Regional Science Inquiry

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Contents

RSI Journal, Volume II, Issue 2 – Editorial

Economic crisis and the regions: A 'new era' for regional policy?

The end of the first decade of the 21st century has found the European economy suffering from a severe crisis. A long period of growth in output and employment seems like a 'distant past' and Europe tackles the worst, probably, recession since World War II. Unemployment, budget deficits uncertainty for the euro, characterise the European Union in 2011. Unemployment is currently 10% in the euro area and only slightly lower in the EU-27. According to EUROSTAT (2010), the EU-27 employment rate rose from an average of 65.4% in 2007 to 65.9% in 2008. The Lisbon employment target is set to 70%, to be achieved in 2010. However, in 2008, only 94 of the 271 NUTS 2 regions in the EU-27 had already achieved the Lisbon target for 2010, while 50 regions were still 10 percentage points below the overall employment target. Relatively low employment rates were recorded in the south of Spain, the south of Italy, Greece, Poland, Slovakia, Hungary, Bulgaria and Romania, whereas in the northern EU regions, including regions in the Netherlands, the United Kingdom, Denmark, Sweden and Finland recorded relatively high employment rates. Clearly, regions have been affected in different ways due to differences that characterise their structures. In this context a crucial question arises: how this crisis will affect the process of regional cohesion in the European Union? The question is simple and straightforward; the answer less so.

The issue of regional convergence, expressed in terms of economic and social cohesion, is mentioned in the Preamble of the Treaty of Rome and has become one of the major goals of the EU. This is formulated in the Single European Act (title XIV, currently title XVII, Articles 2 and 4). According to Article 158 of the Rome Treaty 'reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions or islands, including rural areas' is one of the primary objectives of EU development policies. The objective of regional cohesion is justified on the ground that 'imbalances do not just imply a poorer quality of life for the most disadvantaged regions and the lack of life-chances open to their citizens, but indicate an under-utilisation of human potential and the failure to take advantage of economic opportunities which benefit the Union as a whole' (European Commission, 1996, p. 13). According to the third report of the European Commission (2004) on social cohesion, regional convergence or 'regional cohesion' is seen as vital to the success of several other key policy objectives, such as the single market, monetary union, and EU competitiveness. As a result, the EU has implemented a range of development policies to achieve regional convergence (and continues to do so), such as the direction of funds towards less-advanced areas of Europe from sources, such as Structural Fund Support, the European Regional Development Fund, the European Social Fund and implementation of projects, such as the Mediterranean Integrated Programs.

Several empirical studies, however, suggest that regional convergence in the EU occurs at an extremely slow rate. More detailed studies indicate the existence of two separate groups or clubs across the European regions; a 'rich' and a 'poor' club. The former includes regions mainly from the EU-15 countries while the latter most of the regions of the new Member-States and several Mediterranean regions. Such findings put the issue of European regional cohesion-convergence into a fresh premise. Why have the Structural Funds (and cohesion policy in general) so far had such a limited impact on overall regional convergence? Regional convergence (cohesion) is a complex phenomenon, based upon a number of factors, which shape, to a considerable extent, the regional policies. There is a need to rethink regional policy along the lines of the implementation of more innovative and region-specific development strategiesHence, new analytical tools are needed. The relatively fragmented nature of the spatial patterns of mobility and persistence suggests that broad administrative regions are a poor basis for the implementation of policy. Problems of persistence at the lower level end of the distribution and downward mobility are widely spread across the European regions. Consequently, policy may need to be targeted towards specific localities rather than broad areas such as those, for example, covered by the current regional grouping of the EU. A classification

of areas based on the notions of persistence, divergence and mobility may provide a useful framework for policy development. From this perspective, the notion of '*Macro-Regions*' not from an economic, but also from constitutional, political and administrative point of view, offers an alternative way forward. This notion has important implications for the (re) direction of regional policy in Europe towards a new set of objectives and instruments, especially those related to technology and innovation, which are very likely to put regions on a path of sustainable growth. Nevertheless, developing answers to these and other policy issues requires a good deal of further work. Theory is needed, to see through the full equilibrium implications of policy measures, and to be able to assess the likely effects of other changes, such as population movements, technological discoveries, etc. This adds a new dimension to the research in regional science, both at theoretical and, especially, empirical level. More empirical research, with better specified counter-factuals, is necessary to evaluate the efficiency of these policies and programs and the contexts in which they are likely to succeed.

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In the 2nd Issue of Volume II of the RSI Journal

This issue includes ten papers, all written by academics and policy-makers from all over the world. It is the intention of the editorial board of the Regional Science Inquiry Journal to present in this issue a wide range of topics, such as economics, environmental, politics, theoretical aspects of regional development, empirical case studies.

The first paper by Nunes and Nijkamp offers a historical review of key ecological and economic concepts that are essential in building bridges between ecology and economics and discusses ways to integrate them. This paper discusses several illustrative applications in order to demonstrate the usefulness of these approaches and offers principles for public decision-making.

The issue of agglomeration economies and location decision-making of firms using a location-triangle approach is the topic of the second paper by Daisuke Nakamura. Based on the original work by Alfred Weber, this paper introduces an alternative framework, which enables the location-triangle model to account for the contemporary complex industrial organizations.

Stilianos Alexiadis, Christos Ladias and Antoneta Polo (re)consider the issue of regional cohesion from an alternative perspective. The third paper in this issue sheds some further light on the question of regional cohesion by taking into account the impact of the existing technological gaps across regions. The empirical results indicate a slow rate of regional convergence in the European Union and suggest a (re) direction of regional policy in Europe towards a new set of objectives and instruments.

The paper by Giovanni Guastella and Francesco Timpano extends further the issue of regional cohesion in the European Union using a series of spatial econometric models. Particular attention is placed upon the diffusion of spillover across spatial units. The authors conclude that spillovers characterize more central regions which are connected to rich regions. This is a factor that future regional polices in European Union should take into consideration in order to eradicate regional inequalities.

Rüdiger Hamm and Christiane Goebel attempt to identify regional cluster management potentials using three German regions as case-studies. Their results suggest that the interest of the firms for networks while a spatial dimension is indicated.

In the sixth paper by Aikaterini Kokkinou, a Transcendental Logarithmic Production Function is utilised to provide empirical results for the industries in selected EU countries. In this empirical study total factor productivity (TFP) growth is decomposed into two components: technological

growth and inefficiency changes. A novelty of this study is that estimates time – varying technical efficiencies, incorporating a 'learning-by-doing' behaviour, as industry-specific fixed effects.

Traditionally, the degree of regional specialisation and diversity are considered as two of the most important factors in regional development. Francisco Diniz and Vinod Upadhyay analyse the specialization of Indian regional productive structures using a localization quotient in the seventh paper of this issue. Regional diversity in the context of the Romanian regions is examined by Cristina Lincaru, Mihaela Ghenţa, Draga Atanasiu, Vasilica Ciucă, Codruţa Drăgoiu and Beatrice Chiriac. The empirical results suggest a pattern variation of the regions by the degree of diversity, indicating a structural transformation of regional economic development in Romania.

Professor Ioannis Th. Mazis and Dr Georgios-Alexandros Sgouros offer an interesting aspect of geophysical, geological and geopolitical features in the context of the Exclusive Economic Zone (EEZ). The geopolitics of energy in the Kastelorizo – Cyprus – Middle East complex, are examined in a thorough and in-depth manner. Their study suggests several interesting geopolitical implications.

The final paper by Sotirios Milionis addresses the contribution of city marketing in planning the sustainable post Olympic use of Hellinikon former airport site in Athens. Although several elements of the city marketing theory were attempted to be employed in the design process, nevertheless the actual project implementation was seriously hindered. According to the analysis by Sotirios Milionis this is the result of the involvement of various stakeholders with differing and conflicting interests. His analysis has important implications for the process of urban development in Athens.

The present issue of the RSI Journal concludes with presenting general news and announcements related to regional science research undertake, academic profiles of worldwide distinguished academic scholars in regional science together with the presentation of selected books, useful to regional scientists.

On behalf of the editorial team,

Dr. Alexiadis Stilianos
University of Piraeus

Papers

SUSTAINABLE BIODIVERSITY: EVALUATION LESSONS FROM PAST ECONOMIC RESEARCH

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Abstract:

Biodiversity has received much attention in environmental research and public policy in recent years. There is a world-wide interest in its relevance for the carrying capacity of rich but fragile ecosystems. Voices suggesting building up proper protection mechanisms for unique and scarce diversity become louder. The question emerges whether – and which combination of – ecological and economic insights can help us to identify meaningful policy options to map out proper roads towards a sustainable future. This paper surveys and highlights the potential and limitations of an ecological-economics perspective on biodiversity. Such a perspective on complex biodiversity issues, if firmly supported by modern ecological insights, can help to clarify the processes, functions and values associated with biodiversity. This study aims to offer a historical review of key ecological and economic concepts that are essential in building bridges between ecology and economics, and discusses ways to integrate them. In addition to such issues as biodiversity indices or ecosystem management principles, particular attention is given to various monetary valuation approaches and methods from the perspective of preservation and sustainable use of biodiversity. Furthermore, the use of ecological and value indicators in integrated economic-ecological modelling and analysis is addressed as well. Throughout the paper, several illustrative applications are presented to demonstrate the usefulness of the various approaches discussed. Finally, the paper offers principles for public decision-making regarding biodiversity protection.

Keywords: biodiversity; biological resources; ecosystems; millennium ecosystem assessment; monetary valuation; species values; integrated model assessment; certification

1. The Ecological Paradigm

Biological diversity has in the past decades become a source of concern for both policy makers and scientists, as well as for the world community at large. The recent study on *The Economics on Ecosystems & Biodiversity* (TEEB 2010) expresses this concern as follows: *"Biodiversity loss and ecosystem degradation continue, despite the fact that policy makers, administrators, NGOs and businesses around the world have been seeking ways to stem the tide. There are many reasons for this, but perverse economic drivers as well as failures in markets, information and policy are significant factors. Markets tend not to assign economic values to the largely public benefits of conservation, while assigning value to the private goods and services the production of which may result in ecosystem damage"*(p. 27). In the same vein, Terborgh (1999) calls for serious action in a study on *Requiem for Nature*. The question addressed in the present article concerns the role of economics in valuing ecosystems' functions and biodiversity in particular.

The global interest in environmental-economic matters is partly caused by the increased pressure that mounting population and increased production and consumption exert on the earth's natural resource base. In addition, as personal incomes rise and leisure time becomes more freely available in the developed world, concern for more immediate human needs has been accompanied by interest in nature preservation and conservation for future generations. Although resource and environmental issues manifest themselves on local or regional scales, they are part of a globally interwoven ecosystem. Consequently, the 'new scarcity' has spatial and temporal horizons that extend far beyond the current level of thinking and acting (Carraro et al. 2009).

In the past decades, the concept of sustainable development has gained much popularity. It was officially proposed as a policy goal in the publication *Our Common Future* by the World Commission on Environment and Development (Brundtland 1987). The Commission called attention to the need to consider our planet as an integrated social, economic, ecological and political system that requires collective initiatives in order to ensure continuity under changing conditions. The report suggested that economic growth and environmental protection can go together and are not necessarily mutually antagonistic forces. The idea of compatibility between growth and the environment was also critically investigated by Duchin et al. (1994). Using a multisector-multiregion model for the world, they found that economic growth and environmental quality are in conflict, given certain expectations about technological change and innovation. This complex relationship has induced heated debates, but has also prompted much theoretical and conceptual research, while it also has led many empirical applications, in particular in the field of the so-called 'green Kuznets curve' (see for an extensive review De Bruyn 1999). There is an abundance of literature on the question whether a re-orientation in economic thinking is needed to pave the road towards a sustainable future (McKibben 2007).

A prominent issue in recent discussions about sustainable development is the worry about the loss of biological diversity (or biodiversity). Biodiversity requires our attention for two reasons. First, it provides a wide range of direct and indirect benefits to mankind, which occur on both local and global scales. Second, many human activities contribute to unprecedented rates of biodiversity loss, which threaten the stability and continuity of ecosystems as well as their provision of goods and services to mankind. Consequently, in recent years much attention has been directed towards the analysis and valuation of the loss of biodiversity, both locally and globally.

Clearly, the valuation of biodiversity loss can be approached from an ecological, economic or combined perspective (see Polasky and Segerson 2009). The present study addresses all three options. This includes attention to the ecological and economic foundations of biodiversity analysis and valuation. Relevant concepts and valuation methods are identified and discussed. In addition, empirical applications are reviewed. Finally, the study addresses the opportunities offered by multidisciplinary economic-ecological modelling. This allows for the description of the complexity of ecosystem functions and processes, which can be integrated in a transparent way with solid economic valuation approaches.

In order to arrive at this stage, a number of biological, ecological and economic issues and questions need to be dealt with. For example, what are the implications of biodiversity for the structure and functions of ecosystems? Which underlying driving forces influence the loss of biodiversity? Which direct and indirect roles does biodiversity have for human society? Which considerations are relevant in making decisions about the conservation of biodiversity? These are important questions that will guide the present study.

It should be added that valuation and indicator information play a crucial role in assisting policymakers in the design of resource reallocation plans, contributing to ensure the sustainable use of biodiversity. From many studies it is unclear, however, whether the available information always specifically addresses biodiversity. The reason is that biodiversity is often associated with complex ecosystem functions and processes that relate only very indirectly to human welfare. As a result, 'resource valuation' and 'biodiversity valuation' are often confused. In the present study, biodiversity indicator and valuation techniques will be reviewed with a focus on

providing guidance about how to design operational methods that are most suitable for assessing a particular component of biodiversity value.

Clearly, there are many approaches to studying the relationship between the economy and the environment. This involves linking economics and ecology (Costanza et al. 1997). An important stream is based on materials accounting, using the principle of material balance to describe the chain of extraction, transformation, consumption and emission (Ayres et al. 1999). Another approach has focused on building economic and social accounting systems that can incorporate the measurement of economic welfare together with the measurement of environmental indicators. Here, we will present an ecological economics approach to the study of biodiversity. This is motivated by the fact that biodiversity is a multidimensional concept linked to biological, ecological, cultural and economic entities. A formal mathematical approach to the valuation of biodiversity from an integrated economic perspective can be found in Brock and Xepapadeas (2003). Our contribution differs from other related and earlier studies, such as Barbier et al. (1994), Pearce and Moran (1994), Rapport et al. (1998), and Van Kooten and Bulte (2000), in the following ways: (1) it presents a stronger focus on the analysis of biodiversity rather than ecosystems or natural assets; (2) it offers a multidisciplinary and integrated approach to shed light on the value of particular biodiversity elements; (3) it explores the use of applicable valuation methods and empirical studies; and (4) it analyses the role biodiversity indicators and value information can play in biodiversity policy and management. Some of these other studies provide interesting complementary information, such as on the economics of renewable resources (notably Van Kooten and Bulte 2000).

The sequence of sections in the paper follows the idea that analysis of biodiversity policy involves a number of steps, relating to the identification, measurement and aggregation of biodiversity values. Against this background, the paper is structured as follows. Section 2 provides an exposition on the notion of biodiversity, identifies different levels of life diversity, and discusses alternative perspectives on biodiversity value. Next, Section 3 focuses on general aspects of the economic valuation of biodiversity benefits, offering a discussion on alternative perspectives on biodiversity values. Section 4 then examines which valuation methods can be used for specific value types. In addition, it presents a survey of valuation studies for different levels of diversity, and critically discusses the range of empirical findings. In Section 5 a review is offered of frameworks and methods of integrated modelling of the relationship between biodiversity, ecosystem structure, ecosystem functions, economic activity, and human welfare. Section 6 addresses the implications of the use of biodiversity value information for policy design, devoting special attention to certification and ecolabelling mechanisms, while Section 7 concludes with the role of ecology, economics and their integration in biodiversity analysis.

2. Multilevel Diversity and Types of Biodiversity

2.1. Biodiversity as a Complex Environmental Resource

Biodiversity is a multifaced concept with both ecocentric and antropocentric characteristics showing a great variety in all regions of our world. The analysis of biodiversity is, consequently, rooted in the domain of both the natural and the social sciences. Its modelling implies knowledge of the relationships between biodiversity, the dynamics of ecosystems, and the level of human economic activities. In this context, it is noteworthy that Baumgärtner has argued that measuring diversity presupposes prior value judgements. One reason why biodiversity modelling has been so difficult is the complex and partly unobservable character of these relationships. The geographic diversification in biodiversity and its interrelatedness to socio-economic and physical-climatological conditions make it also difficult to develop and apply an operational methodology for biodiversity analysis. This strand of research is certainly still in its infancy. Essentially, the biological organization base of an ecosystem is made up of three main interrelated classes: (1) biotic resources emerging from the soil or water (such as vegetation and animal populations); (2) abiotic resources with a productive or consumptive nature (such as minerals and energy); and (3) environmental components needed for human

wellbeing (such as clean water or fresh air). In general terms, modelling such a complex biological organization has emerged from two streams of ecology, namely community and ecosystem ecology (Holling 1992, Holling et al. 1995, and Schindler 1988, 1990). Community ecology emphasizes the study of the interrelations between species. Some applied studies have, however, called attention to situations where the abiotic environment plays an important role in (re)shaping the relationships of the ecological community. These situations offered a new impetus to ecological thought, giving birth to a second stream in ecology literature: ecosystem ecology. Ecosystem ecology takes biotic and abiotic elements as variable and interactive. For instance, abiotic diversity (e.g. physical characteristics of the landscape such as soil pH and salinity) is expected to be linked to the prevalence of endemic species and thus to biotic diversity and rarity in a natural way (Bertollo 1998). An illustrative example of analysing in a broader context of land use and biodiversity was provided by Haines-Young (2009).

In this context, ecological valuation methods are not only aimed at assessing diversity and rarity of species, but also at assessing the complex interactions between the biotic and abiotic environments, based on the assumption that the variety of abiotic conditions is equally important as the variety of species. In other words, ecosystem ecology aims to identify and characterize the impact of biotic-abiotic interactions on food webs and species interrelations and to assess the role of nutrient flows. Independent of the ecological modelling approach, an important aspect of ecosystem ecology is the recognition that the variability of the biological resources influences the functioning and structure of ecosystems. An interesting and informative overview of the effects of biodiversity on ecosystem functioning can be found in Balvanera et al. (2006) and Hooper et al. (2005).

2.2. Variability of the Biological Resources

There is an abundance of definitions of biodiversity. The United Nations Convention on Biological Diversity (UNEP 1992) defines biodiversity as *"… the variability among living organisms from all sources, including terrestrial, marine and the ecological complexes of which they are part …"* (art. 2, p. 5). Biodiversity encompasses four levels. At the most basic level is genetic diversity, which corresponds to the degree of variability within species. Roughly speaking, it concerns the information represented by genes in the DNA of individual plants and animals (Wilson 1994). Species diversity refers to the variety of species. Empirical estimates of this are associated with a large degree of uncertainty. In fact, only about one and half million species have been described so far (see Parker 1982 and Arnett 1985), while scientists estimate that the earth currently hosts 5 to 30 million species (see Wilson 1988). Less than half a million have been analyzed for potential economic uses (Miller et al. 1985). Since genetic and species diversity are directly linked, the distinction between them is sometimes blurred. In this sense phenotypic diversity versus genotypic diversity is relevant. Thirdly, ecosystem diversity refers to diversity at a supra-species level, namely at the community level. This covers the variety of communities of organisms within particular habitats as well as the physical conditions under which they live. A long-standing theoretical paradigm suggests that species diversity is important because it enhances the productivity and stability of ecosystems (Odum 1950). However, recent studies acknowledge that no pattern or determinate relationship needs to exist between species diversity and the stability of ecosystems (Johnson et al. 1996). Folke et al. (1996) instead suggest that a system's robustness may be linked to the prevalence of a limited number of organisms and groups of organisms, sometimes referred to as 'keystone species'. It is also possible that the specific relationships depend very much on whether the abiotic environment is stable or not (Holling et al. 1995). Functional diversity refers to the capacity of life-support ecosystems to absorb some level of stress, or shock, without flipping the current ecosystem to another regime of behaviour, i.e. to another stability domain (Turner et al. 1999). This has been originally referred to as 'resilience' (Holling 1973). Unfortunately, a system's functional robustness is still poorly understood and we often do not know the critical functional threshold associated with the variety of environmental conditions at different temporal and spatial scales (Perrings and Pearce 1994). From a management point of view, a safe strategy

seems to be to require a minimum level of biodiversity for any ecosystem to be sustained. A low level of ecosystem resilience can cause a sudden decrease in biological productivity, which in turn can lead to an irreversible loss of functions for both current and future generations (Arrow et al. 1995). Finally, functional diversity expresses the range of functions generated by ecosystems, including ecosystem life support functions, such as the regulation of nature major cycles (e.g. water and carbon) and primary ecosystem processes, such as photosynthesis and biogeochemical cycling (Turner et al. 2000). The task of evaluating the structure and functioning of an ecosystem requires that much be known about what the ecosystem does and what that is worth for both biodiversity and for humans. The value of ecosystem structure is generally more easily appreciated than that of ecosystem functioning. Assessing ecosystem functions, such as nutrient retention and pollution absorption for any given region, is extremely difficult. But ecosystem structure is also incompletely known. To assess the value of, for instance, the insect fauna and soil fungi, when many of these species have never even been described taxonomically, pushes human knowledge beyond its current limits (Westman 1985). The preservation of ecosystem processes and their consequent functioning is as important a goal for conservation as is the preservation of ecosystem structure. Ecology has now come to understand ecosystem processes to the extent that some management principles are evident, even if many questions remain unsolved. In recent years, meta-analysis has helped to create a quantitative synthesis of various empirical findings on ecosystems and biodiversity valuation (see Brander et al. 2006, and Nijkamp and Nunes 2008).

2.3. Biodiversity, Ecosystem Services and Human Wellbeing

How important is biodiversity for human wellbeing? The Millennium Ecosystem Assessment (MEA), an international consortium of over 1300 scientists, has focused intensively on the status of biodiversity and ecosystem services because of their contribution to human wellbeing, and has produced several technical volumes as well as thematic summary reports – see MEA (2003, 2005). The MEA wanted to assess the status of ecosystems and ecosystem services ('the benefits people obtain from ecosystems') because of their contribution to human wellbeing. This conceptual framework states that biodiversity underpins ecosystems and ecosystem services, which in turn contribute to human wellbeing. Against this background, a new conceptual framework was produced: ecosystem services (including supporting, provisioning, regulating and cultural services) are the cornerstone of wellbeing, which provision, in turn, shall be anchored inter alia in the levels of biodiversity. When subscribing this MEA approach, economic valuation of biodiversity is to be characterized by a three-step approach. The first step is the modelling and assessment of the role of biodiversity in the provision of ecosystem services. The second step is the estimation of the bio-physical impact of changes on the levels of biodiversity on the quantity, and quality, of these ecosystems services. The third, and final, step refers to the welfare assessment of changes in the levels of supply of the ecosystem services, portraying as much as possible these changes in monetary terms. The general acceptance of the MEA framework is a major step in explicitly linking biodiversity, ecosystems and human wellbeing. For the same reason, nowadays it is often proposed to use this framework as a basis to value biodiversity benefits, in particular when working on the policy agenda and management of biodiversity resources. A recent example refers to the 'Potsdam Initiative', which was launched at the G8+5 environment ministers meeting in Potsdam, in March 2007. This meeting called for a study on the economic significance of the global loss of biological diversity, looking at the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation (see Markandya et al. 2008, Sukhdev 2008). In a more general sense, the MEA issues have led to a plea for a more focussed scientific research effect (see Carpenter et al. 2009).

