when the composite indicator contains indicators with low values. The absence of synergy or conflict effects among the indicators is a necessary condition to admit either linear or geometric aggregation (Nardo et al., 2005). Furthermore, linear aggregations reward sub-indicators proportionally to the weights, while geometric aggregations reward more those countries with higher scores. In both linear and geometric aggregations weights express trade-offs between indicators: the idea is that deficits in one dimension can be offset by surplus in another. However, when different goals are equally legitimate and important, then a non-compensatory logic may be necessary. This is usually the case when very different dimensions are involved in the composite, like in the case of environmental indexes, where physical, social and economic figures must be aggregated (Nardo et al., 2005). If the analyst decides that an increase in economic performance cannot compensate a loss in social cohesion or a worsening in environmental sustainability, then neither the linear nor the geometric aggregation is suitable. Instead, a non-compensatory multicriteria approach will assure non compensability by formalizing the

idea of finding a compromise between two or more legitimate goals (Nardo et al., 2005).

By the end of Step 6, the constructor should have selected the appropriate weighting and aggregation procedure(s) with reference to the theoretical framework and the data properties (OECD, 2008). Also, the possibility of using alternative methods (multi-modelling principle) should have been considered. Moreover, the constructor should have discussed whether correlation issues among indicators should be accounted for and whether compensability among indicators should be allowed (OECD, 2008).

7. Uncertainty and Sensitivity Analysis

Sensitivity analysis can be used to assess the robustness of composite indicators.

Doubts are often raised about the robustness of the results of the composite indicators and about the significance of the associated policy message. A combination of uncertainty and sensitivity analysis can help to assess the robustness of the composite indicator and improve transparency (Nardo et al., 2005; OECD, 2008).

As often noted, composite indicators may send misleading, non-robust policy messages if they are poorly constructed or misinterpreted. The construction of composite indicators involves stages where judgement has to be made. This introduces issues of uncertainty in the construction line of a composite indicator: selection of data, data quality, data editing (e.g. imputation), data normalisation, weighting scheme, weights' values and aggregation method (Nardo et al., 2005). All these sources of subjective judgement will affect the message brought by the composite indicator in a way that deserves analysis and corroboration. For example, changes in weights will almost in all cases lead to changes in rankings of countries. It is seldom that top performers becomes worse performance due to changes in weights but a change in ranking from for example ranking 2 to ranking 4 is not uncommon even in well-constructed composite indicators (Nardo et al., 2005).

Uncertainty analysis (UA) focuses on how uncertainty in the input factors propagates through the structure of the composite indicator and affects the composite indicator values (Nardo et al., 2005; OECD, 2008). Sensitivity analysis (SA) assesses the contribution of the individual source of uncertainty to the output variance (Nardo et al., 2005; OECD, 2008). In the field of building composite indicators, UA is more often adopted than SA (Jamison and Sandbu, 2001; Freudenberg, 2003 in Nardo et al., 2005)

and the two types of analysis are almost always treated separately. A synergistic use of UA and SA is proven to be more powerful (Saisana et al., 2005; Tarantola et al., 2000 in Nardo et al., 2005). Ideally, all potential sources of uncertainty should be addressed: selection of individual indicators, data quality, normalisation, weighting, aggregation method, *etc*. The approach taken to assess uncertainties could include the following steps (OECD, 2008):

1. Inclusion and exclusion of individual indicators.

2. Modelling data error based on the available information on variance estimation.

3. Using alternative editing schemes, *e.g.* single or multiple imputation.

4. Using alternative data normalisation schemes, such as Min-Max, standardisation, use of rankings.

5. Using different weighting schemes, *e.g.* methods from the participatory family (budget allocation, analytic hierarchy process) and endogenous weighting (benefit of the doubt).

6. Using different aggregation systems, *e.g.* linear, geometric mean of un-scaled variables, and multi-criteria ordering.