3. Economic Analysis of Biodiversity Values

3.1. Alternative Perspectives on Biodiversity Values

Given the above described four levels of diversity, it is clear that there is no single notion of biodiversity. Therefore, this section presents various perspectives which suggest that biodiversity value can be interpreted in several ways:

(1) *Instrumental* vs. *intrinsic valuation*. Many people, including biologists and natural scientists, do not feel comfortable with placing an instrumental value on biodiversity. The common argument is that biodiversity has a value on its own, without being used by humans – also know as intrinsic value. A more extreme version of this perspective even claims that that instrumental valuation of biodiversity, often translated in monetary terms, is a nonsense exercise (Ehrenfeld 1988). Many people, however, accept to place a monetary value on biodiversity arguing that, like any other environmental good or service, it is an outcome of an anthropocentric, instrumental point of view, bearing in mind the benefits of biodiversity for humans in terms of its production and consumption opportunities (Fromm 2000). Two specific motivations are the following. First, making public or private decisions that affect biodiversity implicitly means attaching a value to it. Second, monetary valuation can be considered as a democratic approach to decide about public issues. Finally, some subscribe an intermediate attitude by arguing that monetization of biodiversity benefits is possible, but that this will always lead to an under-estimation of the 'real' value since 'primary value' of biodiversity cannot be translated in monetary terms (Gren et al. 1994). As Gowdy (1997) has recently claimed *"... although values of environmental services may be used to justify biodiversity protection measures, it must be stressed that value constitutes a small portion of the total biodiversity value…".*

(2) *Monetary* vs. *physical indicators*. Monetary valuation of biodiversity is anchored in an economic perspective, based on biological indicators of the impacts of biodiversity on human welfare (see Randall 1988). The economic value of biodiversity can be traced to two important sources. First, biodiversity can serve as an input into the production of market goods. For example, the case of bioprospecting, i.e. the search for new pharmaceutical products (Simpson et al. 1996). In addition, biodiversity can be interpreted as a contributor to individual utility or wellbeing. For example, the human pleasure derived from experiencing nature. Economic valuation of biodiversity always leads to monetary values (or indicators), interpreted by economists as a common platform for comparison and ranking of alternative biodiversity management policies. On the contrary, physical assessments of biodiversity value are based on non-monetary indicators. These include, for example, species and ecosystems richness indices (see Whittaker 1960 and 1972), which have served as important valuation tools in the definition of 'Red Data Books' and 'Sites of Special Interest'. It is not guaranteed, however, that monetary and physical indicators point always in the same direction. In this sense, they should at best be regarded as complementary methods for assessment of biodiversity changes.

(3) *Direct* vs. *indirect values*. The notion of direct value of biodiversity is sometimes used to refer to human uses of biodiversity in terms of production and consumption. Conversely, the notion of direct value of biodiversity is associated to a minimum level of ecosystem infrastructure, without which there would not be the goods and services that are provided by the same system (Farnworth et al. 1981). Later on, the term 'indirect value' of biodiversity was proposed by Barbier (1994) and described as *"... support and protection provided to economic activity by regulatory environmental services…"* (p. 156). Nevertheless, in the literature, one can find different terms, such as 'contributory value', 'primary value', and 'infrastructure

value' of biodiversity, to point at the same notion (see Norton 1986, Gren et al. 1994 and Costanza et al. 1998).

(4) *Biodiversity* vs. *biological resources*. Whereas biodiversity refers to the variety of life, at whatever level of interest, *biological resources* refer to the manifestation of that variety. According to Pearce (1999), *"… much of the literature on the economic valuation of 'biodiversity' is actually about the value of biological resources and it is linked only tenuously to the value of diversity…".* The precise distinction is not always clear, and the two categories seem to be at least overlapping.

(5) *Genetic* vs. *other life organization levels*. Scientists face an important decision when valuing biodiversity: which level of diversity is under consideration? Some scientists, especially from the natural sciences domain, tend to focus on genetic and species levels, whereas others, including social scientists, tend to study species and ecosystems levels. Naturally, such a decision is crucial for the assessment of biodiversity value since it anchors the choice of the most appropriated indicators, a cornerstone of any valuation study of biodiversity.

(6) *Local* vs. *global diversity*. The design of a valuation context involves important decisions about the spatial frame of analysis (Norton and Ulanowicz 1992). Whereas biodiversity loss is usually discussed at a global or worldwide level, valuation biodiversity studies frequently address policy changes or scenarios defined at local, regional or national levels. Although this seems contradicting, it can be argued that biodiversity and its loss are relevant at multiple spatial levels, from local to global

(7) *Levels vs. changes of biodiversity.* One can also focus the assessment on levels of biodiversity. Such a valuation is highly data demanding and trade-offs, the anchor of any economic valuation exercise, will be extremely hard to set. Examples are thus difficult to find in the empirical valuation literature and the ones that exist are often target of a fierce scientific debate (e.g. Costanza et al. 1998). In an extreme perspective, one can always argue that the value of biodiversity is the summed value of the GNPs of all countries from now until the end of the world (Norton 1988). Alternatively, the valuation context can involve the design of policy management options, or scenarios, based on explicit changes in biodiversity levels.

(8) *Holistic* vs. *reductionist approaches*. According to a holistic perspective, biodiversity is an abstract notion, linked to the integrity, stability and resilience of complex systems, and thus difficult to disentangle and measure (Faber et al. 1996). In addition, the insufficient knowledge and understanding of the human and economic significance of almost every form of life diversity further complicates the translation of physical indicators of biodiversity into monetary values. For these reasons, economic valuation of biodiversity is by many scientists regarded as a hopeless task (Ehrenfeld 1988). On the contrary, a reductionist perspective is based on the idea that one is able to disentangle, or disaggregate, the total value of biodiversity into different economic value categories, notably into use and passive use or non-use values (Pearce and Moran 1994).

(9) *Expert* vs. *general public assessments*. Economic valuation starts from the premise that social values should be based on individual values. Therefore, when deciding for a general public valuation context, it is agreed that all taxpayers, with every educational level and varied life experiences, are involved in the valuation exercise. Such a valuation assessment benefits form a clear and legitimate democratic support. Another view assumes that laypersons cannot judge the relevance and complexity of biodiversity-ecosystems functions relationships. Instead, therefore, judgments and evaluation of biodiversity changes in this view should be left to experts, notably biologists. An example of an intermediate 'solution' is to use experts to inform laypersons sufficiently before confronting them with a valuation questionnaire (NOAA 1993).

It is clear that many different biodiversity value perspectives can be distinguished based on the above nine considerations. Evidently, it is crucial to know the perspective being adopted [15]. The next section will clarify this point for the subsequent assessment of empirical valuation studies.

3.2. The Concept of Economic Value

Economic valuation aims to provide a monetary expression of biodiversity values. The reason for this is that the theoretical basis of economic valuation is monetary (income) variation as a compensation or equivalent for direct and indirect impact(s) of a certain biodiversity change on the welfare of humans. Both direct and indirect values, relating to production, consumption and non-use values of biodiversity are considered when pursuing an economic valuation of biodiversity. Explicit biodiversity changes, preferably in terms of accurate physical-biological indicators, should be related to these. Biodiversity changes must be marginal or small for economic valuation to make sense. The economic valuation of biodiversity changes is based on a reductionist approach value. This means that the total economic value is regarded as the result of aggregating various use and non-use values, reflecting a variety of human motivations, as well as aggregating local values to attain a global value, i.e., a bottom-up approach (Nunes and Schokkaert 2003).

Moreover, the economic valuation of biodiversity starts from the premise that social values should be based on individual values, independently of whether the individuals are experts in biodiversity-related issues or not. This can be considered consistent with the democratic support of policies. A more detailed discussion and evaluation of monetary biodiversity valuation is offered in Subsection 3.3.

3.3. A Classification of Economic Values of Biodiversity

It is possible to identify and characterize different value categories of biodiversity. Figure 1 shows a classification of biodiversity values that is the basis for the analysis of valuation studies. A first category, denoted by link $1 \rightarrow 6$, depicts biodiversity benefits that run through ecosystem life support functions and preservation of the ecological structure in natural systems. The diversity of functions generated by ecosystems, in turn, links to the demand for goods and services. This value category can represent, for example, the benefits of flood control, groundwater recharge, nutrient removal, toxic retention, and biodiversity maintenance (Turner et al. 2000). A second biodiversity category, denoted by link $1 \rightarrow 4 \rightarrow 5$, captures the value of biodiversity in terms of natural habitat protection. This can relate, for example, to tourism and outdoor recreational demand. A third value category, denoted by link $2 \rightarrow 5$, captures the benefits of an overall provision of species diversity. This value category represents the indirect value of biodiversity in biological resources in terms of inputs to the production of market goods. Well-known examples are the pharmaceutical and agriculture industries, which use plant and animal material to develop new medicines and new products (Myers 1988, Simpson et al. 1996).

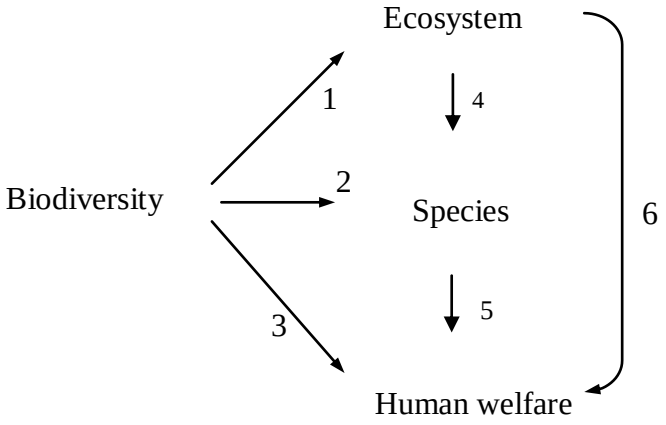

Figure 1. Economic values of biodiversity. Source: Nunes et al. (2001).

Finally, a fourth category, captured by link 3, denotes a passive or non-use component of biodiversity value, which reflects moral considerations to other species (bioethics), human philanthropic, or bequest considerations. The latter relates to the knowledge that biodiversity will be available to the next generations. We refer for a systematic survey to Table 1.

This chapter has tried to clarify various basic economic aspects of biodiversity evaluation. A solid micro-economic welfare-theoretic foundation seems to be a sine qua non condition for a proper biodiversity evaluation. Clearly, in an operational sense, still many advances need to be made. This will be further discussed in Section 4.

Table 1. Total economic value of biodiversity

Biodiversity value category (see Figure 1)	Economic value interpretation	Biodiversity benefits	Methods for economic valuation (and their applicability)
2 → 5	Genetic and species diversity	Inputs to production processes (e.g., pharmaceutical and agriculture industries)	CV: + TC: – HP: + AB: + PF: + Market contracts: +
1 → 4 → 5	Natural areas and landscape diversity	Provision of natural habitat (e.g., protection of wilderness areas and recreational areas)	CV: + TC: + HP: – AB: – PF: + Tourism revenues: +
1 → 6	Ecosystem functions and ecological services flows	Ecological values (e.g., flood control, nutrient removal, toxic retention and biodiversity maintenance)	CV: – TC: – HP: + AB: + PF: +
3	Non-use of biodiversity	Existence or moral value (e.g., guarantee that a particular species is kept free from extinction)	CV: + TC: – HP: – AB: – PF: –

Note: the sign + (–) means that the method is more (less) appropriate to be selected for the design of the valuation context of the biodiversity value category under consideration.
Legend: CV=contingent valuation; TC = travel cost; HP = hedonic pricing; AB = averting behaviour; PF = production function.

4. Measuring Economic Values of Biodiversity Benefits

In this section, we will present a set of illustrative applications of evaluation methods for different types of biodiversity issues.

4.1. Genetic Diversity and Bio-prospecting

Recent years have shown a sharp increase of interest in bio-prospecting, i.e., a search among the genetic codes contained in living organisms in order to develop chemical compounds of commercial value in agricultural, industrial, or pharmaceutical applications (Simpson et al. 1996). This is dominated by pharmaceutical research since most prescribed drugs are derived or patented from natural sources (Grifo et al. 1996). This section considers assessments of willingness to pay by the pharmaceutical industries for genetic diversity as input into commercial products. The marginal value of such input, often translated in terms of genetic information for medicinal purposes, is measured by its contribution to the improvement of health care. For example, research by the US National Cancer Institute on screening of plants over the last two decades has yielded various highly effective anti-cancer drugs (e.g., *paclitazel* and *camptothecin*) and anti-leukemia drugs (e.g., *homoharringtonone*) (Cragg et al. 1998).

Recent registrations and applications of bio-prospecting contracts and agreements between states and pharmaceutical industries represent important benchmarks of monetary indicators for these types of biodiversity values. Illustrations of estimates are shown in Table 2.[1] The most notable of these agreements is the pioneering venture between Merck and Co., the world's largest pharmaceutical firm, and Instituto National de Biodiversidad (INBio) in Costa Rica. At the moment of the contract's signature, in 1991, Merck paid Costa Rica about $1 million and agreed to pay royalties whenever a new commercial product was explored. Since then, INBio has signed contracts on the supply of genetic resources with Bristol-Myers Squibb and other companies and non-profit organizations (Ten Kate and Laird 1999; INBio 2001). Another illustration of the market value of genetic diversity is the commercial agreement signed in 1997 between Diversa, a San Diego-based biotechnology firm, and the US National Park Service. Diversa paid $175,000 for the right to conduct research on heat-resistant microorganisms found in hot springs in Yellowstone National Park (Sonner 1998, Macilwain 1998). More recently, a Brazilian company, Extracta, signed a $3.2 million agreement with Glaxo Wellcome, the world's second-largest pharmaceutical company, to screen 30,000 samples of compounds of plant, fungal and bacterial origin from several regions in the country (Bonalume and Dickson 1999).

Table 2. Valuation of bio-prospecting agreements: examples

Contractors	Study	Value
INBio & Merck (1991)	2,000 samples of the Costa Rica genetic pool	$1 million
Yellowstone National Park & Diversa (1998)	Thermostable enzyme *Taq* polymerase and bacterium *Thermus aquaticus*	$175,000
Brazilian Extracta & Glaxo Wellcome (1999)	30,000 samples of Brazil biota	$3.2 million

Despite the fact that these agreements show a positive economic value of genetic diversity, concern remains about the fairness of such deals. Indeed, some environmental groups have been very critical, claiming that these are unequivocally 'biopiracy' actions (see RAFI 2001). Furthermore, genetic diversity may also give rise to a number of existence and moral values. These however, are not the basis for the pharmaceutical industry's willingness to pay, and therefore are not captured by the market prices of the agreements.

[1] All estimates in Tables 2-7 are in nominal values.

4.2. Species Diversity and Species Values

Most of the valuation studies of species preservation have focused on single animal species. Table 3 lists some recent studies, all applications in the US, except for a Swedish contingent valuation (CV) study of wolves (Boman and Bosdedt 1995). The estimates are derived from CV applications and obtained from the individual willingness to pay (WTP) to avoid the loss of a particular species. Most welfare gains accrued to individuals are based on recreational activities such as watching threatened or endangered species in their natural habitat, or simply reflect the well-being derived from the knowledge that such a species exists. The later case can be interpreted as relating to non-use or passive use values. For example, Van Kooten (1993) assessed the economic value of waterfowls in a wetland region in Canada; Loomis and Larson (1994) valued 'emblematic' endangered species, namely the gray whale; and Stevens et al. (1997) valued the restoration of Atlantic salmon in one river in the state of Massachusetts – see Van Kooten and Bulte (2000) for more examples.

Table 3. Valuation of single species

Author(s)	Study	Mean WTP estimates (per household/year)
Stevens *et al.* (1997)	Restoration of the Atlantic salmon in one river, Massachusetts	$14.38 to $21.40
Jakobsson and Dragun (1996a)	Conservation of the leadbeater's possum, Australia	$29 (Australian $)
Boman and Bosdedt (1995)	Conservation of the wolf in Sweden	700 SEK to 900 SEK
Loomis and Larson (1994)	Conservation of the gray whale, US	$16 to $18
Loomis and Helfand (1993)	Conservation of various single species, US	From $13 for the sea turtle to $25 for the bald eagle
Van Kooten (1993)	Conservation of waterfowl habitat in wetlands region, Canada	$50 to $60 (per acre)
Bower and Stool (1988)	Conservation of the whooping crane	$21 to $141
Boyle and Bishop (1987)	Conservation of the bald eagle and the striped shiner, Wisconsin	From $5 for the striped shiner to $28 to the bald eagle
Brookshire, Eubanks and Randall (1983)	Conservation of the grizzly bear and the bighorn sheep, Wyoming	From $10 for the grizzly bear to $16 for the bighorn sheep

Alternatively, economists can pursue valuation studies of species preservation that focus on more than one species, as shown in Table 4. The estimates are higher than the single species value estimates, though not as high as one would expect, bearing in mind the initial single species estimates. For example, the WTP of the wolf study in Sweden alone corresponds to more than 70 per cent of the WTP for 300 Swedish endangered species.

The interpretation of such estimation results may be, however, heavily criticized because of the CV's design and execution (see Carson 1997). Nevertheless, some authors prefer to work with other categories of biodiversity value, namely value categories related to natural habitat, ecosystem functions and services flows protection. These are discussed in the following subsections.

Table 4. Valuation of multiple species

Author(s)	Study	Mean WTP estimates (per household/year)
Jakobsson and Dragun (1996b)	Preservation of all endangered species in Victoria	$118 (Australian $)
Desvousges et al. (1993)	Conservation of the migratory waterfowl in the Central Flyway	$59 to $71
Whitehead (1993)	Conservation program for coastal nongame wildlife	$15
Duffield and Patterson (1992)	Conservation of fisheries in Montana rivers	$2 to $4 (for residents) $12 to $17 (for non residents)
Halstead et al. (1992)	Preservation of the bald eagle, coyote and wild turkey in New England	$15
Johansson (1989)	Preservation of 300 endangered species in Sweden	1,275 SEK
Samples and Hollyer (1989)	Preservation of the monk seal and humpback whale	$9.6 to $13.8
Hagemann (1985)	Preservation of threatened and endangered species populations in the US	$17.73 to $23.95

4.3. Species Diversity and Habitat Values

A recurrent problem with the interpretation of the value estimates of species preservation is the frequently missing link between the value assigned to a particular (set of) species and the area needed to protect (their) habitats. Some studies instead, link the value of biodiversity to the value of natural habitat conservation. Some examples are listed in Table 5. For example, Bateman et al. (1992) undertook a contingent valuation study to assess the monetary value of conserving the Norfolk Broads, a wetland site in the UK that covers three National Nature Reserves. The estimation results from a mail survey show that respondents living in a zone defined as 'near-Norfolk Broads' had a WTP of £12, whereas those living in the 'elsewhere UK' zone had a WTP of £4. In the context of the Netherlands, Hoevenagel (1994) asked 127 respondents for an annual contribution to a fund from which farmers in the Dutch meadow region would receive a government grant if they managed their land in a way that enhances wildlife habitat. The average WTP was between NLG 16 and NLG 45. Brouwer (1995) found similar results.

More recently, Nunes (2002ab) used for the first time a national CV application in Portugal to assess the willingness to pay for the protection of natural parks and wilderness areas. The mean WTP results ranged from $40 to $51. In the US context, Mitchell and Carson (1984) used the CV method to value the preservation of water ecosystems and the aquatic-related benefits provided by all rivers and lakes in the US. Loomis (1989) used CV to value the preservation of Mono Lake, California – see the valuation figures in Table 5. Kealy and Turner (1993) estimated the benefits derived from the preservation of the Adirondack aquatic system. The WTP estimates ranged between $12 and $18. Boyle (1990) valued the preservation of the Illinois Beach Nature Reserve. The estimation results show that the average WTP ranged between $37 and $41. Silberman et al. (1992) studied the existence value of beach ecosystems for users and non-users of New Jersey beaches. The results show that the mean WTP for a user is about $15.1, while the mean WTP for a non-user is about $9.26.

Table 5. Valuation of natural habitats

Author(s)	Study	Mean WTP estimates (per household)
Nunes (2002a,b)	Protection of natural parks and wilderness areas, Portugal	$40 to $51
Wiestra (1996)	Protection of ecological agricultural fields, The Netherlands	NLG 35 (single-bounded)
Richer (1995)	Desert protection in California, US	$101
Brouwer (1995)	Protection of peat meadow land, The Netherlands	NLG 28 to NLG 72
Carson et al. (1994)	Protection of the Kakadu conservation zone and National Park, Australia	$52 (minor impact scenario) $80 (major impact scenario)
Hoevenagel (1994)	Enhancing wildlife habitat in the Dutch peat meadow region, The Netherlands	NLG 16 to NLG 46
Kealy and Turner (1993)	Preservation of the aquatic system in the Adirondack region, US	$12 to $18
Hoehn and Loomis (1993)	Enhancing wetlands and habitat in San Joaquin Valley in California, US	$96 to $184 (single program)
Diamond et al. (1993)	Protection of wilderness areas in Colorado, Idaho, Montana and Wyoming, US	$29 to $66
Silberman et al. (1992)	Protection of beach ecosystems, New Jersey, US	$9.26 to $15.1
Bateman et al. (1992)	Protection of a wetland site, the Norfolk Broads, UK	£4 to £12
Boyle (1990)	Preservation of the Illinois Beach State Nature Reserve, US	$37 to $41
Loomis (1989)	Preservation of the Mono Lake, California, US	$4 to $11
Smith and Desvousges (1986)	Preservation of water quality in the Monongahela River Basin, US	$21 to $58 (for users) $14 to $53 (for non-users)
Bennett (1984)	Protection of the Nadgee Nature Reserve, Australia	$27
Mitchell and Carson (1984)	Preservation of water quality for all rivers and lakes, US	$242
Walsh et al. (1984)	Protection of wilderness areas in Colorado, US	$32

Other studies link the value of biodiversity to the value of protection of natural areas with high tourism and outdoor recreational demand. In this biodiversity value category, biodiversity has been assessed by various methods, including contingent valuation, the travel cost method and market prices such as tourism revenues. Some examples are listed in Table 6. For example, the World Tourism Organization (WTO 1997) estimated that Ecuador earned $255 million from ecotourism in 1995. A major sum accrued to a single park, the Galapagos Islands. In Rwanda, gorilla tourism in the Volcanoes National Park generated directed revenues of $1.02 million annually until 1994, or $68 per ha (AG Ökotourismus/BMZ 1995). Studies of less popular parks indicate lower values. The recreational value of Mantadia National Park in Madagascar was estimated to range between $9 and $25 per ha (Mercer et al. 1995). One particularly interesting valuation result is shown in the study by Norton and Southey (1995). This study calculates the economic value of natural habitat for biodiversity protection in Kenya by assessing the associated opportunity costs of foregone agricultural production, which is estimated to be $203 million. This is much higher than the $42 million of net financial revenue from wildlife tourism. Layman et al. (1996) explored the travel cost method to estimate the recreational fishing value of Chinook salmon in the Gulkana river, Alaska. The estimates of the mean consumer surplus per day range from $17 to $60 for actual trips, depending upon the wage rate. In a different context, Chase et al. (1998) studied ecotourism demand in Costa Rica. The value estimates result from a survey of foreign visitors to three national parks: Volcan Irazu, Volcan Poas, and Manuel Antonio. Manuel Antonio National Park registered the highest WTP, viz. $24.90. Finally, Moons (1999) used the travel cost method to assess the economic value of recreational activities in the Meerdal-Heverlee forest in Belgium.

Table 6. Valuation of tourism and outdoor recreation

Author(s)	Study	Measurement method	Estimates
Moons (1999)	Enjoyment received in forest-related recreational activities in Flanders, Belgium	Travel cost	BEF 1,030 per trip
Chase et al. (1998)	Protection of recreation opportunities in three national parks, Costa Rica	Contingent valuation	$21.60 to $24.90 per visitor
WTO (1997)	Ecotourism in Ecuador	Tourism revenue	$255 million annually
Layman et al. (1996)	Chinook salmon in the Gulkana river, Alaska	Travel cost	$17 to $60 per trip
AG Ökotourismus (1995)	Gorilla tourism in Volcanoes National Park, Rwanda	Tourism revenue	$1.02 million annually
Mercer et al. (1995)	Recreational value of Mantadia National Park, Madagascar	Tourism revenue	$9 and $25 per ha
Norton and Southey (1995)	Biodiversity conservation in Kenya	Production function	$203 million annually

4.4. Biodiversity, Ecosystem Functions and Service Flows

The contingent valuation (CV) method has been widely used for valuing biodiversity benefits around the world, in terms of both species diversity and natural habitat protection. Nevertheless, when it comes to the monetary valuation of ecosystem functions, CV may not always be the best choice. This is because ecosystem functions, such as ecosystem life support, are not an issue that the general public is familiar with. In addition, the complexity of the relationships involved makes their accurate and comprehensive description in a survey extremely difficult. Researchers frequently end up using valuation methods based on travel costs, averting behaviour or production functions. In this context, valuation studies based on soil and wind erosion, water quality, and wetland ecosystem functions can be distinguished. These are listed in Table 7, and will concisely be discussed.

One particular category of valuation of ecosystem functions and services relates to soil erosion. Veloz et al. (1985) performed an economic analysis and valuation of soil conservation in the Dominican Republic. They estimate that, for a 25-year land use interval, the net returns from the introduction of erosion control programs are about DR$ 260 per hectare. Walker and Young (1986) estimate the damage caused by soil erosion in terms of (loss of) agricultural revenue in the Palouse region of northern Idaho and western Washington to be equal to $4 and $6 per acre, for scenarios with slow and rapid technological progress, respectively. Holmes (1988) studied the impact of water turbidity due to soil erosion on the costs incurred by the water treatment industry. Estimates show that mitigation costs ranged from $4 to $82 per million gallons of water for conventional and direct filtration systems, respectively. When applying these estimates to the American Water Works Association figures on total surface water withdrawal, the nationwide damages induced by turbidity are estimated to fall in between $35 and $661 million annually. King and Sinden (1988) have explored the use of the hedonic price method in order to capture the value of soil conservation in the farmland market of Manilla Shire, Australia. The hedonic land market price regression results show that soil condition (e.g., depth of topsoil) has an implicit marginal price of $2.28/ha. More recently, Huszar (1989) studied erosion due to wind in New Mexico. According to this study, wind erosion costs to households are due to increased cleaning, maintenance and replacement expenditures, and also to reduced consumption and production opportunities. A household cost function was estimated on the basis of 242 survey respondents. The total household costs were estimated to be $454 million per year.

In the valuation field, also various sectoral studies have been undertaken, e.g., on water quality valuation (see Ribaudo 1989a,b, Torell et al. 1990, Abdalla et al. 1992, Laughland et al. 1996, Choe et al. 1996). It is noteworthy but not surprise that many valuation studies address ecosystem's functions in agriculture and forestry (see for recent studies Gallai et al. 2009, Priess et al. 2007). It should be added that in recent years also meta-analytical methods have been used extensively (see e.g. Nijkamp et al. 2008).

Table 7. Valuation of ecosystem services.

Author(s)	Study	Measurement Method	Estimates
Choe et al. (1996)	Value of a public health program at Times Beach, Philippines	Travel cost	$1.44 to $2.04 per trip
Laughland et al. (1996)	Value of water supply in Milesburg, Pennsylvania	Averting expenditures	$14 and $36 per household
Turner et al. (1995)	Life-support value of a wetland ecosystem on a Swedish island, Baltic Sea	Replacement costs	$0.4 to $1.2 million
Barbier (1994)	Preservation of Hadejia-Jama'are wetlands, Nigeria	Production function	N 850 to N 1,280 per ha
Abdalla et al. (1992)	Groundwater ecosystem in Perkasie, Pennsylvania	Averting expenditures	$61,313 to $131,334
McClelland et al. (1992)	Protection of Groundwater Program, US	Contingent valuation	$7 to $22
Andreasson-Gren (1991)	Nitrogen purification capacity of a Swedish island in the Baltic, Gotland	Replacement costs	SEK 968 per kg
Torell et al. (1990)	Water in-storage in the High Plains aquifer	Production function	$9.5 to $1.09 per acre-foot
Tobias and Mendelsohn (1990)	Tourism and ecotourism based on non-consumptive uses of wildlife in Costa Rica	Tourism revenue	$1.2 million per ha
Ribaudo (1989a, b)	Water quality benefits in ten regions in the US	Averting expenditure	$4.4 billion
Huszar (1989)	Value of wind erosion costs to households in New Mexico	Replacement costs	$454 million per year
King and Sinden (1988)	Value of soil conservation in the farm land market of Manilla Shire, Australia	Hedonic price	$2.28 per ha
Holmes (1988)	Value of the impact of water turbidity due to soil erosion on the water treatment	Replacement costs	$35 to $661 million annually
Walker and Young (1986)	Value of soil erosion on (loss of) agricultural revenue in the Palouse region	Production method	$4 and 6$ per acre
Veloz et al. (1985)	Soil erosion control program in a watershed in the Dominican Republic	Production function	DR$ 260 per ha

5. Integrated Ecological-Economic Modelling and Analysis of Biodiversity

5.1. Background

The analysis and modelling of biodiversity are rooted in the domains of the natural and social sciences; they require the study of human economic activities, their relationships with biodiversity, and with the structure and functions of ecosystems. The combination or integration

of the two approaches implies in practice often a somewhat qualitative, formal, sequentially integrated framework. Interdisciplinary work involves economists or ecologists transferring elements or even theories and models from one discipline to another and transforming them for their specific purposes (see also Carpenter et al. 2009, Polasky and Segerson 2009). The objective of the present section is to develop a common way of thinking about the modelling and valuation of biodiversity. This may require activities such as reduction, simplifying or summarizing. This section provides a survey of frameworks and methods of integrated ecological-economic modelling and the valuation of biodiversity. It ends with an illustration of a regional integrating modelling exercise.

5.2. Frameworks and Theories Underlying Integrated Modelling

Before discussing specific methods and models we will address the frameworks and conceptual perspectives underlying the integration of economics, ecology and other disciplines. The literature shows various examples of such simple frameworks. Surveys are amongst other offered by Barbier (1990), Van den Bergh and Nijkamp (1991), Van den Bergh (1996), Costanza et al. (1997), Ayres et al. (1999) and Turner et al. (2000).

A very general and almost non-theoretical ('no assumptions') framework is the Driver-Pressure-State-Impact-Response (DPSIR) framework, a variation on the framework proposed for environmental data classification by Turner et al. (2000) and Rotmans and de Vries (1997) for integrated analysis and modelling. The components can be interpreted as follows: 'Driver' = economic and social activities and processes; 'Pressure' = pressures on the human (health) and environmental system (resources and ecosystems); 'State' = the physical, chemical and biological changes in the biosphere, human population, resources and artifacts (buildings, infrastructure, machines); 'Impact' = the social, economic and ecological impacts of natural or human-induced changes in the biosphere; 'Responses' = human interventions on the level of drivers (prevention, changing behaviour), pressures (mitigation), states (relocation) or impacts (restoration, health care). According to Rotmans and de Vries (1997) integration can be of various types. Vertical integration means that the causal chain in the PSIR or DPSIR framework is completely described in one model. Horizontal integration (of subsystems) in this context is defined as the coupling of various global biogeochemical cycles and earth system compartments (atmosphere, terrestrial biosphere, hydrosphere, lithosphere and cryosphere). Full or total integration means a combination, leading to the complex linking, of various drivers, pressures, states, impacts and responses, thus allowing for various synergies and feedback. The integration frameworks proposed in environmental and ecological economics represent more specific theoretical choices than the DSPIR model. We will discuss several of these in the following subsection.

5.3. Integrated Model Assessment

A very general method of developing integrated models is the systems well-known approach (also 'systems dynamics'). This includes a wide range of model types: linear versus nonlinear, continuous versus discrete, deterministic versus stochastic, and optimizing versus descriptive. The systems approach allows us to deal with concepts like dynamic processes, feedback mechanisms, and control strategies (see Bennett and Chorley 1978, Costanza et al. 1993). One can integrate two subsystems, or have a hierarchy or nesting of systems. The fixed elements in the system can either be considered black boxes or be described as empirical or logical processes themselves. The systems approach is suitable for integrating existing models, and can incorporate temporal as well as spatial processes.

Costanza et al. (1993) distinguish between economic, ecological and integrated approaches on the basis of whether they optimize: (1) generality, characterized by simple theoretical or conceptual models that aggregate, caricature and exaggerate; (2) precision, characterized by statistical, short-term, partial, static or linear models with one element examined in much detail; and (3) realism, characterized by causal, nonlinear, dynamic-evolutionary, and complex models.

These three criteria are usually conflicting, so a trade-off between them is inevitable. A distinction between analytical and heuristic integration is relevant here. Analytical integration means combining all aspects studied in a single model (and therefore model type). Heuristic integration can proceed by using the output of one model as input to another, and vice versa, as well as by extending this through (finite) iterative interaction. In this case different model types, such as optimization models and descriptive models, can be combined. If one desires to attain a great deal of analytical power, analytical integration seems attractive, whereas striving for realism would imply the use of a heuristically linked set of models from different disciplines. Striving for empirically sound models often implies modest approaches to improving precision, which usually goes at the cost of model use in a wider context or with a wider range of parameter values. The development of integrated models, through the joint efforts of economists and ecologists, is based on bringing together elements, theories or models from each discipline and transforming these for the purpose of integration. This may require operations such as reduction, simplification or summarizing. The results may not always be greeted with enthusiasm within the disciplines, especially when they neglect certain nuances or different viewpoints.

Many integrated models defined at the level of ecosystems are based on the standard systems-ecological approach (Patten 1971, Jørgenson 1992). They include ecosystem modules that describe the effects of environmental pollution, resource use and other types of disturbance. A main problem is modelling the effects of multiple stress factors, since the empirical basis for this is often lacking. Various integrated models have been developed for terrestrial and aquatic systems. Surveys are presented in Braat and Van Lierop (1987), Van den Bergh (1996) and Costanza et al. (1997). Some studies have paid much attention to spatial aspects, focusing on spatial disaggregation into zones (for instance, Giaoutzi and Nijkamp 1995, Van den Bergh and Nijkamp 1994) or on land-use planning in interaction with landscape ecology (see Bockstael et al. 1995). Formal theoretical approaches in ecology that provide a basis for these approaches have been described by Watt (1968), Maynard-Smith (1974), Roughgarden et al. (1989) and Jørgenson (1992). Perrings and Walker (1997) consider resilience in a simple integrated model of fire occurrences in semi-arid rangelands such as those found in Australia. The model describes the interaction between extreme events (fire, flood, and droughts), grazing pressure, and multiple locally stable states. Carpenter et al. (1999) develop and explore water and land-use options in an integrated model of a prototypical region with a lake that is being polluted. This model combines rationally bounded behaviour, supposedly in accordance with the reality of regional resource and environmental management, and a nonlinear ecosystem module describing processes occurring at different speeds. The model generates multiple locally stable states as well as 'flipping' behaviour (see also Janssen and Munda 1999). Swallow (1994) integrates theoretical models of renewable and non-renewable resources to address multiple uses and tradeoffs in wetland systems. A special category of integrated modelling is sometimes referred to as the biophysical or energy approach. This aims to integrate economic and environmental ecological processes in energy-physical dimensions, based on the notion that any system is constrained by energy availability (Odum 1987). These models include energy and mass balances. A central concept in this approach is 'embodied energy', which is defined as the direct and indirect energy required producing organized material structures. Applications of these energy-inspired models cover ecosystems, economic systems, and environment-economy models (Odum 1987). An extended application to a regional system is presented by Jansson and Zuchetto (1978) (see also Zuchetto and Jansson 1985).

The recent focus on integrated assessment of the enhanced greenhouse effect (a potential climate change) can be regarded as the new wave in 'world models', where (again) economists and others have tended to rely on different model approaches (Bruce et al. 1995). The integrated climate assessment models combine results from the natural sciences (physics, chemistry, biology, earth sciences) and the social sciences (economics, sociology, political science), and have so far given rise to a continuation of the trend in world models towards increasing detail and disaggregation. These climate assessment models have a multilayered conceptual structure that distinguishes physical and environmental effects of human activities from adjustments to

climate change by humans (individuals, firms, organizations) and policy responses (mitigation, aimed at the causes) at various spatial levels (Parry and Carter 1998).

5.4. Specific Methods and Models

Integrated models can have different formats. Table 8 illustrates some characteristics of integrated models and provides general examples. One important distinction is between policy optimization and evaluation (usually numerical simulation) models. One of the first and famous integrated assessment models used in policymaking is the RAINS model (Alcamo et al. 1990). This includes an optimization algorithm for calculating cost-effective acidification strategies in Europe, aimed at realizing deposition targets throughout Europe, and taking account of sensitive natural areas (forests and lakes). This model is a rare case of direct science-policy influence, as it was used in the negotiations on transboundary air pollution in Europe. Castells (1999) offers an informative analysis of the institutional and evolutionary dimensions of the interaction between scientists, research institutions and negotiations on international environmental agreements, with special attention given to the RAINS model and the acid rain context in Europe. In the area of integrated assessment models for CO_2 emissions (climate) strategies, one can find both economic optimization (Nordhaus 1994) and detailed descriptive model systems like IMAGE and TARGETS (Alcamo 1994; and Rotmans and de Vries 1997). DICE by Nordhaus (1991) is the first example of a policy optimization model for climate change. The model essentially combines economic growth theory with a simplified climate change model. Tol (1998) provides a short account of the evolution of the economic optimization approach to climate change research. He emphasizes the attention placed upon the analysis of uncertainty and learning from a cost-effectiveness perspective, which has given rise to various model formulations and analyses. More recently, Janssen (1998) and Van Ierland (1999) present informative surveys and categorizations of macroeconomic-cum-environment and macro-level integrated models, including the climate-oriented integrated assessment models. Van Ierland devotes special attention to the various 'regionalized world' models (with acronyms like RICE, CETA, MERGE, DIALOGUE, FUND). Van den Bergh and Hofkes (1998) have collected distinct approaches to integrated modelling with an economic emphasis that focus on sustainable development questions in theory and in practice, as well as at global and regional levels.

Table 8. Characterizing integrated models

Model criterion	Range of choice	Examples of distinct approaches
Analytical integration	Optimization (benevolent decision maker); Equilibrium (partial or general); Game-theoretical; Dynamic-mechanistic; Adaptive (multi-agent & dynamic); Evolutionary (irreversible, bounded rationality)	Many theoretical models: growth theory, renewable resource economics (fisheries, forestry, water quality/quantity), systems models (Limits-to-growth), cost-effectiveness models (RAINS), welfare optimization (DICE)
Heuristic integration	Satellite principle; Multilayer subsystems; Sequential; Parallel consistent scenarios; Aggregation of indicators; Evaluation	Regional environmental quality models (Resources for the Future), world models (Club of Rome), integrated assessment model
Spatial coverage	World; National; Regional; Urban; Local Ecosystem	Ecosystem modelling, macroeconomic modelling, regional modelling, urban modelling, world models
Spatial disaggregation	Single region; Multiregion; Spatial grid (GIS)	Integrated assessment models (climate change), land use models
Aggregation level	Micro (individuals, households); Macro (national economy, main sectors, global); Sectorial; Interest groups; Homogeneous land plots; Spatial grids; Temporal (days, seasons, years)	Computable general equilibrium models, macroeconomic models (Keynesian), multisector models, land use models, landscape models

Source: Van den Bergh (1996)

5.5. Interaction between Integrated Modelling and Monetary Valuation

Progress in improving models to provide economic information, particularly predictive information, will require a vital and dynamic interdisciplinary dialogue. At this level, integrating modelling and monetary valuation can present important advantages for guiding

policy by presenting important interactions. First, values estimated in a valuation study can be used as parameter values in model studies. Benefit or value transfer (e.g., meta-analysis exercises) can be used to translate value estimates into other contexts, conditions, locations or temporal settings that do not allow for direct valuation in 'primary studies' (due to technical or financial constraints). Second, models can be used to generate values under particular scenarios. In particular, dynamic models can be used to generate a flow of benefits over time and to compute the net present value, which can serve as a value relating to a particular scenario of ecosystem change or management. Third, models can be used to generate detailed scenarios that enter valuation experiments. An input scenario can describe general environmental change, regional development or ecosystem management. This can be fed into a model calculation, which in turn can provide an output scenario with more detailed spatial or temporal information. The latter can then serve, for example, as a hypothetical scenario for valuation, which is presented to respondents in a certain format (graphs, tables, story, diagrams, pictures) so as to inform them about potential consequences of the general policy or exogenous change. User-friendly computer software can be used in such a process. Finally, the outputs of model and valuation studies can be compared. For instance, when studying a scenario for wetland transformation, one can model consequences in multiple dimensions (physical, ecological and costs/benefits), and aggregate these via a multi-criteria evaluation procedure, with weights being set by a decision-maker or a representative panel of stakeholders. Alternatively, one can ask respondents to provide value estimates, such as willingness to pay for not experiencing the change. If such information is available for multiple management scenarios, then rankings based on different approaches can be compared.

5.6. Advantages and Disadvantages of Integrated Modelling

Using integrated economic-environmental models for the analysis and evaluation of biodiversity issues has both advantages and disadvantages. Three main advantages are: (1) handling data, information, theories, and empirical findings from various contributing disciplines in a systematic and consistent way; (2) being explicit about assumptions, theories and facts; and (3) addressing complex phenomena, interactions, feedback, laborious calculations and temporally, spatially and sectorally detailed and disaggregate processes. An argument against non-formal approaches to integrated research is that these fail to provide for a systematic and consistent linking of data, theories and empirical insights from various disciplines. Instead, these approaches tend to result in a battle of perspectives based on distinct and usually implicit premises and information bases. Models force researchers to be explicit about at least the latter two inputs to integrated research. Most of the disadvantages of integrated modelling apply to non-model-based integrated research as well. They include: an unclear synergy of approximations and uncertainties; rough application of monodisciplinary theories and empirical insights; simplification of complex phenomena (e.g., by treating them as a black box); misinterpretation or arbitrary choice of disciplinary perspectives by the model, and a lack of systematic or complete linking of subsystems or submodels. Complex or high-dimensional models have the extra disadvantage of being difficult to calibrate and validate, and of lacking transparency.

The main disadvantage of models perhaps is that they are trusted too much, so that they run the risk of being interpreted as objective representations of reality, and are then taken too seriously, especially by laypersons and policymakers. On the other hand, policymakers often express their doubts about formal modelling. Shackley (1997) states that numerical models have, despite their long tradition of development and widespread use, not achieved the epistemological status; the controlled laboratory experiment has in natural sciences (and more recently in the social sciences and in environmental economics in particular). This relates to the fact that modelling results never 'prove' anything, since they do not generate real or physical processes. The best way to view theoretical and especially empirical models is to consider them tools for hypothetical experiments with complex systems, which serve as analogies or pictures of real-world systems that do not allow – technically, morally or politically – for

experimentation. In other words, complex model systems, notably integrated economic-ecological models, are heuristic devices for learning about the real-world system, rather than for predicting its real course of behaviour. In addition, integrated modelling is restricted by the model type.

If economic and ecological models fit within a (general) systems framework, they may be blended into a single model structure, where compartments or modules may represent the original models, and certain outputs of one module serve as input for another. Nevertheless, it is often not easy to link models directly. For instance, if both the economic and ecological systems are represented in the form of programming or optimization models, several options are available: look for a new, aggregate objective; adopt a multiobjective or conflict analysis framework; or, when possible, derive multiple sets of optimality conditions and solve these simultaneously. Alternatively, when the economic and ecological systems are represented by different model types, it is difficult to suggest how they could be linked to one another. When economic models have an optimization format and ecosystem models have a descriptive format, direct technical integration seems feasible; otherwise heuristic approaches are needed.

6. Biodiversity Policy

6.1. Public Policy Strategies

As argued above, biodiversity comprises functions that affect the wellbeing of individuals and societies in all regions of our world. The mainly public good character of biodiversity, combined with the presence of many externalities, evidently gives rise to a market failure. In particular, market prices fail to capture the full range of biodiversity benefits to individuals and society. This contributes to the rapid depletion of biodiversity, leading to important welfare losses. Therefore, there is a clear scope for public biodiversity policy. A successful public policy design aimed at ensuring the conservation and sustainable use of the full range of biodiversity benefits implies the use of environmental instruments that: (1) protect biodiversity private values, such as benefits in terms of species and genetic diversity, through the provision of proper market incentives, such as taxes and charges or the assignment of well-defined property rights; and (2) protect biodiversity public values, such as benefits in terms of the knowledge of the continued existence of ecosystems diversity and bequest values related to maintaining them for the enjoyment of future generations, through the use of institutions and the creation of market mechanisms such as the provision of information. Therefore, biodiversity policy-related measures are often applied in a policy mix, combining standard-setting, direct and indirect market intervention and the provision of information. Table 9 presents a concise list of the strategies available to governments involved in biodiversity policy design. These are discussed in more detail in the subsequent subsections.

Table 9. Strategies for government involvement in public biodiversity policy

Direct government interventions:

1. Price incentives: fees, charges, taxes and tradable permits.
2. Command-and-control strategy: quantity standards, technology regulation, access restrictions.
3. Assignment of property rights.

Provision of information:

4. Development of market mechanisms: certification, ecolabelling, and institutional building.

Source: OECD (1999)

6.2. Direct Government Intervention

One possible way of addressing market failures is through direct government intervention. This involves the use of policy instruments such as taxes, command-control policy, and the definition of property rights. The best-known price instrument is the optimal or Pigouvian tax, which restores a situation with biodiversity externalities to a social optimum. For example, in 1995 the Dutch government introduced a groundwater tax so as to minimize the desiccation effects associated with the excessive use of groundwater reserves, one of the most important causes of biodiversity loss in the country (Bellegem et al. 1999). However, the implementation of Pigouvian taxes for policy design is very difficult in view of the large degree of uncertainty associated with determining the social costs of biodiversity loss and the high financial expenses of the activities involved in translating such social costs into monetary terms. As a result, it is difficult to find other situations where policy instruments make the use of Pigouvian taxes to internalize the full non-market benefits of biodiversity.

Alternatively, the government can impose strict command-control policies. This means that the government directly dictates clear quantity targets, i.e., quantity standards, which have to be followed by producers and consumers. The government may have to set up a regulatory body, which monitors whether the restriction is being complied with by the firms and which enforces it by punishing violators. An example is to set a limit on the number of daily visitors to nature areas, such as sensitive wilderness areas, or on the number of animal species that can be caught by hunters or fishers. Adopting such quantity standards is especially attractive from the perspective of policy effectiveness. However, command-control policy generally implies embracing high monitoring and enforcement costs. Moreover, uniform control does not sufficiently address the heterogeneity of agents, and thus misses out on potential efficiency gains.