7. Using different plausible values for the weights.

A careful analysis of the uncertainties included in the development of a composite indicator can render the building of a composite indicator more robust. The composite indicator is no longer a magic number corresponding to crisp data treatment, weighting set or aggregation method, but reflects uncertainty and ambiguity in a more transparent and defensible fashion (Nardo et al., 2005). The iterative use of uncertainty and sensitivity analysis during the development of a composite indicator can contribute to its well-structuring, provide information on whether the countries' ranking measures anything meaningful and could reduce the possibility that the composite indicator may send misleading or non-robust policy messages (Nardo et al., 2005).

However, "is the assessment of robustness enough for guaranteeing a sensible composite?" Certainly not. A sound theoretical framework is the primary ingredient. Nevertheless, the statistical analysis could (and should) help in thinking about the framework used. This is a sort of "backward thinking" that should enable the modeller to answer questions like (OECD, 2008): "does the theoretical derived model provide a

good fit to the data? What the lack of fit tells about the conceptual definition of the composite of the indicators chosen for it? What concept would the available indicators good measure of? Is that concept useful? Proving an answer to these questions assures the robustness and coherence of the index given as well as getting the theoretical model correct is the main challenge of a composite (OECD, 2008).

Thus, by the end of Step 7, the constructor should have identified the sources of uncertainty in the development of the composite indicator, assessed the impact of the uncertainties/assumptions on the final result and conducted sensitivity analysis of the inference, *e.g.* to show what sources of uncertainty are more influential in determining the relative ranking of two entities (OECD, 2008).

8. Back to the Data

De-constructing composite indicators can help extend the analysis.

Composite indicators can be used as summary indicators to guide policy and data work. They can be decomposed such that the contribution of subcomponents and individual indicators can be identified and the analysis of country performance extended (OECD, 2008). The decomposition of the composite indicator can shed light on the overall performance of a given country. So, to profile national performance**,** each sub-component of the index has been further disaggregated and the individual indicators are then used to show strengths and weaknesses. Tools like path analysis, Bayesian networks and structural equation modelling could help to further illuminate the relationship between the composite and its components (OECD, 2008).

Thence, by the end of Step 8, the constructor should have decomposed the composite indicator into its individual parts and tested for correlation and causality (if it is possible) (OECD, 2008). Also, the constructor should have profiled the country performance at the indicator level to reveal what is driving the composite indicator results, and in particular whether the composite indicator is overly dominated by a small number of indicators. Moreover, the relative importance of the sub-components of the composite indicator should have been interpreted (OECD, 2008).

9. Links to other Indicators

Composite indicators can be linked to other variables and measures.

Composite indicators often measure concepts that are linked to well-known and measurable phenomena, *e.g.* productivity growth, entry of new firms. These links

should be made to correlate the composite indicator (or its dimensions) with existing (simple or composite) indicators as well as to identify linkages through regressions and in this way to test the explanatory power of a composite (OECD, 2008). Simple cross-plots are often the best way to illustrate such links. An indicator measuring the environment for business start-ups, for example, could be linked to entry rates of new firms, where good performance on the composite indicator of business environment would be expected to yield higher entry rates (OECD, 2008).

It should be noted that composite indicators often include some of the indicators with which they are being correlated, leading to double counting. For example, most composite indicators of sustainable development include some measure of GDP as a sub-component (OECD, 2008). In such cases, the GDP measure should be removed from the composite indicator before running any correlation.

Therefore, by the end of Step 9, the constructor should have correlated the composite indicator with other related measurable phenomena taking into consideration the results of sensitivity analysis, developed data-driven narratives on the results. Moreover, these correlations and results should have been documented and interpreted (OECD, 2008).

10. Visualisation of the Results

A well-designed graph can speak louder than words.