Third, the government can opt for the provision and enforcement of well-defined property rights. This instrument is particularly efficient in addressing the market price internalization of the private values of biological resources. An example of this type of public policy is the assignment of property rights to ship ballast waters (see Van den Bergh et al. 2002). However, the public value of biological resources, such as existence and moral values cannot be internalized in the market price through the provision and enforcement of property rights, thus hindering the effectiveness of this strategy.

Independent of the policy instrument used, direct government intervention often involves administrative costs, for instance, the government may have to establish a monitoring and enforcement agency, thus hampering the effectiveness of this strategy. In addition, the strategy may also be ineffective in the presence of important information asymmetries. This is because information plays a crucial role in the design of an effective Pigouvian tax, particularly when firms have an incentive to conceal true information. In the literature we distinguish two types of informational problems, i.e., hidden information and hidden action problems. Hidden action refers to a post-contractual problem in which one party knows more about his or her type, or effort, after the contract is signed. This is also known as an adverse selection problem. Hidden information refers to a pre-contractual problem, in which one party knows more about his or her true type than the other party before the contract is signed. This is also known as a moral hazard problem – see Akerlof (1970) for a detailed analysis.

Finally, public policies based on direct government intervention may create bureaucratic inefficiency. Bureaucrats may pursue rents and are prone to influences from lobbying activities by market participants. In fact, in the absence of rent-seeking behaviour, such direct government involvement may instead create a disincentive for market participants to innovate or to employ the most efficient method of production.

6.3. Information Provision

Information provision is an integral part of a public policy directed to the use of market forces without direct government involvement in supply and demand forces. In such a context,

policy instruments based on market creation mechanisms have proven to be a valid alternative to direct market intervention policies. The provision of information works within one of two basic conceptual frameworks: certification or ecolabelling. Biodiversity ecolabelling refers to the act of providing information to the consumer that a product, or a product's attributes, possesses specific characteristics regarding the product's origins or ecological, social and economic specifications. Biodiversity certification refers to the act of provision of information with respect to alternative management systems, based on the ability to create a product in an environmentally sound and sustainable manner. Assessing the integrity of a product, or a product's attributes, and the underlying management system involves an evaluation of management practices with respect to defined standards, generally fixed at the management unit level.

In both cases, a credible scheme must evaluate the integrity of the producer's claim and the authenticity of product origin. The assessment of the authenticity of the product's origin involves the identification and monitoring of the supply chain, including raw materials transport and processing, secondary manufacturing and, finally, retail distribution. Therefore, the success of certification and ecolabelling may prove to be difficult to achieve. This strategy often goes hand-in-hand with direct government intervention-oriented public policies, giving rise to 'mixed policies'. The goal of this policy is to circumvent the weaknesses and inefficiencies that may occur when adopting either the command-and-control policy or the market mechanism approach and therefore to achieve higher policy effectiveness. In the next section we explain the use of the certification and ecolabelling policies for conservation and sustainable use of biodiversity and how they can be combined with other instruments to improve their effectiveness.

6.4. Biodiversity Certification and Ecolabelling

Biodiversity certification and ecolabelling refers to an act of provision of information to the consumer about a product, or product characteristics, creating a separate market segment for the product. The participation of consumers in markets for these differentiated products usually permits the market price internalization of some biodiversity benefits. As a matter of fact, consumers are willing to pay a price premium for these benefits. According to the US Environmental Protection Agency, several market surveys indicate that a majority of consumers consider themselves to be environmentalists and would prefer to buy products with a reduced environmental impact when the quality and costs are comparable (EPA 1993). The question is then: can consumers, who purchase biodiversity-friendly products, internalize the full range of benefits of biodiversity? If the answer to this question is yes, then biodiversity certification and ecolabelling can effectively create a segment of the market that is a market for biodiversity friendly products and services. An organic vegetable product, i.e., a vegetable product that is planted without chemical fertilizers, could be an example of such a market segment (Van Ravenswaay 1995, 1996). The underlying steering engine for the creation of such a market relies on the fact that consumers believe that there is a difference in taste between organic and non-organic vegetables. It is often argued that organic vegetables taste better than non-organic ones. In addition, consumers believe that organic products are healthier than non-organic ones and, most of the time, they are able to distinguish between the two products by their appearance. In this setting, the role of certification and ecolabelling is to inform and provide assurance to consumers. Hence, consumers are able to internalize the benefits of consuming the good. Therefore, ecolabelling works as an instrument for resolving the standard hidden information problem.

Most of the time, however, the benefits from biodiversity certification and ecolabelling largely accrue to society at large, and are not explicitly internalized by the individual consumer who purchases the good. In this setting, where benefits from biodiversity certification and ecolabelling are characterized by a public good nature, it is harder to achieve an effective biodiversity certification policy. There are three important factors that determine the success of this type of policy. These are consumer awareness, firm incentives to undertake certification and

ecolabelling, and the sensitivity of consumer demand to production costs. These will concisely be discussed.

Consumer awareness

Consumers' awareness is a necessary condition for the creation of an effective policy certification of public biodiversity benefits. In the extreme scenario of 'no consumer awareness' about environmental and biodiversity protection benefits, which are indirect for the consumption and use of the goods and services, there will be no willingness to pay, or price premium, for such biodiversity benefits. Once there is sufficient consumer awareness about the need for a biodiversity-friendly environment, there will be a significant willingness to pay a price premium for ecolabeled or certified products. However, consumer awareness may take many years to develop (see Van Ravenswaay and Blend 1997). Hence, policymakers may want to launch extensive information campaigns, targeting the general public, as well as initiate formal education programs about the benefits of having a clean and biodiversity-protected environment.

Incentives of firms to undertake certification and ecolabelling

If firm costs are not sensitive to the costs of undertaking certification and ecolabelling regimes, then producers may have sufficient incentive to incorporate such policies. However, in most cases the adoption of certification and ecolabelling policies would increase firms' production costs because producers may have to install new production technologies or may have to utilize certain inputs in order to satisfy the environmental standards that are stipulated by the product label – see Van Ravenswaay and Blend (1997) for more details. Therefore, adopting certification implies incurring higher production costs. These, in turn, damage the firm's market competitiveness, eventually leading to reductions in the firm's profits. Therefore, hardly any producer would like to adhere to certification and ecolabelling regimes. In other words, there are simply not enough market mechanism incentives to make the adoption of certification and ecolabelling policies successful. In such a setting, policymakers may need to complement (or combine) certification policy instruments with other policies aimed at providing enough incentives for producers to adopt certification and ecolabelling. In other words, policymakers may need to launch mixed public policies. For example, it may be effective to combine biodiversity certification and ecolabelling with input subsidies, technical assistance provision, and R&D subsidy regimes.

It is worthy of note that in situations where firms' production costs do not change with the adoption of a certification or ecolabelling regime, it does not mean that a certification or ecolabelling policy is always advisable. In this setting, two markets co-exist, i.e., the market for the conventional product and the market for the certified product. Mattoo and Singh (1994) show that market complementarity between certified and non-certified products can stimulate investment in the technology of the non-certified, or conventional, products – a so-called 'benefit spillover' to the non-certified products. This may lead, in turn, to an increase in the output of the conventional product, in contrast with the original goal of the certification and ecolabelling policy, i.e., gradually increasing the market share of the environmentally friendly product. To avoid such a situation, policymakers are advised to implement certification and ecolabelling schemes together with other public policies, such as the introduction of environmental quality standards and only awarding certificates and ecolabels to those who meet the standards – see Dosi and Moretto (1998) for additional details.

Sensitivity of consumer demand for biodiversity price premiums

If consumers are not willing to pay a premium for certified and ecolabelled products while, at the same time, the introduction of such products boosts firms' production costs, then producers' profits will inevitably decrease. Without any further developments, the certification and ecolabelling regimes would be predestined to fail. In this context, the success of the biodiversity certification and ecolabelling requires that it be combined with other policy strategies. Once again policymakers may want to launch a mixed policy. For instance,

policymakers can introduce a certification regime followed by a strong environmental information campaign, stressing the benefits of biodiversity certified products. NGOs also have an important role in building up consumer awareness and disseminating information, for instance through the design and content of ecolabels and certificates. It should be clear to consumers what benefits they can obtain from buying ecolabelled products.

In any situation where consumers are aware of biodiversity benefits, are willing to pay a price premium to consume and use them and the firms' production costs are not too sensitive to the adoption of certification and ecolabelling schemes, policymakers can rely on certification and ecolabelling as effective instruments for protecting biodiversity products, without having the need to combine these instruments with other public policies.

Evaluation of biodiversity certification and ecolabelling policy instruments

It can be concluded that the success of certification and ecolabelling as policy instruments for the creation of markets for biodiversity benefits, which is a crucial tool for protecting biodiversity products and service flows, depends on several crucial factors. These include the ability of the proposed policy instrument to internalize a wide range of the biodiversity benefits, which ultimately depend on the public good nature of the biodiversity benefit under consideration. In addition, three other factors determine the success of biodiversity certification and ecolabelling policy instruments. These are consumer awareness, firm incentives to undertake certification and ecolabelling, and the sensitivity of consumer demand to production costs. From this discussion, it emerges that certification and ecolabelling policy instruments alone are not sufficient to guarantee the successful protection of biodiversity products and services flows. The Dutch energy market, which includes green-energy certification and direct government intervention in the market forces, has shown the crucial significance of combining public policies in order to create an effective means of protecting biodiversity products.

Finally, the certification schemes need to be sufficiently flexible to allow for mutual recognition among the agents involved, to meet the demands of weak and sensitive markets, and to avoid encouraging unfair international trade. To achieve this, it is important to explore each country's unique environmental and cultural characteristics. Through mutual understanding and learning from the past, certification and ecolabelling can positively contribute to the creation of markets for biodiversity and thus are expected to assist in the development of effective and broadly accepted sustainable management policies for scarce natural resources.

7. Conclusions

How can we use the ideas presented here to formulate an integrated, effective framework to assess the value of biodiversity? And what can we learn from the large number of available studies? The answers to these questions require, inter alia, that a clear life diversity level be chosen, that a concrete biodiversity change scenario be formulated, that biodiversity changes – notably losses – be within certain pre-specified boundaries, and that the particular perspective on biodiversity value be made explicit.

So far, most studies lack a uniform and clear perspective on biodiversity as a distinct, univocal concept. In addition, at present we have insufficient knowledge about, for example, how many species there are; for this reason alone, it is very difficult, if not impossible, to assess the total economic value of biodiversity. To completely answer the question, 'What is the value of biodiversity?', we would have to include the value of genetic variation within species across populations, the value of the variety of interrelationships in which species exist in different ecosystems, and the functions among ecosystems. Without any doubt, full monetary assessment is impossible or would be subject to much debate. An additional problem is that, at the global level, biodiversity values can differ significantly, even for similar entities, due to unequal international income distribution. All in all, the available economic valuation estimates should be considered, at best, as a lower bound to an unknown value of biodiversity, and are always contingent upon the available scientific information as well as their global socio-economic context.

As we have seen, biodiversity can be dealt with at different levels: genetic, species, ecosystem, and functional diversity. For the analysis and valuation of biodiversity at the ecosystem and functional levels, which may be regarded as the cornerstone of the analysis and valuation of biodiversity, an active interdisciplinary dialogue is necessary, with emphasis on the complex interface between natural science and social science approaches. A comprehensive assessment of ecosystem biodiversity characteristics, structure, and functioning requires the analyst to take various important steps. First, the socio-economic causes and consequences of biodiversity degradation or loss should be determined. Second, the negative impacts on biodiversity caused by human activities should be assessed. The range and degree of biodiversity functioning should be estimated, especially in terms of ecosystem-functional relationships. Finally, alternative biodiversity management strategies should be ranked and a joint spatial and temporal systems analysis of each policy scenario should be carried out.

The physical assessment of the functions performed by biodiversity is an essential prerequisite of any ecological evaluation. However, simply identifying these functions is insufficient if we want to present resource managers and policymakers with relevant policy response options. It is necessary to develop criteria for the expression of the functions in a form that allows for evaluation. For example, one can identify the range of biodiversity management strategies by exploring the use of methods such as Red Data Species Lists and biological value indexes. Recently, computer models have become available to aid making decisions about species conservation. Models have been applied to calculate minimum dynamic areas that support the minimum viable population of a certain species. In addition, computer models have been used for habitat evaluation, predicting ecological conservation values under different development scenarios. This approach to ecological evaluation allows for a direct comparison of management or conservation strategies.

From an economic perspective, certain aspects of biodiversity are scarce and highly desirable, which is the reason why they have economic value. The concept of economic value is founded in welfare economics, which developed around the theory of consumer behaviour. Economic valuation assumes interaction between a subject – a human being – and an object – for example, an element of biodiversity. As a result, economic value is distinct from the notion of intrinsic value, which assumes that an object has or can have value in the absence of any (human) subject. It is important to recognize that economists do not pursue absolute value assessment of environmental systems or all the biodiversity they contain, but always focus attention on valuing environmental system changes. This means that the terms ‘economic value’ and ‘welfare change’ are two sides of the same coin. Economics can thus assess the human welfare significance of biodiversity changes, namely through the determination of changes in the provision of biodiversity-related goods and services and their consequent impacts on the wellbeing of humans who derive – use or non-use – benefits from their provision. Further note that, although many economic studies employing monetary valuation claim to have assessed biodiversity values, they often confuse biodiversity with biological resources.

Different instruments are available for assessing the monetary value of biodiversity. Stated preference methods have often been used, because the use of revealed preference methods would leave out important biodiversity value types, notably non-use and quasi-option values. This can lead to a significant value measurement bias, especially since biodiversity conservation is associated with many non-use and indirect use (or primary ecological) values. Alternatively, researchers can combine distinct valuation techniques. Special attention however, should be given to the aggregation of resulting values so as to avoid double counting. From our review of economic valuation studies, it is clear that the assessment of biodiversity values does not lead to an unambiguous monetary value of biodiversity. Instead, available economic valuation estimates should generally be regarded as providing a very incomplete perspective on, and at best lower bounds to, the unknown value of biodiversity changes.

Integrated economic-ecological modelling can contribute to, and may even be essential for, a thorough understanding of the intricate relationship between biodiversity and ecosystem and economic dynamics. Although integrated modelling has somewhat of a tradition, both at the ecosystem level and at the global level, applications to biodiversity-related problems are scarce.

Integrated modelling can be linked to biodiversity valuation and evaluation in various ways. Integrated models can generate a set of biological and economic, possibly monetary, indicators that can be further aggregated through multicriteria analysis techniques. In addition, it is possible to provide for a closer, innovative connection between modelling and valuation, among other methods, by: generating conditional values for specific environment-economic scenarios; using scenario-modelling outcomes such as tables and graphs in valuation experiments (e.g., contingent valuation); and using spatial models to aggregate monetary values related to specific areas.

Biodiversity public policy entails the use of direct market intervention, including taxes and command and control instruments, the provision of information, such as certification and ecolabelling, or the combination of both in some sort of policy mix. The success of certification in internalizing biodiversity benefits in the market prices of goods and services – which means that it constitutes an effective instrument in protecting biodiversity – depends on three factors: the public good nature of non-market biodiversity benefits; the application of economic valuation methods to assess the monetary magnitude of non-market biodiversity benefits; and, supply and demand factors, which include the level of consumer awareness and sensitivity to certain products and the producer's propensity to embrace certification schemes. In some cases certification and ecolabelling policy instruments alone are insufficient to guarantee the successful internalization of biodiversity benefits and thus to contribute to a better allocation of biodiversity. Indeed, mixed policy strategies involving both certification and direct government intervention in supply or demand may sometimes be needed.

Finally, one needs to be aware of the limitations of biodiversity valuation and analysis. Biodiversity is a complex and abstract concept. It can be associated with a wide range of benefits to human society, most of them still poorly understood. In general terms, the value of biodiversity can be assessed in terms of its impact on the provision of inputs to production processes, on human welfare, and on the regulation of ecological functions. A complete understanding of these and their integration into multidisciplinary studies provides a great challenge for future research, in which economists, ecologists and others will have to work closely together. Only then can useful policy insights be expected. There is no doubt that the ecological economics of biodiversity will face many research and policy challenges in the years ahead of us.

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AGGLOMERATION ECONOMIES AND LOCATION DECISION-MAKING OF FIRMS IN LOCATION-TRIANGLE APPROACH*

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Abstract:
The location-triangle framework, which was originally established by Alfred Weber, has been expanded in various ways and generalized as the Weber-Moses location-triangle model. However, several essential elements, in particular, regarding agglomeration economies have been excluded from the model framework. This may cause a potential difficulty to connect location-triangle approach with recent more advanced spatial economic analysis. In this paper, an alternative hypothetical model is introduced to the location triangle framework with the notions of agglomeration economies and corresponding transportation costs. The alternative model framework enables the location-triangle model to deal with investigating modern complex industrial organizations. Further avenues of extension are also discussed.

JEL Classification: L14; O21; R30; R58

Keywords: Location-triangle model; agglomeration economies; transportation costs; firm location

1 Introduction

The location-triangle model was initially developed by Weber (1909 [1929]), applying the relationship between physical distance and transportation costs, which was originally explored by Launhardt (1885). Weber included the notion of trade-off interaction between transportation costs and agglomeration economies with respect to the economy of labor in order to specify the optimal firm location by setting two different extracting sites of inputs for processes and one location of consumption for selling the final products. Regarding external terms of agglomeration economies in his period of time, it was solely necessary to consider the localization type of economy, which was also indicated by Marshall (1890) as the concentration of specialized industries in particular localities.

Since the initial establishment of the model framework by Weber, the location-triangle model was further expanded by Moses (1958), Khalili et al., (1974) and Mai and Hwang (1992), those who attempted generalizations by introducing the homogeneous production function, the homothetic production function and the condition of market demand, respectively. These advanced methods are commonly known as the Weber-Moses location-triangle model. However, during these expansions, agglomeration economies were almost fully dropped from the model framework and this may cause certain difficulties to apply for more recent location economic analysis.

Agglomeration economies are divided into two parts as internal and external dimensions. According to the categorization by Parr (2002a), each dimension can be further categorized under three criteria, namely, economies of scale, scope and complexity. In the

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external dimension, these are also referred to as localization, urbanization and activity-complex economies. While this paper mainly focuses on these external forces, internal forces have also important roles when the location model involves in upstream and downstream external linkages between neighbor different firms within the industry.

The concern of this paper is to reveal a missing relationship between location triangle and agglomeration economies. As introduced earlier, the established location-triangle analysis employed at most the localization type of agglomeration economies, which are referred to the spatially-constrained economies of scale. In order to enable the analysis to investigate urbanization and activity-complex economies in addition to localization economies, the central-place system, particularly, market-area analysis should be encouraged to employ in this framework. By applying the established framework of market areas, an alternative hypothetical model is developed in this paper, which demonstrates the determination of optimal firm location for different types of conditions.

Market-area analysis was systematically formalized by Lösch (1944 [1954]), which examines how products are distributed to an economic plane under the given conditions of output price, density of demand and distribution transportation costs. This areal framework validates the studies of different sizes and shapes of regions, spatial distributions of labors, households and types of production orientation. While this paper limits the scope of the study on a non-hierarchical spatial model, the central-place theory also deals with the urban hierarchical structure. Those contributions were made by Christaller (1933 [1966]) and Lösch (1944 [1954]) as initial attempts, and Mulligan (1982) and Parr (2002b) for more detailed investigations. These may have particularly important roles for the analysis of firm location and agglomeration economies with respect to localization and urbanization economies.

In addition to these agglomeration elements, activity-complex economies become more common to be observed in modern industrial structures. These are relevant to vertical integration or specialization, if the economies are internal to the firm. The vertical integration was systematically formalized by Stigler (1951) and applied to the vertical specialization and trade in Hummels et al., (1995), and the idea was also given to fragmentation of production by Jones and Kierzkowski (2005). Furthermore, the recent operational and location changes in the relationship between headquarter and production plant was attempted by Silva and Hewings (2007). Under these progresses, the framework of location-triangle model lost its significance due to exclusions of agglomeration criteria. However, there still have rooms to investigate the optimal firm location from the approach of location-triangle model, if the neglected elements are properly taken into account.

In this paper, instead of attempting a modification of the generalized Weber-Moses framework, it is aimed to re-examine the original Weber model in order to avoid complication of the argument and to reveal the fundamental nature of location-triangle analysis and the studies of agglomeration economies.

2 Agglomeration economies and the location-triangle model

Agglomeration economies are spatially-constrained internal and external economies. As introduced earlier in the previous section referring to Parr (2002a), spatially-constrained internal economies have three dimensions in terms of scale, scope and complexity. First, the internal economies of scale can be relevant to the horizontal integration. In other words, a larger quantity of output achieves the more cost reduction for processing a product as long as the average-cost curve falls. Secondly, the internal economies of scope may be referred to the lateral integration, which can be exemplified that a variety of production enhances more opportunities of revenues. A representative case is a motorbike company who also produces motorboats, audio speakers and music instruments. Finally, the internal economies of complexity can be relevant to the vertical integration, which achieves lower-cost production by an integrated process within a single firm than operations by different firms.

In addition, spatially-constrained external economies also have three dimensions, commonly known as localization, urbanization and activity-complex economies. First, localization economies can be referred to the original Weber model that the economic

concentration at a particular location creates the economy of labor. In addition, as indicated in Marshall (1890), localization economies also include joint action for input extraction and specialized services. Secondly, urbanization economies are typically available at the metropolitan area, brought by advantages of concentration on the variety of economic activity. These economies include administrative accessibility, well-organized infrastructure, variety of labor supply and highly-advanced systems of communication and transportation. While it is excluded from the analysis in this paper, the inclusion of central-place system validates to examine urbanization economies with respect to hierarchical spatial structure. Further details should be referred to the notion of functional system in Parr (2007). Finally, activity-complex economies are commonly observed in modern advanced industries, where upstream and downstream stages have important roles for processing. These can be exemplified by the Ford campus of automobile-assembly plant in Chicago and the aero-space industries complex in Toulouse.

Those elements of agglomeration economies can be examined within the framework of the location-triangle model. In order to integrate these different approaches, it is initially necessary to set a model under the following conditions. There are multiple firms those who produce different products. However, some of inputs such as coppers are common to use during the processing stages. Also, the place of consumption for the final product of each firm is assumed to place at the same location, therefore, certain parts of infrastructure facilities such as the network of transportation can be shared among these firms. Under these conditions, an alternative location-triangle model is investigated in the following section.

3 An alternative location-triangle model

In order to examine the notion of agglomeration economies within the framework of location-triangle model, an alternative model considers three independent firms in an economic plane. These are defined as firms A, B and C, those who are engaging productions in a particular economic space. First, firm A produces q_A, which has a place of consumption at MK, using inputs RM_1 and RM_2 for processing this particular product. Similarly, firm B produces q_B, which is also consumed at MK, using inputs RM_2 and RM_3. In addition, firm C produces q_C, which has a place of consumption at MK, and uses two different inputs RM_2 and RM_4. As commonly assumed in the established location-triangle model, each firm determines the optimal firm location where the aggregate transportation costs are minimized. Here, transportation costs have three types. First, shipping costs between the first input and the firm location, secondly, costs between the second input to the firm location as well as costs between the firm location and the place of consumption. These costs for inputs are relevant to assembly transportation costs, and costs for the final product are referred to distribution transportation costs.

In this paper, each firm is assumed to bear these transportation costs. In other words, transportation costs are regarded as the elements of production costs, therefore, each firm attempts these costs to keep at minimum level. The minimization of transportation costs is affected by the value and bulkiness of shipping goods, in addition to the physical distance between two relevant locations. As a result, the structure of production function also has an important role for the determination of the firm location. In this way, for instance, the optimal firm locations of each firm A, B and C may be given as points P_A, P_B and P_C, which are respectively plotted in Fig. 1. From the above assumptions, the point P_A satisfies the minimization of the sum of transportation costs from RM_1 to P_A, from RM_2 to P_A, and from P_A to MK. Similar discussions are applied for locations P_B and P_C of firms B and C, respectively.

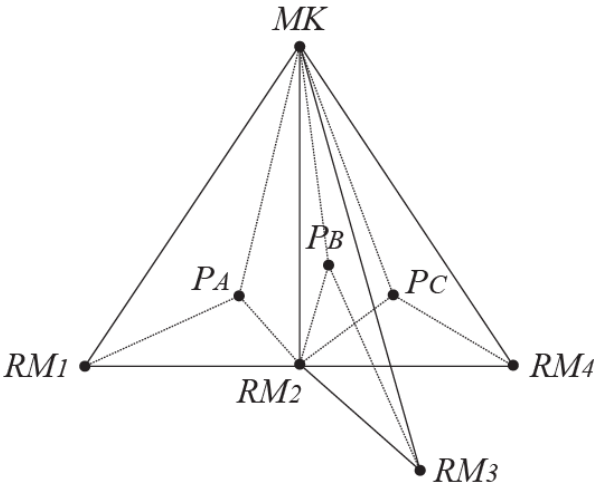

Fig. 1 Location triangles of three firms

However, if these firms have certain opportunities of agglomeration economies by locating at immediate nearby each other, the optimal locations of three firms may be given at a specific single point. There are three different scenarios shown as follows. First, they may locate at a common-use raw-material site and have the advantage of localization economies, if the raw-material extraction or other production-related cooperation is jointly organized. Secondly, the location can be at the metropolitan area, if the economies of urbanization and accessibility to the place of consumption have important roles for all three firms. Here, the place of consumption may be treated as the center of metropolitan area in the location triangle model, while this assumption is not revealed in their original framework. Finally, one more different location incentive can be considered in cases of activity-complex economies for more advanced industries. In this way, the optimal location varies depend on spatial proximity both to raw-material sites and to the place of consumption. Moreover, each corresponding transportation-cost element also affects this location decision-making process. These aspects are further detailed individually in the following section.

4 Hypothetical analysis

4.1 Firm location and localization economies

First, a consideration is given to examine the relationship between firm location and localization economies. From the assumption in the previous section, all three firms need to use the common input RM_2. As a result, they may locate at P_L in Fig. 2, and have certain opportunity to share the process of raw-material extraction. At the same time, other types of localization type of economy such as the economy of labor and specialized services can be also available under this circumstance. Such agglomeration force is encouraged, particularly, if the shipping cost of RM_2 to the firm location is significantly high level, while the shipping cost to the place of consumption is relatively lower level. If the price of land is significantly high level at populated areas, the lower price of land may be an incentive to locate at raw-material sites those are normally situated at local regions of a country. Such areas are also suitable for productions which need good quality of air, water, soil and space.

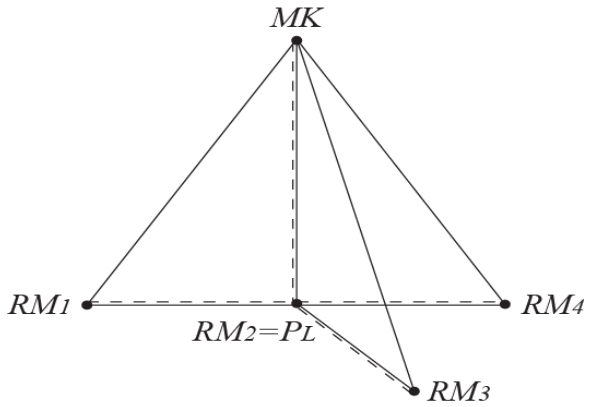

Fig. 2 Location triangle and localization economies

Finally, it should be noted that this alternative location is situated within each critical isodapane of all three firms. In other words, transportation costs of other raw materials are needed to be lower enough to cover the re-locating production site within each critical isodapane, which represents the maximum level after the lines of aggregate minimum transportation costs that radiate in all directions from the center of the original firm location (see Weber, 1909 [1929]: 147-153).

4.2 Firm location and urbanization economies

Urbanization economies are usually available at the center of market area. It implies that the optimal firm location can be situated at the center of an area. However, there are a number of exceptions where the optimal location may not be the center of market area. This can be seen for firms those who supply products as intermediate, which are purchased by downstream firms as household-unrelated commodities. These are the cases where the condition of centrality of market area and supply area is not satisfied (Nakamura, 2008). By contrast, the place of consumption may be at the center of market area, if the products of this operation are the final goods or commodities for households. In this case, these firms are not necessarily locating closely to each other, as urbanization economies are separately available to entire economic activity who locates at this area. Such criterion is a remarkable difference to other types of agglomeration economies, which location proximity to other economic activity is required. In this scenario, the optimal firm location may be preferred to situate at the center of area at P_U in Fig. 3.

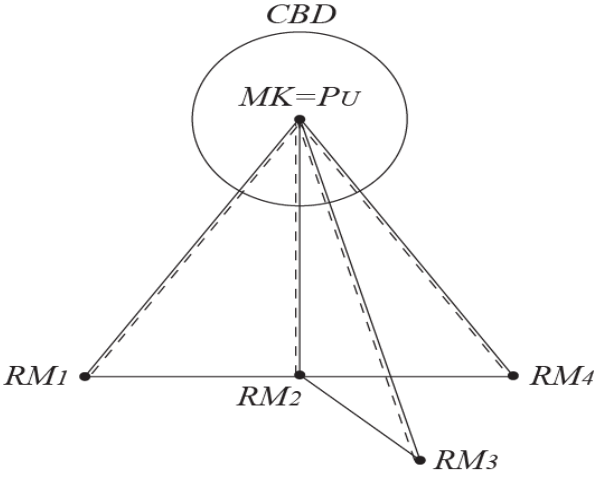

Fig. 3 Location triangle and urbanization economies

It should be noted that urbanization economies do not solely work as an incentive to locate three firms together. As a result, it is more plausible for this scenario to consider that there are also spatially-constrained economies of scale or complexity, which are exclusively available at the metropolitan area, in addition to the advantages of urbanization economies. Since the optimal firm location is at or very close to MK, the distribution costs between the firm location and the place of consumption become negligibly small. As a result, the overall physical distance of transportation is minimized, while assembly transportation costs between raw-material sites and the firm location are higher than the original firm locations.

4.3 Firm location and activity-complex economies

If the products of three firms are similar but solidly product differentiated, the concentration of the production may bring certain cost savings by joint production at some processing stages during the processes. As shown in Fig. 4, the optimal firm location P_X may be somewhere between raw-material sites and the place of consumption MK. If the transportation system from P_X to MK is possible to share among these three firms, the distribution transportation costs may be saved by enhancing the economies of scale. However, the optimal firm location still approaches toward the center MK, if the joint cost-saving distribution is significantly high level. By contrast, if the assembly transportation contains bulky and high-cost structure, they are locating close to raw-material sites.

Also, the presence of CBD also leads to a similar outcome. Namely, the larger CBD locates the firm away from the center in order to avoid highly price of land, congestion and pollution. It can be refereed to the centrifugal forces of urbanization economies or more simply urbanization diseconomies. In this way, agglomeration economies and transportation costs have important roles to solve the problem of optimal firm location.

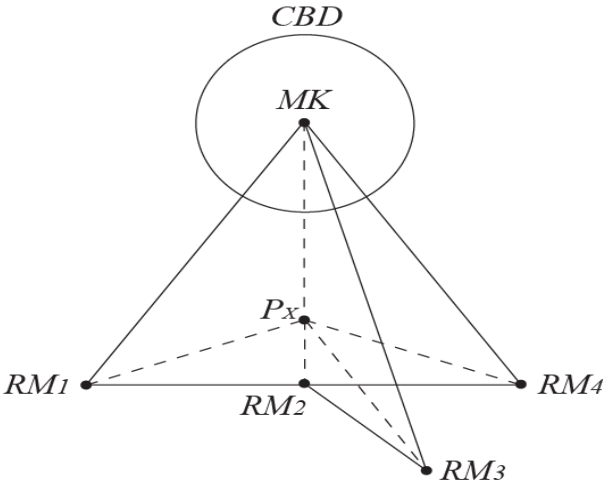

Fig. 4 Location triangle and activity-complex economies

5 Policy implications

In order to generalize the alternative framework, the following cost function of a representative firm is given:

$$\min C = \left(\left(w_i + t_i d_i\right)x_i + \left(w_j + t_j d_j\right)x_j + \alpha \cdot t_k d_k q_k\right) \cdot \beta \tag{1}$$

where w_i = price of input i, t_i = transportation cost rate for i, d_i = distance from the input site i to the firm location, x_i = the amount of input i, w_j = price of input j, t_j = transportation cost rate for j, d_j = distance from the input site j to the firm location, x_j = the amount of input j,

α $(0<\alpha<1)$= cost saving index by sharing the distribution transportation system, t_k = distribution transportation rate, d_k = distance from the firm location to the place of consumption, q_k = the quantity of product, and β $(0<\beta<1)$= index of the economies of agglomeration.

Here, α and β are zero, if each firm establishes their plant location separately. In that case, each firm can minimize the sum of distance d_i, d_j and d_k. By contrast, the sum of distance cannot be minimized when a firm locates together with other two firms in order to obtain opportunities of agglomeration economies and shared distribution costs. In that case, α and β are set non-zero and certain cost saving may be available. This is a trade-off interaction between agglomeration economies and physical distance in Weber sense. However, a remarkable difference is that this analysis also includes the cost-saving opportunity of distribution transportation costs. The evaluation can be provided as follows. First, each firm does not locate together, if the benefit of α and β are less than the cost increase by additional distance of d_i, d_j and d_k. Otherwise, each firm locates together and the optimal firm location varies depend on the conditions given in Table 1.

As an exception, it should be noted that these firms are not locating at the place of consumption, if the diseconomies of urbanization are set significantly high level. In that case, there is a centrifugal force from the center and the optimal location is away from the center. In this circumstance, the parameter β may be exceptionally set more than 1 as the impact of diseconomies such as pollution, congestion and highly price of land. In addition, the outcome can be affected by the formations of production function and demand curve of the product, although this analysis limits the scope of the analysis within a simplified framework.

Table 1. The location decision-making of firms and the condition

Location	Condition
the raw-material site i or j	$t_i > \frac{t_j + t_k}{2}$ or $t_j > \frac{t_i + t_k}{2}$
the place of consumption	$t_k > \frac{t_i + t_j}{2}$
somewhere between above locations	Otherwise

There is one more note regarding the cooperative behavior among different firms. As introduced earlier in the previous section, the notion of critical isodapane implies that agglomeration economies are not available to obtain, unless all three isodapanes overlap with each other. Regarding this criterion, further concerns were indicated by Isard (1956: 176-182) as a scenario where the isodapane of one firm does not reach to an overlapping area. Even though such a circumstance is faced on a firm, the economies of agglomeration are achieved when this firm is suggested to be subsidized by two other firms for the amount of complementing transportation costs to the agglomeration area. This kind of bargaining approach not only has an opportunity for solving the location problems of firms but also enable the framework to apply for welfare aspects in terms of household, producer, social and natural environment. In other words, the optimal location decision-making model may be possible to avoid the potential issues on unwilling location of economics from the standpoint of comprehensive systems of economic activity. The bargaining theory has a particularly important role when inappropriate short-run profit for a part of firms exceeds long-run social-optimal benefits. This has certain difference from regulation and tax policies by the governmental authority, as the long-run profit of any economic agent is guaranteed and this enables policy makers to avoid anticipated problematic conflicting issues between different economic agents without severe difficulties.

6 Concluding comments

In this paper, it is revealed that the notion of agglomeration economies is excluded from the Weber-Moses model and this causes potential issues to examine the optimal firm location that involves complex structures of industrial organization. An alternative hypothetical model is introduced to the original Weber model, which includes the trade-off interaction between localization economies and transportation costs. In addition, other parts of agglomeration such as urbanization and activity-complex types are also added to the alternative model by means of importing the framework of central-place system. While this examination solely includes market-area analysis, the introduction of supply-area analysis may enable the alternative framework to deal with upstream and downstream production linkages.

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CONVERGING AND DIVERGING REGIONS IN THE EU: IMPLICATIONS FOR REGIONAL POLICY

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Abstract:

This paper investigates the extent of regional cohesion amongst European regions; an issue of emerging importance in the fast growing literature on regional economics. This paper aims to shed some further light on the question of regional cohesion by taking into account the impact of the existing technological gaps across regions. Regional cohesion is examined in terms of labour productivity for the NUTS-2 regions of the EU-27 during the time period 1995-2006. The results suggest the existence of two separate groups or clubs. The first includes regions from advanced northern European countries, while the members in the second club are mainly found in the new member-states and in southern European countries, putting the issue of European regional policy into a fresh premise. To be more specific, the results have important implications for the (re) direction of regional policy in Europe towards a new set of objectives and instruments.

Key words: Regional Cohesion, Technological Gap, Regional Policy
JEL: C21; O18; R11

1. Introduction

The debate on regional convergence has bred, and continues to do so, dozens of empirical studies (e.g. Button and Pentecost, 1995; Neven and Gouyette, 1995; Martin, 2001; Funke and Niebuhr, 2005). In this fast growing literature technological progress has been acknowledged to be of critical importance in promoting regional convergence. Nevertheless, the impact of the adoption of technology has received surprisingly little attention thus far. Indeed, Bernard and Jones (1996) claim that empirical studies on convergence have over-emphasised the role of capital accumulation in generating convergence at the expense of the diffusion of technology. It is the intention of this paper to develop and apply a model that incorporates technology. To complete this introduction, mention must be made to the context upon which the empirical analysis will be conducted. In this paper we will use the NUTS-2 regions of the EU as a sort of laboratory for the analysis of regional convergence. The paper is organised in five sections. The first section introduces the theoretical framework. Data related issues are overviewed in Section 3, and the models are submitted to the usual econometric tests yielding the main findings in section 4. In the concluding section we offer a possible explanation for the results we obtain and suggest that might afford an interesting policy conclusion.

2. Regional Convergence and Technology Adoption

It is possible to identify two sources of technological change. The first is a process of intentional creation of technology; an autonomous process that takes place exclusively within the 'borders' of a region. Acknowledging the idea that regions are, by definition, open economies technology is also affected by technological improvements that take place in other regions. This process is usually termed as *technology adoption* and constitutes the second source of technological change. Alternatively, this source refers to the part of technology that is generated from

interaction between spatial units. An essential assumption for the purpose of this paper is that technology adoption is related to the size of the 'technological gap'[1]. This can be defined as the difference between an exogenously determined best-practice frontier (x), and the prevailing level of technology in a region (a_i), i.e. $b_i = a_i - x_i$; a measure which can be conceived as an approximation of 'technological proximity'. Thus, technology in a region ($\dot{a}_i$) grows as follows:

$$\dot{a}_i = \tilde{\theta}_i + \xi b_i \tag{1}$$

In equation (1) $\tilde{\theta}_i$ denotes the autonomous part of technology growth, i.e. technology created within a region. The ability of a region to implement technological innovations is represented by the parameter ξ, which reflects the opportunities for technological catch-up. Given that $b_i = a_i - x_i$, then the technological distances between a leading and a follower region, are given by: $b_l = a_l - x$ and $b_f = a_f - x$, respectively or $\dot{a}_l = \tilde{\theta}_l + \xi b_l$ and $\dot{a}_f = \tilde{\theta}_f + \xi b_f$. The growth rate for the technology gap between the two regions ($\dot{b}_{lf}$) is therefore:

$$\dot{b}_{lf} = \dot{a}_l - \dot{a}_f = \left(\tilde{\theta}_l - \tilde{\theta}_f\right) + \xi\left(b_l - b_f\right) \tag{2}$$

Defining $b_{lf} = b_f - b_l$ and $\tilde{\theta}_{lf} = \left(\tilde{\theta}_l - \tilde{\theta}_f\right)$, equation (2) can be written as follows:

$$\dot{b}_{lf} = \tilde{\theta}_{lf} - \xi b_{lf} \tag{3}$$

Assuming that ξ is a decreasing function of the *initial* technological gap in a region, i.e. $\xi_i = f\left(b_{lf_{i,0}}\right)$ with $f' < 0$, then a relatively high initial level of technological gap implies that the prevailing conditions are not favourable for technology adoption and, consequently, the distance from the technological leader increases through time. Conversely, a relatively low level of the initial technological gap can be taken as an indication that conditions allow adoption of technological innovations, reflected in a relatively high value of ξ. Obviously, regional disparities in the absorptive parameters generate a strong tendency for regional per-capita output to diverge.

It becomes of crucial importance, therefore, to determine the dynamic path of convergence that this model implies. This can be shown using an example in which the economy is divided into three regions, one 'leader' (l), which is at the technological frontier ($b_l = a_l - x = 0$), and two followers ($i = 1, 2$). Assume that $\tilde{\theta}_{lf_1} - \tilde{\theta}_{lf_2} = 0$ and $b_{lf_{1,0}} - b_{lf_{2,0}} > 0$, which implies that $\xi_1 - \xi_2 < 0$. If this difference remains unchanged over a given period of time, then a catch-up, in terms of technology, between region 1 and 2 is not feasible. Stated in alternative terms, if $\left(\Delta\xi_{1,2}\right)_t \to \infty$, then $\left(\Delta b_{lf_{1,2}}\right)_t \to \infty$, as $t \to \infty$ and the two regions move towards different directions (Figure 1). Only regions with low technology gaps are likely to converge towards a steady-state equilibrium growth path, as represented by the growth rate of the leading region. Regions with relatively large technology gaps may fall progressively behind. It seems thus legitimate to ask, if there is a way for the 'technologically poor' regions to catch-up with the 'technologically rich' regions? In this example a catch-up is feasible only if region 1, viz. the 'technologically poor' region, improves its adoptive ability, i.e. if the value of ξ increases through time, from ξ_1 to ξ_1', as shown in Figure 2. Provided that $\left(\Delta\xi_{1,2}\right)_t \to 0$, then gradually

[1] See Alexiadis (2010) for further elaboration of this argument.

$\left(\Delta b_{lf_{1,2}}\right)_t \to 0$, allowing region 1 to catch-up with the 'technologically rich' region 2. The conclusion to drawn is that a pattern of club-convergence is the most probable outcome, if the adoptive parameters differ across regions. Movements towards overall convergence occur only as regions become similar in terms of their adoptive abilities.

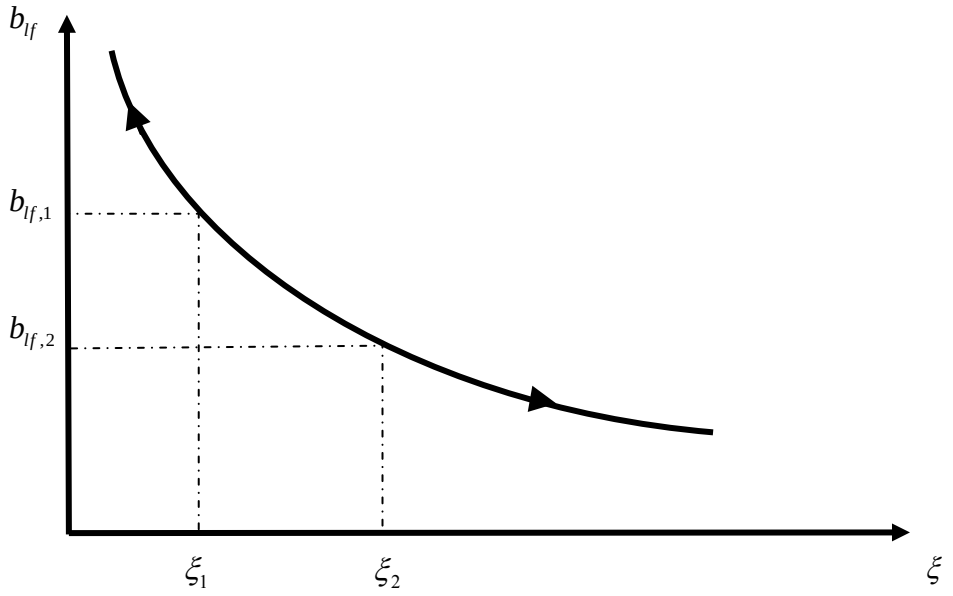

Figure 1: Diverging regions

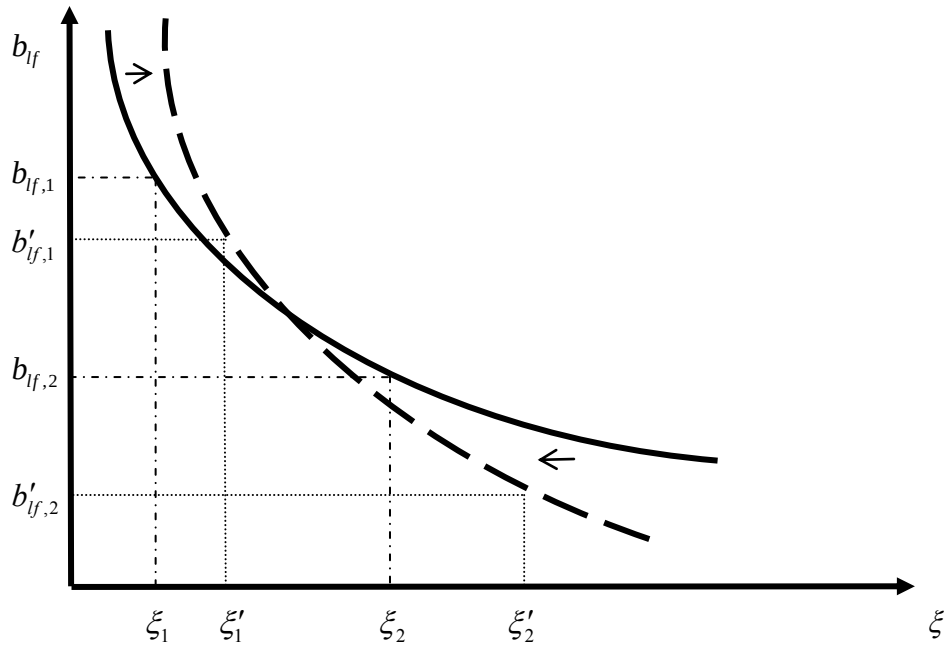

Figure 2: Converging regions

Overall, this model suggests that convergence towards the leading region(s) is feasible only for regions with sufficient absorptive capacity. There is the distinct possibility that only regions with low technology gaps are able to converge towards a steady-state equilibrium growth path, relative to the growth rate of the leading region. Regions with large technology gaps may fall progressively behind.