The way of presenting composite indicators is not a trivial issue. Composite indicators must be able to communicate a story to decision-makers and other users quickly and accurately. Visual models of these composite indicators must be able to provide signals, in particular, warning signals that flag for decision-makers those areas requiring policy intervention (Nardo et al., 2005; OECD, 2008). Therefore, presenter needs to decide, in each situation, whether to include a table, a graphic or both. The literature presents various ways for presenting the composite indicator results, ranging from simple forms, such as tables, bar or line charts, to more sophisticated figures, such as the four-quadrant model (for sustainability), the Dashboard, etc. In all situations graphics need to be designed carefully for clarity and aesthetics and have words, numbers and graphics working together (Nardo et al., 2005; OECD, 2008).

Finally, by the end of Step 10, the constructor should have identified a coherent set of presentational tools for the targeted audience, selected the visualisation technique which

communicates the most information and visualised the results of the composite indicator in a clear and accurate manner (OECD, 2008).

One final suggestion for this section concerns the transparency of the indicator. It would be very useful, for developers, users and practitioners in general, if composite indicators could be made available via the web, along with the data, the weights and the documentation of the methodology (Nardo et al., 2005). Given that composite indicators can be decomposed or disaggregated so as to introduce alternative data, weighting, normalisation approaches etc., the components of composites should be available electronically as to allow users to change variables, weights, etc. and to replicate sensitivity tests (Nardo et al., 2005).

The following table provides a stylised "checklist" to be followed in the construction of a composite indicator, which was discussed in more detail in the text above.

Table: Checklist for Building a Composite Indicator

Step	***Why It Is Needed***
1. Theoretical Framework Provides the basis for the selection and combination of variables into a meaningful composite indicator under a fitness-for-purpose principle (involvement of experts and stakeholders is envisaged at this step).	•To get a clear understanding and definition of the multidimensional phenomenon to be measured. •To structure the various sub-groups of the phenomenon (if needed). •To compile a list of selection criteria for the underlying variables, *e.g.,* input, output, process.
2. Data Selection Should be based on the analytical soundness, measurability, country coverage, and relevance of the indicators to the phenomenon being measured and relationship to each other. The use of proxy variables should be considered when data are scarce (involvement of experts and stakeholders is envisaged at this step).	•To check the quality of the available indicators. •To discuss the strengths and weaknesses of each selected indicator. •To create a summary table on data characteristics, e.g., availability (across country, time), source, type (hard, soft or

	input, output, process).
3. Imputation of Missing Data Is needed in order to provide a complete dataset *(e.g.* by means of single or multiple imputation).	•To estimate missing values. •To provide a measure of the reliability of each imputed value, so as to assess the impact of the imputation on the composite indicator results. •To discuss the presence of outliers in the dataset.
4. Multivariate Analysis Should be used to study the overall structure of the dataset, assess its suitability, and guide subsequent methodological choices *(e.g.,* weighting, aggregation).	•To check the underlying structure of the data along the two main dimensions, namely individual indicators and countries (by means of suitable multivariate methods, *e.g.,* principal components analysis, cluster analysis). •To identify groups of indicators or groups of countries that are statistically "similar" and provide an interpretation of the results. •To compare the statistically-determined structure of the data set to the theoretical framework and discuss possible differences.
5. Normalisation Should be carried out to render the variables comparable.	•To select suitable normalisation procedure(s) that respect(s) both the theoretical framework and the data properties. •To discuss the presence of outliers in the dataset as they may become unintended benchmarks.