3. Econometric Specification

The empirical literature on regional convergence (e.g. Barro and Sala-i-Martin, 1992) makes extensive use of two alternative tests for convergence, namely absolute and conditional convergence:

$$g_i = a + b_1 y_{i,0} + \varepsilon_i \quad (4)$$

$$g_i = a + b_1 y_{i,0} + b_{\mathbf{X_i}} \mathbf{X_i} + \varepsilon_i \quad (5)$$

where y_i typically represents per-capita output, or output per-worker, of the i[th] region (in logarithm form), $g_i = \left(y_{i,T} - y_{i,0}\right)$ is the growth rate over the time interval $(0,T)$, and ε_i is the error-term, which follows a normal distribution while the rate of convergence (β) is calculated as $\beta = -\dfrac{\ln(b_1 + 1)}{T}$, where T is the number of years in the period. Absolute (unconditional) convergence is signalised by $b_1 < 0$. On the other hand, conditional convergence is based upon the argument that different regional characteristics will lead to different steady-states. Conditional convergence requires that $b_1 < 0$ and $b_{\mathbf{X_i}} \neq 0$. Consider two groups of regions, let $i = k, l$, that differ not only in terms of initial labour productivity, i.e. $\mathbf{\Delta y_{kl,0}} \equiv y_{k,0} - y_{l,0} \neq 0$, but also in terms of their structural characteristics, i.e. $\mathbf{\Delta X_{kl}} \equiv \mathbf{X}_k - \mathbf{X}_l \neq 0$. Assume that $\mathbf{\Delta y_{kl,0}} > 0$ and $\mathbf{\Delta X_{kl}} > 0$. An implication of this assumption is that a superior (inferior) regional infrastructure, approximated in terms of a high (low) $\mathbf{X_i}$, is associated with a high (low) level of initial level of labour productivity. Absolute convergence amongst these groups is possible if $g_{k,T} - g_{l,T} < 0$. However, given that $\mathbf{\Delta X_{kl}} > 0$, a relatively slow process of convergence is expected. It follows, therefore, that a test for conditional convergence is more suitable for the empirical application of the model developed in Section 2, with variable(s) representing technology the principal focus, which is what the remaining paragraphs of this section will be dealing with.

Technical change, leading to regional productivity growth, originates either from within the region, namely indigenous innovation (IC_i), or from other regions, i.e. technological spillovers from adopting innovations created elsewhere (ADP_i). In the former case, technical change may be approximated in several ways[2]. Nevertheless, in this paper we use the percentage of workers employed in the science and technology sectors of each region[3]. The second source of technical growth, namely the ability of a region to adopt technological innovations, is approximated as the percentage of total employment in technologically dynamic sectors:

$$ADP_{i,t} = \frac{\sum_{\rho=1}^{\kappa} \eta_{i,t}^{\rho}}{\sum_{j=1}^{m} L_{i,t}^{j}}, \ \rho \subset j \quad (6)$$

[2] Pigliaru (2003), for example, uses the 'propensity to innovate', which can be measured in terms of the number of patents per-capita in each region. Empirical applications of this measure in the case of EU regions can be found in Alexiadis (2010b), Alexiadis and Korres (2010).

[3] This corresponds to 'Human Resources in Science and Technology' (HRST) database of EUROSTAT, which includes persons who have completed a tertiary education in a field of science or technology and/or are employed in science and technology.

where $\eta_{i,t}^{\rho}$ refers to personnel employed in high-tech manufacturing and knowledge-intensive high-technology services ($\rho = 1, \ldots, \kappa$), while $L_{i,t}^{j}$ is the employment in all the sectors ($j = 1, \ldots, m$).

Equation (6), represents the level of technological development, but also, indicates a capacity for technology adoption, since these are taken to apply high technology. However, the potential for such technology diffusion increases as the technological gap increases, defined as the distance between a region's technological level and that of the most advanced technological region with the highest percentage of employment in high-tech manufacturing and knowledge-intensive high-technology services[4]. Consequently, in this context a variable that approximates the technological gap for region *i* at time *t* can be defined as follows:

$$TG_{i,t} = \left(\frac{ADP_{L,t}}{ADP_{i,t}} \right) \tag{7}$$

Expressing equation (7) in logarithmic terms yields:

$$TG_{i,t} = \ln ADP_{L,t} - \ln ADP_{i,t}. \tag{8}$$

Embodied in this variable is the idea of both a gap and the capacity to adopt technological innovations. As shown by the model in Section II, the presence of a technological gap alone is not sufficient to promote significant technology diffusion. There has to be an appropriate level of capability to adopt technology. Thus, the bigger the gap the greater the potential for technology adoption, but the lower the capacity to actually achieve this[5]. To explain the impact of technology adoption a model is set up of conditional convergence. This takes the usual Barro and Sala-i-Martin (1992) form, but includes two additional explanatory variables. Therefore, a model of 'technologically-conditioned' convergence can be structured as follows:

$$g_i = a + b_1 y_{i,0} + b_2 IC_{i,0} + b_3 TG_{i,0} + \varepsilon_i \tag{9}$$

The time dimension of variables describing technology should refer to the initial point in time for the period of study. From an econometric point of view, inclusion of technological variables measured at the initial time helps to avoid the problem of endogeneity. Moreover, Pigliaru (2003) claims that models which include measures of technology require data on total factor productivity. In the absence of such data, econometric estimation requires that the variables related to technology ought to be included in initial values.

Equation (9), thus, incorporates the potential impact of both internally generated technological change and technology adoption upon a region's growth. Broadly speaking, it is anticipated that $b_2 > 0$, since regions with high initial levels of patents per capita are normally associated with high levels of growth and vice versa. However, it is not automatically the case that this condition promotes convergence. In other words, this view accepts the argument that if low productivity regions have a high initial level of intentional technology creation, then this will have positive impacts on convergence, by enhancing their growth rates. On the other hand, if such regions have a low propensity to innovate, then no significant impacts on growth are anticipated and, hence, it may be difficult to converge with technologically advanced regions. The latter case is the more likely.

In the case of the $TG_{i,0}$ variable, this variable reflects two distinct features, namely the level of 'technological distance' from the leading region and the degree to which existing (initial)

[4] This is the region 'Berkshire, Bucks and Oxfordshire' in the UK.

[5] See also Alexiadis and Tomkins (2008).

conditions in a region allow adoption of technology. The approach adopted here is based on the contention that a high initial technological gap combined with a high rate of growth may indicate, ceteris paribus, that less advanced regions are able to adopt technology, which is transformed into high growth rates and, subsequently, convergence with the technologically regions. It may be argued, therefore, that the condition $b_3 > 0$ promotes convergence. On the other hand, a high initial value for $TG_{i,0}$ may indicate that although there is significant potential for technology adoption, initial infrastructure conditions are not appropriate to technology adoption and, therefore, there are no significant impacts on growth. In other words, if the latter effect dominates then $b_3 < 0$, and convergence between technologically lagging and technologically advanced regions is severely constrained. This brings the notion of club-convergence into consideration.

4. Econometric Estimation and Discussion

In this paper we exploit data on Gross Value Added (GVA) per-worker since this measure is a major component of differences in the economic performance of regions and a direct outcome of the various factors that determine regional 'competitiveness' (Martin, 2001). The European Statistical Office (EUROSTAT) is the main source for data used in this paper. Regional GVA data and all the structural data stem from this source. The regional groupings used in this paper are those delineated by EUROSTAT and refer to 267 NUTS-2 regions. The EU uses NUTS-2 regions as 'targets' for convergence and are defined as the 'geographical level at which the persistence or disappearance of unacceptable inequalities should be measured' (Boldrin and Canova, 2001, p. 212). Despite considerable objections for the use of NUTS-2 regions as the appropriate level at which convergence should be measured, the NUTS-2 regions are sufficient small to capture sub-national variations (Fischer and Stirböck, 2006). The time period for the analysis extends from 1995 to 2006, which might be considered as rather short. However, Durlauf and Quah (1999) point out that 'convergence-regressions' are valid for shorter time periods, since they are based on an approximation around the 'steady-state' and are supposed to capture the dynamics toward the 'steady-state'.

The dynamics of regional growth for Europe between 1995 and 2006 are summarised in Figure 3, which shows a scatterplot of the average annual growth rate against the initial level of GVA per-worker. Alternatively, Figure 3 indicates the potential or otherwise for β-convergence. Even a cursory analysis of the EU27 data suggests that the inverse relationship between growth rate and initial level of labour productivity is not so obvious. Figure 3 indicates that this relationship is more probable to occur among regions that exceed a certain level of initial labour productivity. The presence or absence of β-convergence, however, cannot be confirmed by visual inspection alone. Therefore, the cross-section test, based on estimation of equation (4) for the 267 NUTS2 regions, is applied to the period 1995-2006. Furthermore, the conventional test of regional absolute convergence is modified to include the hypothesis of 'technologically-conditioned' convergence. The relevant results are set out in Table 1 and show the convergence coefficient to be negative and significant at the 95%, implying a positive value for the rate of convergence (β), although in a relatively small range, estimated to be 0.65% per annum.

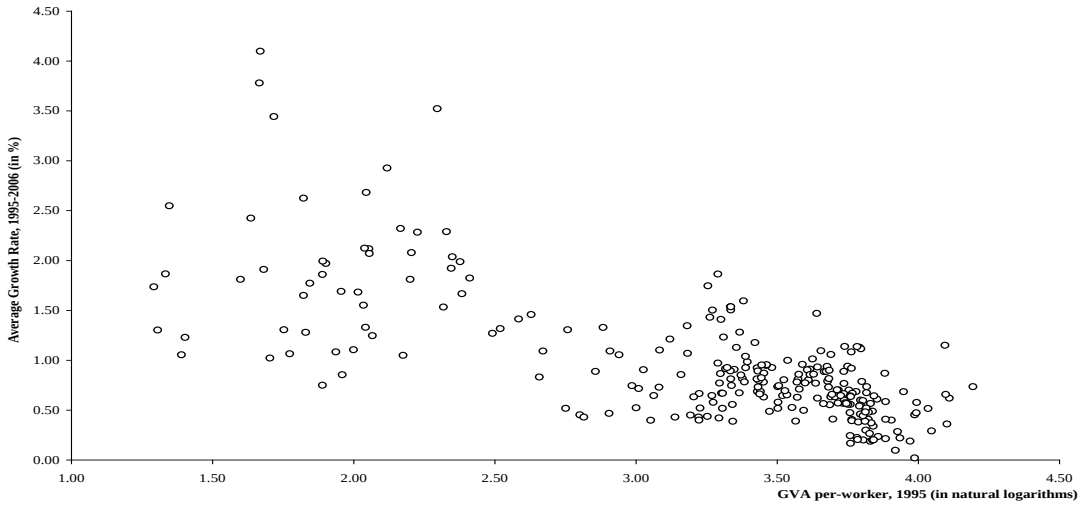

Figure 3: Absolute Convergence, GVA per-worker, EU NUTS-2 Regions, 1995-2006

Table 1: Regional Convergence, GVA per-worker, EU regions: 1995-2006

	Eq. (4)	Eq. (9)
Depended Variable: g_i , n = 267 NUTS-2 Regions, Ordinary Least squares		
a	0.5714**	0.6144**
b_1	-0.0747**	-0.0824**
b_2		0.0016
b_3		-0.0191*
Implied β	0.0065**	0.0072**
LIK	147.552	148.711
AIC	-291.104	-289.422
SBC	-283.929	-275.073

Notes: ** indicates statistical significance at 95% level of confidence, * 90% level. AIC, SBC and LIK denote the *Akaike*, the *Schwartz-Bayesian* information criteria and Log-Likelihood, respectively.

These cross-section tests provide some, albeit, very limited evidence that the NUTS2 regions of EU-27 are in the process of absolute β-convergence with low productivity regions growing faster than high productivity areas. But given the extremely slow convergence rate estimated[6], it would take a very long time for all prefectures to reach a common level of productivity, as predicted by the absolute convergence model. A positive coefficient is estimated for the variable describing technology creation. As argued in Section 3, a positive value of b_2 does not necessarily promote convergence as such, since regions with relatively high initial level of innovation exhibit relatively higher rates of growth. The variable $TG_{i,0}$ is statistically significant and negative in sign. A high technological gap does not necessarily imply that technologically lagging regions will be able to adopt technology - a large gap may constitute an obstacle to convergence. This proposition is supported by the empirical analysis which suggests that, on average, regions with high technological gaps at the start of the period grow slower than regions with low gaps, ceteris paribus. But what can this possibly mean? Clearly, a high initial

[6] This slow process of regional convergence can, possibly, be explained by the low degree of labour mobility that characterises the European regions, due to linguistic and cultural barriers. As Boldrin and Canova (2001, p. 243) state 'while capital is moving around Europe, labour is definitely not'. Obstfeld and Peri (1998) report that labour mobility in Germany, Italy and the UK over the period 1970-1995 was only about one-third of the US level.

technological gap is a factor that helps to sustain initial differences across regions, constraining any possibilities for overall convergence. If technologically backward regions of the EU were successful in adopting technology, then the estimated coefficient b_3 would be positive. Since $b_2 < 0$ this indicates that infrastructure conditions in regions with high technological gaps are inhibiting this process of technology adoption. It follows, therefore, that adoption of technology, although it might be the best 'vehicle' for lagging regions to converge with leading regions, nevertheless, this is a process which might be difficult for lagging regions, especially during the early stages of development when conditions are least supportive. Although the concept of conditional convergence implies a slower rate of convergence (Barro and Sala-i-Martin, 1992), nevertheless introducing the technological variable increases the estimated rate of convergence (0.72%).

The superiority of the model described by equation (9) is supported by both the criteria for model selection applied here, namely the *Akaike* (AIC) and the *Schwartz-Bayesian* (SBC) information criteria.[7] Further support is also provided by the value of the Log-likelihood (LIK), which increases, as anticipated, with the introduction of the technological variables. Overall, these results suggest a significant technological dimension in the process of European regional convergence. However, the relatively low rates of convergence imply the existence of a cumulative mechanism. There seems to be a certain 'threshold' level of technology and regions below that level are not able to assimilate technological innovation in an efficient way. In order to further corroborate this argument the empirical analysis is extended by estimating a model that incorporates the possibility of 'convergence in groups'; the so-called 'club-convergence' model.

There are several different approaches for identifying convergence clubs. Economic theory, however, offers little guidance in detecting both the number and composition of such clubs within a given cross-section of regional economies, as Corrado et al. (2005) claim. As a result, choosing a methodology that is appropriate or suitable in the present context is not necessarily a straightforward task, particularly when data is limited.

Nevertheless, existing methodologies can be classified into two broad categories, namely methods that are based on time-series data and those that rely on cross-section data. However, a potential pitfall in these methodologies is that they rely exclusively upon a single variable, namely GVA per-worker, which may be unsatisfactory in terms of policy implications. From a policy perspective, identification of convergence clubs alone is not enough, since successful implementation of economic policies at the regional level requires information on the specific factors that determine the pattern of regional growth. Thus, for example, Corrado et al. (2005) develop an approach that identifies both the number and the composition of convergence clubs using pair-wise stationarity tests on time-series data, but for a variety of conditioning variables. Using these variables, Corrado et al. (2005) test for regional convergence clusters across the EU regions against a number of hypothetical, a priori determined clusters. However, an application of this methodology across all the regions of the 27 countries of the EU is entirely feasible, since it requires an extensive time-series data for variables such as R&D labour and so forth; a requirement that it is difficult to fulfil, especially for the new member-states.

Using cross-section methodologies, on the other hand, can overcome the problem of small data sets for particular conditional variables. Durlauf and Johnson (1995), for example, apply a 'tree-regression' method using cross-section data sets. Here, a conditional convergence equation is estimated for the entire data set and then the same equation is estimated excluding those

[7] As a rule of thumb, the best fitting model is the one that yields the minimum values for the AIC or the SBC criterion.

economies that do not fulfil certain criteria, defined ex-ante[8]. However, application of such a methodology seems to be biased in identifying a predetermined convergence club. Moreover, applying a 'tree-regression' method in a regional context[9] fails to take into account the spatial dimension of the growth and convergence process (Fischer and Stirböck, 2006).

Apart from the above methodologies, there are two cross-section approaches to convergence club detection, found in Baumol and Wolff (1988) and Chatterji (1992). The latter defines convergence in terms of the narrowing of gaps between a leading region and other regions. Such an approach does not seem entirely appropriate in the case of EU-27, as the group of leading regions is an exceptional case. Thus, a predominant focus on gaps compared to the leading region reveals very little about underlying growth and convergence trends across the remaining regions.

Fischer and Stirböck (2006) propose a methodology that overcomes several of the shortcomings of the previous methodologies and involves two broad stages. In a first stage "spatial regimes in the data in the sense that groups (clubs) obey distinct growth regressions" (p. 695) are identified. The hypothesis of β-convergence within the clubs in conjunction with spatial dependence is then examined in a second stage. It is possible, however, to introduce these considerations in the Baumol and Wolff's framework (1988). The reason is that in this methodology a bias from a leading region, although still present to some degree, is much reduced, and can be systematically investigated. More importantly, perhaps, the logic and structure of the model is such that additional variables, which represent initial conditions, can be accommodated, with a view to improving the explanation of growth patterns.

Subsequent empirical analysis is, therefore, based upon application of Baumol and Wolff's (1988) specification. Furthermore, using the Baumol and Wolff (1988) specification it is possible to distinguish between different clubs due to dissimilarities in the rate of β-convergence, which is an essential feature in the clubs identified using the methodology by Fischer and Stirböck (2006)

Baumol and Wolff's model[10] is defined by the following equation:

$$g_i = a + b_1 y_{i,0} + b_2 y_{i,0}^2 + \varepsilon_i \qquad (10)$$

A pattern of club convergence is established if $b_1 > 0$ and $b_2 < 0$. Members of a convergence club are identified as those economies which exhibit an inverse relation between the growth rate and initial level of GVA per-worker and exceed a threshold value of initial GVA per-worker, which is calculated as: $y^* = \frac{-b_1}{2b_2}$. Estimating, therefore, equation (10) using cross-section data for the 268 NUTS-2 regions of the EU-27 gives the results in Table 2.

[8] According to this methodology the existing observations are ordered in increasing order based on a control variable and then the sample split that minimises the residual variance is identified. To that aim, Durlauf and Johnson (1995) propose two methods. The first identifies the number of splitting in an arbitrary way, based exclusively on one variable (usually per-capita income). The second implements a branching approach. Initially, the entire sample is divided into two sub-samples based on the variable that produces the best fir and this procedure is repeated for each of the resulting sub-samples, until the degrees of freedom become too small or the split into sub-samples becomes insignificant.

[9] The reader interest in these issues can, for instance, refer to the contributions Fagerberg and Verspagen (1996) and Siano and D'Uva (2006).

[10] Alexiadis (2010a) applies this method in the case of the Greek regions.

Table 2: Convergence Clubs: Baumol and Wolff's (1988) specification, 1995-2006

OLS, Estimated equation: $g_i = a + b_1 y_{i,0} + b_2 y_{i,0}^2$ Sample: 268 EU-27 NUTS-2 regions					
a	b_1	b_2	R^2 [ser]	Implied y^*	
0.0057	0.3233**	-0.0704**	0.17261 [0.1361]	2.2926**	
LIK	155.034	AIC	-304.068	SBC	-293.306

Notes: ** indicates statistical significance at 95% level of confidence [ser] denotes the standard error of the regression. AIC, SBC and LIK denote the *Akaike*, the *Schwartz-Bayesian* information criteria and Log-likelihood, respectively.

The SBC criterion indicates a very marginal preference for the convergence club model. The outcome is also consistent with the presence of a convergence club, in that the estimated coefficients are as expected. As can be seen from Table 2, the coefficient b_1 is positive while the coefficient b_2 is negative. In order to identify convergence club members the threshold value of initial GVA per-worker (y^*) is determined using equation (10), which is statistically significant at 95% level of confidence. At this point the conclusion that the simple model of club convergence provides a better explanation of the data than the simple absolute convergence model is tentative. The overall fit remains poor, and the power to discriminate between those regions which exhibit β-convergence, and those which do not, must be therefore be viewed with caution.

According to Baumol and Wolff's (1988) specification of convergence club, the property of β-convergence is apparent for the regions with an initial level of GVA per-worker in excess of the estimated threshold value of initial labour productivity. According to the implied threshold value, over the period 1995-2006, all but 43 NUTS-2 regions can be identified as exhibiting the property of β-convergence. Figure 4 and Table 3 point in the direction of the existence of convergence clubs among the European regions.

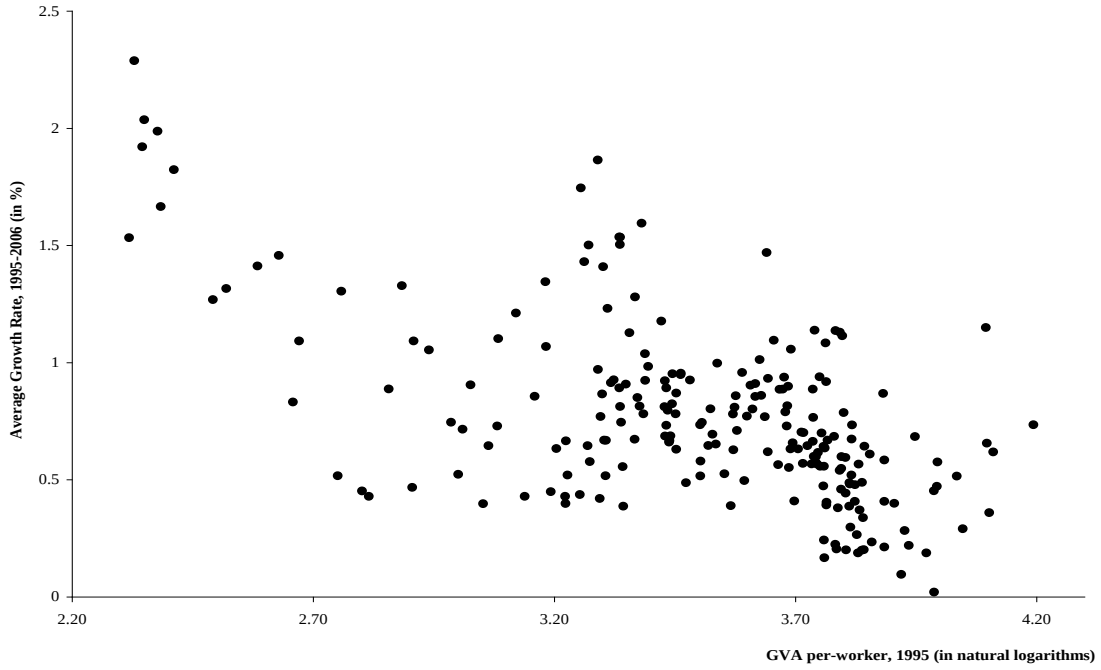

Figure 4: β-convergence amongst the convergence club

Table 3: β-convergence in the converging and diverging club

OLS, Estimated equation: $g_i = a + by_{i,0}$, Sample: 226 NUTS-2 regions		
a	*b*	Implied β
0.7444**	-0.1238**	1.102**
OLS, Estimated equation: $g_i = a + by_{i,0}$, Sample: 42 NUTS-2 regions		
a	*b*	Implied β
-0.0871**	0.2766**	-2.035**

Notes: ** indicates statistical significance at 95% level of confidence while * indicates significance at 90% level.

The regions included in the club converge at an average rate equal to 1.1% per annum. An opposite picture is revealed for the regions excluded from the convergence club (Figure 5). Given that the estimated value of the *b* coefficient is positive (Table 3), these regions exhibit *diverging* tendencies, at an average rate about 2% per annum.

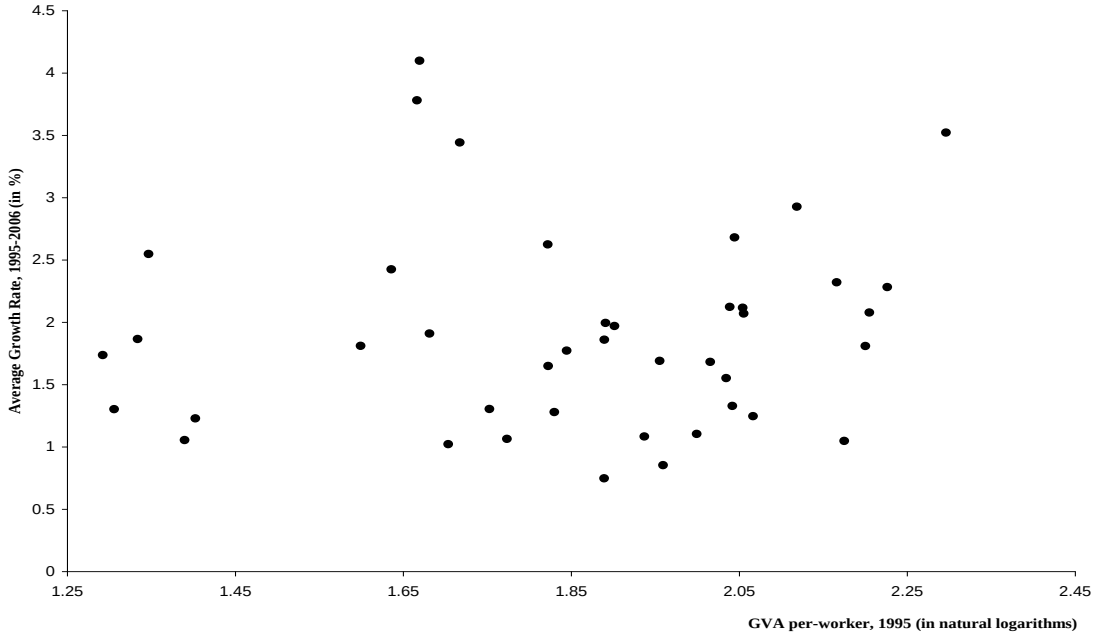

Figure 5: Diverging regions

Of particular importance, from a policy point of view is the impact of the technological variables. Thus, introducing these variables in a club-convergence context yields the following regression equation:

$$\mathbf{g_i} = a + b_1 y_{i,0} + b_2 y_{i,0}^2 + b_3 \ln IC_{i,0} + b_4 \ln TG_{i,0} \quad (11)$$

The obtained results are reported on Table 4.

Table 4: Club Convergence and Technology

Depended Variable: g_i , n = 267 NUTS-2 Regions, OLS	
a	-0.0221
b_1	0.4472**
b_2	-0.0919**
b_3	-0.0123
b_4	-0.0427**
Implied y^*	2.43**
LIK	159.566
AIC	-309.133
SBC	-291.197

Notes: ** indicates statistical significance at 95% level of confidence, * 90% level. AIC, SBC and LIK denote the *Akaike*, the *Schwartz-Bayesian* information criteria and Log-Likelihood, respectively.

Overall, the extended model confirms, yet again, the existence of the convergence club across the NUTS-2 regions of the EU-27. The coefficients b_1 and b_2 have the appropriate signs but individually highly significant coefficients (at 95% level). This outcome is perhaps not unexpected in that convergence is now conditional upon initial structural characteristics. The threshold value of GVA per-worker (y^*), which is a combination of the two estimated coefficients, is found to be statistically significant, however. Turning to the impact of the other explanatory variables, only the technology gap variable yields a statistically significant coefficient at the 95% level. The innovation variable ($IC_{i,0}$) indicates a negative relationship with growth for the overall period, which can be interpreted as a source of convergence, in the sense that benefits from a high initial technological level have already taken place. As a result, regions with high initial $IC_{i,0}$ grow slowly, which can create a catch-up potential. However, the negative and significant value for b_4 suggests that, in the long-run, regions with high technological gaps at the start of the period grow slower than regions with low gaps, ceteris paribus. Bearing in mind that a high initial technological gap may also signify inappropriate conditions for technology adoption, then a large gap may not promote convergence. Since $b_4 < 0$ in all the equations above this suggests that for technologically poor regions this problem exists. Alternatively, $b_4 < 0$ indicates that regions with high technological gaps do not have the potential to adopt technology. This constitutes a substantial barrier to the diffusion of technology across the regions of the EU-27. The empirical findings reported in this section enhance the argument put forward by Fisher and Stirböck (2006) that "technology does not instantaneously flow across regions and countries in Europe" (pp. 710-711).

Accordingly, it may be adequate, but with much caution, to associate the poor convergence performance of the diverging group with a series of structural elements that characterise the regions in this group. Although it is beyond the scope of this paper to go into detail, nevertheless it is worth mentioning that the list of these elements includes the usual suspects such as science, technology and conditions related to the structure of the economy. More specifically, in 2005 the R&D intensity, measured in terms of R&D expenditure as a percentage of GDP[11], in these regions was less than 0.5%. There are two exceptions; a region in Poland

[11] A level of R&D intensity above 3% in the EU as whole to reach by 2010 is set by the Barcelona Council in 2002 and maintained in the Europe 2020 strategy. Nevertheless, only 10% of the EU regions were able to reach this target, located in the advanced EU-12 Member-States (UK, Germany and France).

(Mazowieckie) and the capital-region of Romania (Bucuresti-Ilfov). The R&D intensity in these two regions is about 1%. It is important to note that a comparison of GDP per-capita in these regions between the three-year periods 1998-2000 and 2005-2007 indicates that were able to pass the 75% threshold set by EU, which is a key criterion for being eligible to support from the Structural Funds. Contrary, the GDP per-capita in the remaining regions in the diverging group is still below the threshold. A similar situation with respect the distribution of patents applications to the European patent office (EPO) appears among the regions of the diverging group (less than 5 patents per million inhabitants). In 2006 the 'Human resources in science and technology' (HRST) in this group was less than 35%. An exemption is the Romanian region of Bucuresti-Ilfov with a percentage above 40%. It should be noted, however, that there is a tendency for HRST to concentrate in or around capital cities, especially in countries with a low overall proportion of HRST. An average share of high-tech sectors in total employment was less than 4% in the diverging group. For the central region a percentage above 5% is reported. A similar share can be found in four regions in the diverging group; three Hungarian regions, Nyugat-Dunántúl, Közép-Dunántúl and Közép-Magyarország, and one Slovakian, Bratislavský Kraj. It is worth to note that the three Hungarian regions are located in close geographical proximity while the regions Bratislavský Kraj and Nyugat-Dunántúl are close to the Austrian borders. Agriculture plays an important role in the economy of the diverging regions, if one considers the fact that this sector contributes about 3-6% in their GDP and in several cases, mainly in Romania and Bulgaria, over 6%. The percentage of rural population in these regions is in the range between 20% and 50%, with several regions above 50%. Furthermore, the regions in the diverging group exhibit a low degree of business concentration, with the anticipating exception of Bucuresti-Ilfov.

Figure 6 shows the spatial distribution of the convergence-club member regions. The convergence club includes, almost exclusively, regions from the 'old' and 'advanced' members-states of the European Union (EU-15). Such an outcome is in accordance with the view put forward by Dunford and Smith (2000), which highlight a significant '*development divide*' between the EU-15 and the East Central Europe. Indeed, according to the threshold value of the initial level of labour productivity, implied by the Baumol and Wolff's (1988) specification of convergence club, very few regions form the new member-states are included in the converging group. Most of these regions are located in Czech Republic; a relatively advanced economy of the East Central Europe. Conversely, the diverging areas are found in relatively backward Eastern European countries, such as Slovakia, Hungary, Poland, Romania and Bulgaria. The results reported insofar, clearly, indicate that the wide economic disparities between the regions of the EU-15 and the regions in the East Central Europe is a factor that constraints any possibilities for overall convergence across the EU-27.

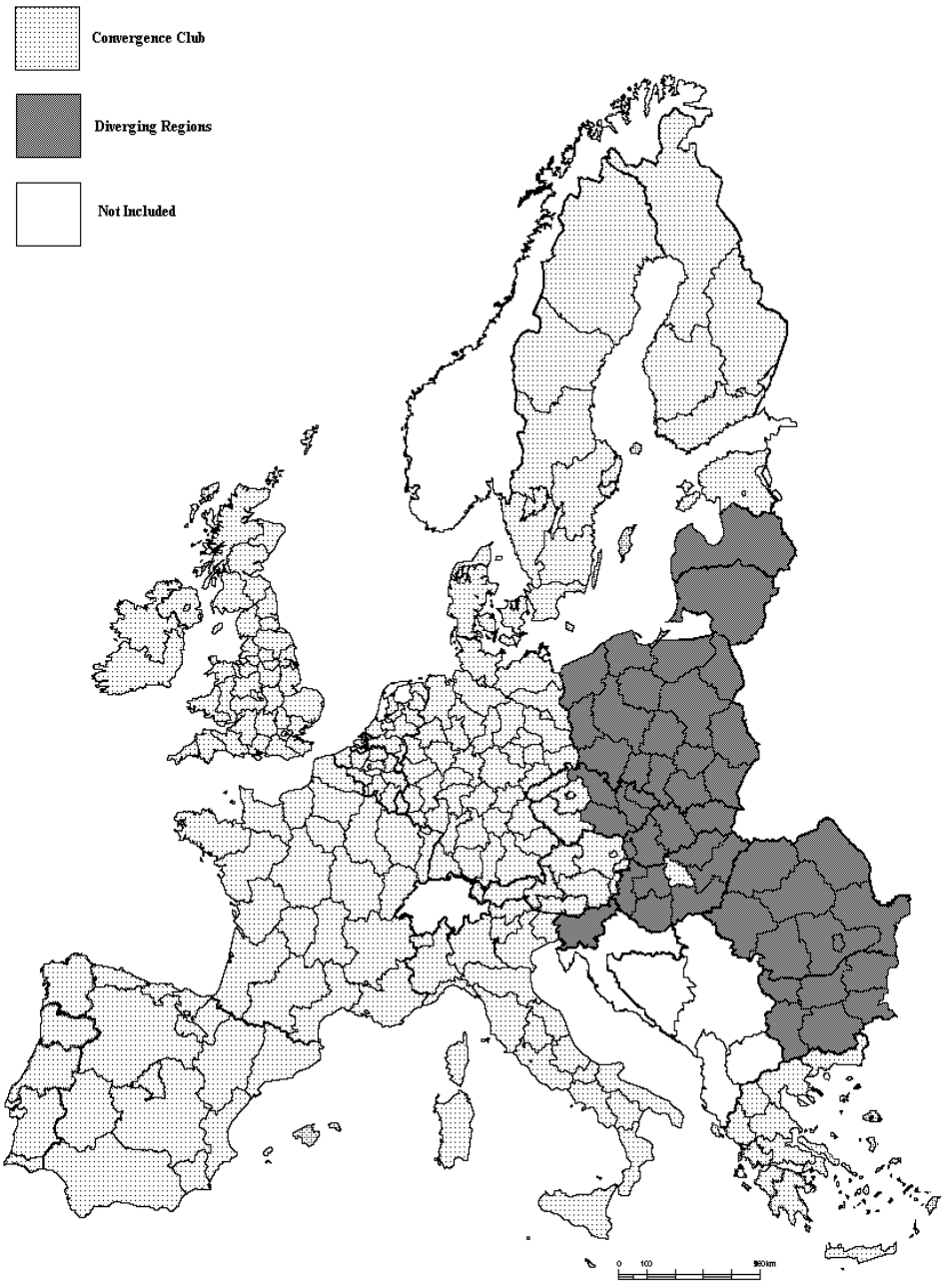

Figure 6: Converging and Diverging clubs

5. Conclusion

It is beyond argument that, although an increasing number of empirical studies have paid attention to issues of economic convergence in the EU, the impact of technology adoption in regional convergence has so far received more limited attention. We have attempted in this paper to address this issue by developing a model of regional convergence that puts primary focus upon the infrastructure conditions in a region. As in any modelling situation, we cannot know for certain whether a lack of correspondence between our theoretical presuppositions and the available empirical evidence is the result of falsify of our target theory or the approximations and omissions that we employed in specifying the empirical model. Nevertheless, estimating this model using data for the 267 NUTS-2 regions of the EU-27 over the period 1995-2006 yields some interesting results. To be more concrete, it is established that

the NUTS-2 regions of EU-27 exhibit a very slow tendency towards overall convergence in terms of labour productivity. In this context, club-convergence seems to be a more probable outcome across the regions of an enlarged Europe. The evidence reported in this paper seems to confirm this hypothesis. More than ever, policy makers in the EU need independent and encompassing studies like this which can provide critical new information about regional convergence. Nevertheless, the important point to grasp, from a policy perspective, is that a primary aim of regional economic policy in an enlarged Europe should be the promotion of high-technology activities, and R&D, including universities, scientific and research institutions. Moreover, in order to enhance regional growth and convergence, policy should seek to reorient these activities. High-technological and knowledge-creating activities should be directed, if possible, at regions with unfavorable infrastructure conditions, as to stimulate the production structure in those regions towards activities that implement high technology.

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SPILLOVER DIFFUSION AND REGIONAL CONVERGENCE: A GRAVITY APPROACH*

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Abstract:
Among the different sources of regional growth, agglomeration economies, both internal to regions and external to regions (spillovers) play a primary role. However the presence of agglomeration economies may obstacle the path toward cohesion making rich (poor) regions become richer (poorer). While, according to New Growth Theory and New Economic Geography, there is no doubt that internal economies may lead to divergence, the debate on the role of external economies on convergence is still open. Much, of course, depends on the spatial extension of spillovers. The aim of this work is to study the spatial dimension of spillovers using the framework of cross-region growth regression. In particular we seek to explain whether the intensity of spillover is either completely exogenous or it can be explained by some endogenous regional characteristics. Results indicate that the intensity of externalities is determined by a) the regional geographical position and b) the distance from neighbors with high growth rates. While the first is completely exogenous, the second is not. Curiously enough, infrastructural endowments and factors commonly assumed to induce agglomeration do not contribute to explain the intensity of spillovers. Results have important policy implications. Since spillovers characterize more core regions, which are well connected to other rich regions, than periphery, the presence of these externalities may foster the increase of disparities between core and periphery, making harder to reach the objective of cohesion.

JEL: R11, O18
Keywords: spatial econometrics, regional growth, spillovers, gravity models

INTRODUCTION

This paper aims to investigate the spatial dimension of growth spillovers within the framework of the convergence process in European Union at regional level. Regions are the main objective of European Cohesion Policy, both because they represent an intermediate political level between states and local administrations and because they are the main funds receivers. A convergence process is expected to take place in European regions since efforts have been done in order to remove barriers to flows of goods and services. Moreover, labor and capital mobility should have contributed to convergence re-equilibrating differences between factors' productivity and revenues in Eastern and Western Europe, as neoclassical theories would predict (Solow, [28]). However, growth does not result only from capital accumulation under exogenous and constant technological change. Scholars have emphasized the contribution of increasing returns to growth in the form of knowledge spillovers (Romer, [26]) and agglomeration externalities (Krugman, [17]). Spillovers and externalities may contribute to convergence in different ways. On one side they can foster growth in already developed regions stimulating the mechanism of *cumulative causation*. In such a case economies will diverge in the long run. On the other side it is possible that spillovers and

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externalities cross regional borders, reaching other regions that may eventually benefit in terms of growth. It is therefore quite evident that, as Grossman and Helpman [13] pointed out, the effect on growth of spillovers and externalities will depend on the spatial dimension of these lasts[1].

Empirical strategies adopted to estimate the contribution of spillovers and externalities to growth involves the use of spatial econometric tools. After the work of Rey and Montouri [25], spatial econometric methods have become the mainstream approach to study spillovers and in this direction can be considered, among the others, the works of Neven and Gouyette [21], Ertur et al. [9], Bosker [7], Brauninger and Niebuhr [8], and Fischer and Stirböck [12]. Most of these studies concentrate on the presence of regional patterns of convergence in EU, differentiating agglomerated from non agglomerated areas and core from periphery regions, highlighting evidences of *club-convergence*. In any of the cited studies, empirical evidences based on European regional data suggest the presence of positive interregional spillovers.

Couriosly, not so much attention has been paied to what is behind the mechnaism of spillover[2], and in particular what are the regional characteristics allowing spillovers and externalities to be more easily exchanged across regional borders. This paper attempts to do so modelling the continuity matrix, useful to define the sets of neighbors to be used in spatial econometric models, according to a gravity approach. In the basic formulation of the gravity approach the amount of interaction (attraction) of two regions (bodies) is a positive function of some regional (body) mass and a negative function of the distance separating them. Using data on 243 EU regions belonging to 24 member states we first search for the contiguity matrix best representing the structure of the linkages among European regions, and then apply a gravity formulation in which several definitions of regional *mass* are used in order to account for economic and social interactions and for the role of infrastructures.

The remaining of the paper is organized as follows. Next section introduces to the subject of regional convergence and territorial cohesion, presenting the European Commission perspective. The aim is to highlight why it is worth focusing on matters like agglomeration economies, peripherality and transportation infrastructure in a discussion on regional convergence. Section 3 shortly describes the empirical model and the source of data. Section 4 is devoted to the empirical results, followed by some discussion and conclusions.

REGIONAL CONVERGENCE AND TERRITORIAL COHESION

The role and the importance of disequilibria among European regions are clearly stated in the EU Treaty where territorial cohesion is introduced along with economic and social cohesion (art.174). Furthermore, the Treaty clarifies that a "particular attention shall be paid to rural areas… and regions which suffer from severe and permanent natural or demographic handicaps such as the northernmost regions with very low population density and island, cross-border and mountain regions" (art.174).

The emphasis on disparities is largely discussed in the sequence of reports on cohesion among regions and countries published by the EU Commission. Most of them are widely used as basis to cohesion policies. The latest evidence provides a contradictory picture of the phenomenon. On one side economic cohesion among countries has improved due to relevant performance of the so-called "cohesion countries" (countries with per capita GDP lower than 90% of European average) like Ireland and Spain that reached the top levels of European ranking. On the other side, cohesion among regions globally improved since eight regions over 78 overcome the 75% of per capita GDP (EU-27). Despite the low number of regions involved by a significant improvement, the fourth relation on social cohesion states that "The lagging regions in the EU-15, which were major recipients of support under cohesion policy during the period 2000-2006, showed a significant increase in GDP per head relative to the rest of the EU between 1995 and 2004. In 1995, 50 regions with a total of 71 million inhabitants had a GDP per head below 75% of the EU-15

[1] Hereafter the words *spillovers* and *externalities* will be both used to identify externalities crossing regional borders.

[2] Apart from some notable exceptions, e.g. Audretsch & Feldman, [4], which examine knowledge spillovers.

average. In 2004, in nearly one in four of these regions home to almost 10 million, GDP per head had risen above the 75% threshold".

Territorial cohesion exhibited an evidence of an increasing number of poles of development. Most of these poles are concentrated in large urban areas, in EU-15 regions as well as in the enlargement countries. A symmetric phenomenon of decreasing economic activities in rural areas emerged. Until the nineties the core of the European growth was concentrated in the middle of EU-15 (Munich, Hamburg, Paris, London and Milan). Afterwards, the new comers of European economic growth emerged in Scandinavian countries, Spain and Ireland and in the capital towns of the enlargement countries. The polarization of the economic development has largely been characterized by increasing diseconomies of agglomeration, due to increasing congestion costs and pressure on housing markets and network services, and subsequent suburbanization. Despite an increasing optimistic view about economic convergence among EU regions, the analysis of EU policy-makers about territorial cohesion is focused on the potential problems arising from growth polarization. Large capital towns (or better capital regions) often became strong economic growth attractors but, at the same time, increasing problems in surrounding regions and deprivation in rural areas offset the economies of agglomeration generated by increasing growth rates. Their core-peripheral dynamics is often characterized by relevant economic growth and loss of population at the core of capital region and less moderate economic growth and increasing population at the periphery of capital region (urban sprawling). In some countries economic growth is characterized by a bi-modal (or tri-modal) distribution of regional growth rates with a leading town/region (usually the capital town region) and strong secondary poles (like Milan and Naples in Italy, Barcelona in Spain, Frankfurt and Munich), where economic growth is even higher than in the capital town. Usually, most of the economic growth is concentrated in the capital town region and less distributed in the rest of the country. Moreover, most of the economic potential is concentrated, according to EU analysis, in cross-border cooperation due to relaxation of constraints to economic exchanges from physical and administrative point of view. Cross-border areas are certainly in some cases consolidated areas of spillover effects in economic growth and in other cases, where the physical context is an obstacle, are marginal areas due to lack of infrastructure (i.e. mountain areas).

Territorial and economic differences in EU regions are also clearly due to different development patterns among European regions. Looking at the latest years (1995/2005), there have been at least three different situations: in some regions high growth rates in per capita GDP have been obtained along with increase in productivity and in employment rates: ie. the case of Ireland; in some other regions, relatively high growth rates in per capita GDP have been obtained along with increase in productivity and strong decline in employment rates; in other regions, most of them in highly industrialized countries, lower (or negative) per capita GDP growth rate are accompanied by low productivity growth rate and by moderate employment rate growth.

The current economic crisis will certainly re-depict the current situation, since some of the new member states might be interested by structural crisis. Nevertheless, the underlying fundamentals of economic structure will strongly influence the recovering phase and the productivity patterns will be crucial. The empirical evidence and most of the analysis of territorial cohesion are openly oriented to discuss how space may matters in the dynamics of convergence among European regions. Some very practical questions may arise. Are agglomerative factors crucial to explain increasing economic convergence? Is increasing economic convergence widely justified by current cohesion policies? Is there any additional room to stimulate spillover effects by supporting specific cooperation policies? Are spillover effects still relevant in a dematerialized economy in which geographical proximity may reduce its importance?

METHODS AND DATA

The idea of economic convergence is derived from neo-classical growth models (Solow, [28]) in which, under the simple hypothesis of constant returns to scale, perfect competition and homogeneous agents it is shown that all the economies with similar characteristics converge to a long-run level of per-capita income. Barro-type regressions (Barro and Sala-i-martin, [5]), in which regional growth is explained by the initial income level, have been used to search evidences

of income convergence[3]. Using the notion of *conditional convergence*, the model is generally augmented with some control variables in order to account for heterogeneity in structural characteristics. However, the lack of data at regional level has made harder the work of scholars interested in investigating the causes of regional development. Attempts in such a direction have been made by Islam [15], who first introduced fixed effects estimators in growth regression, Paci e Pigliaru (2001) accounting for technological disparities and Fagerberg and Caniels [16] introducing differences in labor market conditions.