	•To make scale adjustments, if necessary. •To transform highly skewed indicators, if necessary.
6. Weighting and Aggregation Should be done along the lines of the underlying theoretical framework.	•To select appropriate weighting and aggregation procedure(s) that respect(s) both the theoretical framework and the data properties. •To discuss whether correlation issues among indicators should be accounted for . •To discuss whether compensability among indicators should be allowed.
7. Uncertainty and Sensitivity Analysis Should be undertaken to assess the robustness of the composite indicator in terms of e.g., the mechanism for including or excluding an indicator, the normalisation scheme, the imputation of missing data, the choice of weights, the aggregation method.	•To consider a multi-modelling approach to build the composite indicator, and if available, alternative conceptual scenarios for the selection of the underlying indicators. •To identify all possible sources of uncertainty in the development of the composite indicator and accompany the composite scores and ranks with uncertainty bounds. •To conduct sensitivity analysis of the inference (assumptions) and determine what sources of uncertainty are more influential in the scores and/or ranks.
8. Back to the Data Is needed to reveal the main drivers for an overall good or bad performance. Transparency is primordial to good analysis and policymaking.	•To profile country performance at the indicator level so as to reveal what is driving the composite indicator results. •To check for correlation and causality (if

	possible). •To identify if the composite indicator results are overly dominated by few indicators and to explain the relative importance of the sub-components of the composite indicator.
9. Links to other Indicators Should be made to correlate the composite indicator (or its dimensions) with existing (simple or composite) indicators as well as to identify linkages through regressions.	•To correlate the composite indicator with other relevant measures, taking into consideration the results of sensitivity analysis. •To develop data-driven narratives based on the results.
10. Visualisation of the Results Should receive proper attention, given that the visualisation can influence (or help to enhance) interpretability	•To identify a coherent set of presentational tools for the targeted audience. •To select the visualisation technique which communicates the most information. •To present the composite indicator results in a clear and accurate manner.

APPENDIX IV - The Problem of Heteroscedasticity

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The Problem of Heteroscedasticity

When using some statistical techniques, such as OLS, a number of assumptions are typically made. One of these is that the error term has a constant variance. The possible existence of heteroscedasticity is a major concern in the application of regression analysis, including the analysis of variance, because the presence of heteroscedasticity can invalidate statistical tests of significance that assume the effect and residual (error) variances are uncorrelated and normally distributed (Halkos, 2006). In fact, heteroscedasticity is the absence of homoscedasticity. Usually, this problem can be occurred in cross-sectional data.

The reasons of presence of heteroscedasticity are the variability in levels / classes of the size of the explanatory variables, specification error, improvements in data collection. As already said, if the assumption that the variance of the error term is constant for all values of independent variables is not applied then we have the problem of heteroscedasticity. The estimators of OLS are biased, consistent but not efficient. Other consequences of heteroscedasticity are, significance test between the parameters are no longer applicable and there is bias in the estimate of variation of parameters (Halkos, 2006).

One of the several methods to test for the presence of heteroscedasticity is the White test. In statistics, the White test is a statistical test establishes whether the residual the residual variance of a variable in a regression model is constant (White, 1980). To test for constant variance one undertakes an auxiliary regression analysis: this regresses the squared residuals from the original regression model onto a set of regressors that contain the original regressors, the cross-products of the regressors and the squared regressors. One then inspects the R^2. The Lagrange multiplier (LM) test statistic is the product of the R^2 value and sample size (White, 1980):

$LM = n * R^2$

This follows a chi-squared distribution, with degrees of freedom equal to the number of estimated parameters (in the auxiliary regression) minus one.

Furthermore, the corrections methods for heteroscedasticity are the following (Halkos, 2006):

- Logarithmic transformation. Unlogged series that are growing exponentially often appear to have increasing variability as the series rises over time. The variability in percentage terms may, however, be rather stable.

- Use a different specification for the model (different X variables, or perhaps non-linear transformations of the X variables).

- Apply a Weighted Least Squares estimation method, in which OLS is applied to transformed or weighted values of X and Y.

- Heteroskedasticity-Consistent Standard Errors (HCSE), while still biased, improves upon OLS estimates proposed by White (1980). HCSE is a consistent estimator of standard errors in regression models with heteroskedasticity. The White method corrects for heteroscedasticity without altering the values of the coefficients. This method may be superior to regular OLS because if heteroscedasticity is present it corrects for it, however, if the data is homoscedastistic, the standard errors are equivalent to conventional standard errors estimated by OLS.

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