The advantage of spatial econometric models is evident: on one hand it is possible to account for unobserved (and usually unobservable because of data missing) heterogeneity (LeSage & Pace, [19] and Elhorst, [11]), provided that neighboring regions have similar characteristics; on the other hand these methods allow to introduce and measure the effect of spillovers and externalities external to regions, the outcome of the interaction process. Basically a spatial econometric formulation of the growth regression can be obtained augmenting the Barro-type model (1)

$$\frac{1}{T}\log\left(\frac{gdp_{i,t+T}}{gdp_{i,t}}\right)_i = a + b\log\left(gdp_{i,t}\right) + e_i \tag{1}$$

(in which the term in the left-hand side is the annual average growth rate over a period of T years) with a spatially lagged dependent variable (Spatial Lag Model (2)), a spatially lagged initial income (Spatial Cross-Regressive Model (3)) or modeling the error term as a simultaneous autoregressive process (Spatial Error Model (4)) (Rey & Montouri, [25]).

$$\frac{1}{T}\log\left(\frac{gdp_{i,t+T}}{gdp_{i,t}}\right)_i = \rho W\frac{1}{T}\log\left(\frac{gdp_{i,t+T}}{gdp_{i,t}}\right)_i + a + b\log\left(gdp_{i,t}\right) + e_i \tag{2}$$

$$\frac{1}{T}\log\left(\frac{gdp_{i,t+T}}{gdp_{i,t}}\right)_i = a + b\log\left(gdp_{i,t}\right) + \gamma W\log\left(gdp_{i,t}\right) + e_i \tag{3}$$

$$\begin{cases}\dfrac{1}{T}\log\left(\dfrac{gdp_{i,t+T}}{gdp_{i,t}}\right)_i = a + b\log\left(gdp_{i,t}\right) + e_i \\ e_i = \lambda W e_i + u_i\end{cases} \tag{4}$$

Elhorst [11] gives evidence of how to nest the three models in (2), (3) and (4) in a more general formulation, the Spatial Durbin Model, which is basically a model with both a lagged dependent and independent variable on the right hand side. W is a standard $n \cdot n$ contiguity matrix, with n the number of observations, whose element w_{ij} is non-zero if region i and region j are neighbors. Different approaches can be used to define contiguity, namely *k-nearest*, *great circle distance* and *common border*. Among these three criteria the last is the less used because, in case of islands, it is likely to produce regions with empty neighbors sets. Regression results are generally quite sensitive to the choice of the contiguity matrix and sensitivity analysis is usually necessary. And that is the reason why two points are worth to discuss here before presenting empirical results.

First it would be misleading to interpret the choice of the correct W matrix as the simple outcome of model comparison based on measures of statistical fitting. The matrix in itself in fact contains information about the structure of linkages that is assumed to exist among the economies. Such a structure is of fundamental importance in the understanding of how regions affect each other in the

[3] This kind of models represents the workhorse of growth theorists although it has been criticized (Quah, [23], [24] and Durlauf & Quah, [10]) because the evidence it provides is necessary but not sufficient to argue in favor of real income convergence, measured as a reduction of disparities over time.

growth process. Figures 1 shows the map generated connecting regions according to two criteria used in next section to construct contiguity matrices.

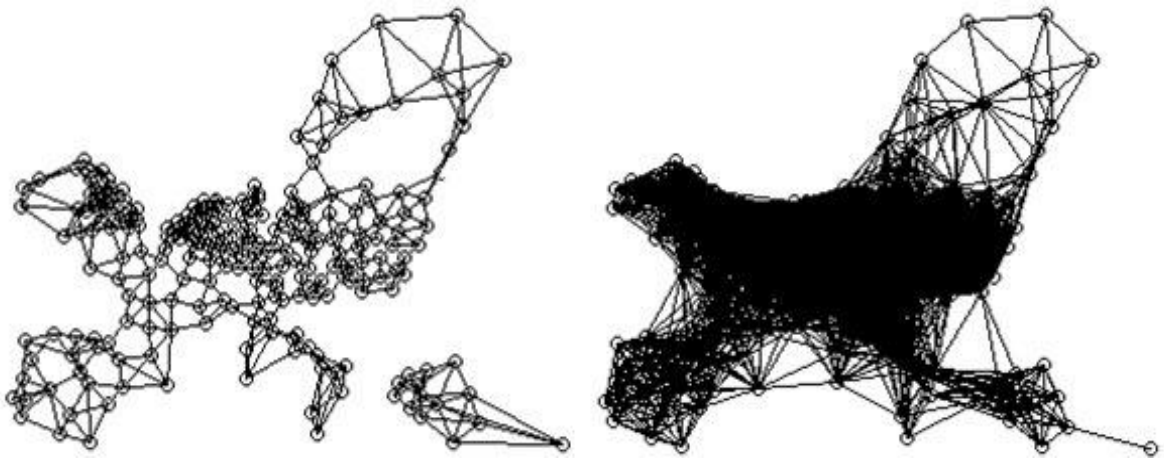

Figure 1: k-nearest (left) and distance (right) contiguity

In the case of *k-nearest* criterion *k* has been set to 4 and distance has been set to the distance allowing no regions to appear as islands. A first look reveals that the second structure weights more the central positioning of regions attributing a less complex structure to regions in the periphery. The main assumption behind the first kind of contiguity structure is the homogeneity of linkage structures across regions. It means that regions hosting capital cities and metropolitan areas like Brussels, London, Milan, Hamburg of Frankfurt have the same connectivity structure of peripheral regions like Cyprus, southern Italy's regions, or Ireland. It looks that, beyond the statistical goodness of fit of each matrix, the distance method leads to a more realistic structure of linkages, because of the different ways core and periphery are taken into account.

Secondly, a common practice in spatial econometric is to assign a value equal 1 to all non-negative elements of the W matrix. In this way the matrix will result as a binary contiguity matrix. In practical use the matrix is row-standardized and the lagged value of a random vector, say z can be therefore interpreted at the average value of z in neighboring regions. Although having the great advantage of letting the weight matrix to be completely exogenous, the binary choice is far from innocent because it assumes that each of the neighbors of a region gives the same identical contribution to regional growth in the destination region. To some extent this may look as an excessive simplification, as the intensity of relationships between two neighbors is not completely exogenous but instead may depend on some regional characteristics. Such a non-binary choice for the contiguity structure would lead to a weight matrix such that the lagged value of z would be interpreted as the weighted average of z in neighbors. Weights allow to attribute a stronger connection, and consequently higher spillover flows, to regions where certain characteristics are abundant. According to theoretical models of New Economic Geography, interactions among economies are determined by low distances and reduced transportation costs in general (Krugman and Venables, [18]). Agglomeration forces make the rest attracting workers and/or firms in already developed regions.

Interactions among economies should be therefore modeled according to these evidences; in other words linking the intensity of interactions with distance, transportation costs and agglomeration economies. To that purpose some special weight matrices have been also used, whose elements are constructed according to the following gravitational law (Sen and Smith, [27], Toral, [29]):

$$w_{ij} = \frac{Size_i \cdot Size_j}{dist_{ij}} \tag{5}$$

where $dist_{ij}$ is the physical distance between centroids or regions i and j, and $Size$ is a measure either of infrastructural endowments (kilometers of road or motorways), proxy for low transportation costs, or of agglomeration economies (Gross Domestic Product or population because of possible GDP endogeneity).
All the data used in the empirical model come from Eurostat regional database. Regions are selected according to NUTS II classification. GDP is measured in Purchasing Power Standards per inhabitant at constant prices and growth rate has been computed for the period 1995-2006. Data on Population (number of inhabitants), Km of roads and motorways refer to nearest year to 1995 for which data were available (mostly 1995). Geographical information has been obtained making use of data and maps available at Eurostat Geographical Information section, GISCO.

EMPIRICAL RESULTS

This section provides empirical results of the analysis. To start with the simplest specification, a standard cross-region regression has been estimated for our sample of 243 regions. The dependent variable is the annual average growth rate for the period 1995-2006.
In table 1 the coefficient on the log of initial income level indicates that there has been some convergence during this period. However several tests on estimated residuals confirm that errors are not normally distributed and that are spatially auto-correlated. The general evidence of spatial autocorrelation is robust to several specifications of the contiguity matrix.
After testing this hypothesis with two sets of k-nearest based and distance based matrices, the values of k and d have been chosen according to the maximum level of Log-Likelihood achieved when such matrices have been used in estimating Spatial Models. According to this criterion, $k = 4$ and $d = \max\left(\min_j \left[d_{ij} \right]\right)$[4], are the best matrices to be used. Results in table 1 have been obtained using these matrices.

Table 3 Cross-regional growth regression results

OLS Estimates		
Constant	0.202349 (11.896) ***	
LN GDP95	-0.016663 (-9.347) ***	
Adj R-Squared	0,182638889	
F(1,241)	87.36 ***	
Log-Likelihood	7.472.297	
Akaike Information Criterion	-1.488.459	
Spatial Autocorrelation Diagnostic		
	distance method	k-nearest method
Moran I on residuals	0.170	0.317
LM-Lag	112.29 ***	75.58 ***
LM-Err	104.42 ***	55.52 ***
Robust LM-Lag	19.29 ***	21.63 ***
Robust LM-Err	11.41 ***	15.68

Note: ***, ** and * respectively indicate significance at 1%, 5% and 10% confidence levels. t-statistics in parenthesis

Regarding spatial autocorrelation diagnostics, Moran-*I* index is constructed according to Moran [20] and *LM* tests are the statistics proposed by Anselin [2]. While the Moran-*I* index is only used in order to explore whether the spatial distribution of error terms departs from the standard normal one, *LM* statistics, in their simple and robust versions, can be used for model selection purposes.

[4] This is the distance such that any region has at least one neighbor and corresponds to the distance separating Cyprus from eastern Greece.

The specification with the highest value of *LM* statistic is generally chosen and in case both are strongly significant the robust version of the test should indicate which one of the two specifications should be chosen. With both distance and k-nearest matrices results clearly indicate that spatial lag is the best choice, as *LM* tests are both significant with both matrices and robust *LM* tests achieve higher scores when the Lag specification is the alternative (in the case of k-nearest matrix the robust test on the Error alternative is also insignificant).
Table 2 reports results of estimation of the four possible spatial model specifications with both matrices, (a) indicates that the model is estimated making use of the matrix constructed with the distance criterion; (b) indicates the same with k-nearest criterion. With respect to the convergence hypothesis, the inclusion of a spatial effect in any of the possible ways does not alter the slope and the significance (except for two cases) of the convergence coefficient. However the magnitude of this coefficient is lower than that estimated without spatial effects. With respect to the spatial autoregressive coefficient either of the dependent variable or of the error term, it is always positive and significant. It is worth to note that it is also higher in cases a distance matrix is used.

Table 4: Spatial models estimates with both distance (a) and k-nearest (b) contiguity matrices

	Spatial Lag		Spatial Error		Common Factor Hypothesis		Spatial Cross Regressive	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
CONST	0.089 (4.88) ***	0.095 (5.53) ***	0.135 (6.01) ***	0.1200475 (5.3153) ***	0.122 (3.30) ***	0.129 (5.61) ***	0.309 (10.88) ***	0.249 (13.16) ***
LN GDP95	-0.008 (-4.82) ***	-0.008 (-4.80) ***	-0.009 (-4.0353) ***	-0.008 (-3.39) ***	-0.006 (-2.55) *	-0.003 (-0.99)	-0.007 (-2.44) ***	-0.004 (-1.5)
LAGGED LN GDP95	- -	- -	- -	- -	-0.005 (-1.06)	-0.008 (-2.65) ***	-0.021 (-4.55) ***	-0.017 (-4.84) ***
LAGGED GR RATE	0.794 (10.57) ***	0.567 (9.58) ***	0.849 (12.45) ***	0.595 (9.98) ***	0.746 (7.97) ***	0.517 (7.86) ***	- -	- -
Likelihood Ratio	54.032 ***	65.784 ***	45.215***	51.94 ***	35.15 ***	50.4 ***	-	-
Wald test / F Statistic	111.72 ***	91.94 ***	154.93 ***	99.67 ***	63.51 ***	61.76 ***	57.6 ***	59.47 ***
Log-Likelihood	7.742.455	7.801.217	7.698.374	7.731.996	774.85	783.75	757.28	758.55
Akaike information Criterion	-1540.5	-1552.2	-1531.7	-1538.4	-1539.7	-1557.5	-1506.59	-1509.11
LM test on residual autocorrelation	0.11062	4.914 ***	-	-	0.2105	0.0263	-	-

Note: ***, ** and * respectively indicate significance at 1%, 5% and 10% confidence levels. z-statistics in parenthesis (t-values only in Spatial Cross-Regressive model). LAGGED GROWTH RATE in Spatial Error model refers to the spatial autoregressive coefficient of the error term. LR test refers to the null hypothesis of coefficient of LAGGED GR=0.

Regarding model choice, it seems that, as predicted by *LM* statistics, the Spatial Lag Model is a preferred specification. The inclusion of a spatial lag of the initial income level (i.e. Spatial Durbin Model or Common Factor Hypothesis) does not alter so much the value of coefficient. However either the initial income, or its lagged value, turns to be insignificant depending on the matrix used.
Using the Spatial Lag model as reference specification the effect of agglomeration economies on spillovers has been tested. Using $GDP\ [Y]$ as size of economic activity (or $POP\ [P]$ to avoid problems of endogeneity) and km of roads $[R]$ or motorways $[M]$ as size of transportation infrastructures, and euclidean distance $[D]$ as proxy for transportation costs, different contiguity matrices have been constructed (Table 3).

Table 5: List of contiguity matrices

Model	Specification of matrix elements
W	$w_{ij}, binary$
W/D	w_{ij}/d_{ij}
W/D2	w_{ij}/d_{ij}^{2}
YY/D	$gdp_i \cdot gdp_j / d_{ij}$
PP/D	$pop_i \cdot pop_j / d_{ij}$
MM/D	$km_i^{mways} \cdot km_j^{mways} / d_{ij}$
RR/D	$km_i^{road} \cdot km_j^{road} / d_{ij}$

All the matrices in table 3 have been used to estimate the Spatial Lag Model for the cross-regional regression with both k-nearest and distance matrices. Results are respectively in table 4 and 5. Significance of coefficients is maintained in all models and also the values of slopes are not affected by the matrix choice. The coefficient on initial income level is always around the value of -0.008, while the lagged growth rate coefficient is around 0.56 in the case of k-nearest contiguity and 0.75 in the case of distance contiguity; which brings to the conclusion that, independently of how spillovers are affected by agglomerations, externalities contribute to growth much more than the convergence effect does.

To test the hypothesis of relevance of agglomeration economies we can compare the likelihood of different models. However, because models are non-nested, it is not possible to use likelihood ratios. In the case of k-nearest contiguity there are evidences of agglomeration economies and in particular of the role of distance. Introducing simple distance between neighbors produces an increase of the likelihood of the model together with the use of cross-product of income and km of roads, while km of motorways do not help explaining spillovers.

The main problem with the use of k-nearest distance matrix is that model residuals show traces of autocorrelation even after the inclusion of the spatially lagged growth rate. This can be noted looking at values of LM statistics. The null hypothesis of absence of autocorrelation in residuals of the Spatial Lag Model is rejected at 5% confidence level in all the models. To some extent this indicates that some residual spatial heterogeneity may not be captured by the model.

Table 6: Spatial Lag model – gravity approach to k-nearest contiguity matrix

ML Estimates: k-nearest contiguity

Model	Coefficients			LR	W Stat	LL	AIC	LM
	CONST (z-stat)	INIT INC (z-stat)	LAG GR (z-stat)	(p-value)				(p-value)
W	0.095 (5.53)	-0.008 (-4.80)	0.5668 (9.59)	65.78 (0.000)	91.94 (0.000)	780.12	-1552.2	4.91 (0.026)
W/D	0.095 (5.61)	-0.008 (-4.84)	0.564 (9.90)	70.53 (0.000)	98.08 (0.000)	782.50	-1557	6.85 (.009)
W/D2	0.099 (5.92)	-0.008 (-5.07)	0.537 (9.73)	70.5 (0.000)	94.68 (0.000)	782.48	-1557	10.57 (0.001)
YY/D	0.095 (5.62)	-0.008 (-4.85)	0.563 (9.89)	70.68 (0.000)	97.80 (0.000)	782.57	-1557.1	6.92 (0.008)
PP/D	0.094 (5.62)	-0.008 (-4.85)	0.562 (9.86)	70.15 (0.000)	97.16 (0.000)	782.31	-1556.6	6.99 (0.008)
MM/D	0.106 (6.08)	-0.009 (-5.27)	0.515 (8.61)	61.62 (0.000)	70.09 (0.000)	778.04	-1548.1	11.29 (0.000)
RR/D	0.094 (5.57)	-0.008 (-4.81)	0.567 (10.00)	70.83 (0.000)	100.02 (0.000)	782.63	-1557.3	5.76 (0.016)

Note: Indicators of z-values confidence levels omitted: all coefficients are strongly significant. LR test refers to the null hypothesis of coefficient of LAGGED GR=0.

Table 7: Spatial Lag model – gravity approach to distance contiguity matrix

ML Estimates: threshold distance method								
Model	Coefficients			LR	W Stat	LL	AIC	LM
	CONST (z-stat)	INIT INC (z-stat)	LAG GR (z-stat)	(p-value)				(p-value)
W	0.089 (4.88)	-0.008 (-4.83)	0.795 (10.57)	54.03 (0.000)	111.65 (0.000)	774.24	-1540.5	0.11 (0.74)
W/D	0.076 (4.40)	-0.007 (-4.26)	0.817 (13.21)	71.95 (0.000)	174.43 (0.000)	783.21	-1558.4	0.67 (0.41)
W/D2	0.077 (4.50)	-0.007 (-4.19)	0.742 (12.12)	82.49 (0.000)	146.87 (0.000)	788.48	-1569	1.70 (0.19)
YY/D	0.104 (5.47)	-0.010 (-5.46)	0.754 (8.46)	43.42 (0.000)	71.51 (0.000)	768.94	-1529.9	2.77 (0.09)
PP/D	0.1021 (5.33)	-0.009 (-5.33)	0.752 (8.46)	44.45 (0.000)	71.66 (0.000)	769.45	-1530.9	2.61 (0.11)
MM/D	0.106 (5.69)	-0.009 (-5.62)	0.717 (7.22)	42.66 (0.000)	50.20 (0.000)	768.56	-1529.1	3.93 (0.047)
RR/D	0.102 (5.28)	-0.009 (-5.28)	0.748 (8.36)	43.53 (0.000)	69.68 (0.000)	768.99	-1530	2.19 (0.14)

Note: Indicators of z-values confidence levels omitted: all coefficients are strongly significant. LR test refers to the null hypothesis of coefficient of LAGGED GR=0.

A different picture emerges looking at the results with distance method matrix. Here the only factor of the gravity approach that contributes to increase the likelihood of the model is distance. And in particular the squared distance is what allows the model to reach the highest likelihood. The relevance of squared distance is justified with the fact that the average distance from neighbors is relatively higher using distance matrix compared to that obtained using k-nearest matrix. The inclusion of other measures of agglomeration effects like income and/or infrastructure does not positively impact the likelihood of the model.

Contrary to what happens with k-nearest matrix, there is no trace of auto-correlated residuals in the models of interest (i.e. with distance and distance squared in the denominator). The fact that distance squared produces the best contiguity matrix has some important implications. Firstly, such a distance is about 700 km, which means that growth externalities are quite localized or at least localized enough to prevent growth benefits to flow from the core to the periphery of Europe, if not after decades. Secondly, the squared distance indicates that half of spillovers are confined within one fourth of the distance. And this means that real spillovers benefit are bounded in a circle of less than 200 km from the origin.

DISCUSSION

The focus of this work is to discuss the aspects linking economic convergence to agglomeration economies and externalities. With respect to the first aspect, economic convergence, results drive in the direction of giving support to the theory according to which poor and peripheral EU regions, mostly located in New Member States, are having higher growth rates. This is without doubt a source of economic convergence. On the other side it is worth to note that this convergence rate is relatively low with respect to what is needed to reduce disparities in the long run. With respect to the second aspect, agglomeration economies and externalities, results indicate that externalities external to the region play a very important role in regional growth.

However spillovers (external externalities) cannot be considered as a source of convergence as long as benefits produced by the mechanism of diffusion are not homogeneously distributed across space. And results indicate that they actually are not. A contiguity matrix assigning the same number of neighbors to all regions (homogeneous distribution of externalities) is not sufficient to account for the spatial relations occurring among regions in growth dynamics, as residuals of the models estimated using this matrix are auto-correlated in any case. On the contrary, a contiguity matrix reflecting a stronger connectivity of regions in the centre and a poor network structure of regions in the periphery has to be preferred. Moreover, applying a gravity structure to the elements

of the distance matrix does not improve the likelihood of the model, except for using the inverse of squared distances between neighbors as elements of the matrix. None of the sources of agglomeration economies suggested by NEG literature helps to explain the intensity of these external externalities. On one side this may be the result of the fact that distance itself captures most of the *transportation cost effect*, therefore making not necessary the use of a proxy for infrastructure endowments. On the other side it can be also due to the use of a distance matrix that already weights more the central position of a region and, consequently, its proximity to other reach regions. Finally, evidences suggest that spillovers are geographically bounded and the majority of benefits are spent within less than 200 km from the origin region. This has very important implications in terms of convergence because implies that regional growth in the periphery is not affected by growth in the core. In synthesis the intensity of spillovers between neighbors is not completely exogenous. But, at the same time, it is not determined by economic and structural characteristics of regions. On the contrary it seems that the intensity of flows of this externalities between neighbors is affected by the geographical location of the region (core vs periphery, which means proximity to vs distance from other rich regions) and by the distance separating the destination from the origin.

CONCLUSION

The evidence, found in this work, suggests that the presence of different patterns of growth. On one hand the core of Europe, characterized by a very intense network structure, in which growth has been lower but regions have benefited of growth externalities. On the other hand the periphery of Europe, in which growth has been higher in last decade due to the effect of economic convergence, but that have not benefited of externalities. This has very important policy implications that are worth to note. In particular there is a trade-off between cohesion and competitiveness. As growth in the core is sustained by the mechanism of cumulative causation and is reinforced by the fact that rich regions are well connected to each others, this development model will continue to increase the competitiveness of regions in the core.

Nonetheless, if externalities are typical of the core and are also bounded within very short distances, this will prevent the benefits of this increase in competitiveness to reach peripheral regions. And, in turn, this will be an inevitably obstacle the process of cohesion within European area.

In order to achieve the cohesion objective, European policies should not only rely on the natural higher growth in poorer and peripheral regions, but should also think on how to stimulate growth in these regions making them benefit from the process of cumulative development of the core.

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IDENTIFYING REGIONAL CLUSTER MANAGEMENT POTENTIALS EMPIRICAL RESULTS FROM THREE NORTH RHINE-WESTPHALIAN REGIONS*

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Abstract:
The development and support of clusters is an issue that became quite popular by players dealing with regional economic policy. But before a regional development agency can start to implement a cluster-oriented strategy there a two question that have to be answered: 1. What are the regional fields of competence (cluster potentials) that fulfill the requirements for a cluster-oriented regional development policy? 2. If you find such regional fields of competence, are the enterprises willing to cooperate in a network? The present paper describes an approach used in several analyses. On the one hand fields of competence were identified by a two stage procedure. On the other hand the firms that were identified in that procedure were questioned about their willingness for networking. The results of the surveys show the interest of the firms for networking and give some additional information on the subjects and partners for networking.

Key words: Cluster, networking, regional development policy, firm survey

1. Introduction

Michael Porter himself, who coined the concept of clusters by his ideas points at the necessity of a cluster-oriented economic policy: "Clusters arise because they increase the productivity with which companies can compete. The development and upgrading of clusters is an *important agenda for governments*, companies, and other institutions. Cluster *development initiatives are an important new direction in economic policy*, building on earlier efforts in macroeconomic stabilization, privatization, market opening, and reducing the costs of doing business" (Porter, o.J.). For regional development agencies the hope for economic success gives reason enough to think about how to create clusters in "their" region or at least how to support their development. Beyond it the concept of clusters has an additional advantage (cp. Grote-Westrick/Muth/Rehfeld 2005, p. 153): For the regions it offers the possibility to concentrate on its strengths and competitive advantages and so to strategically concentrate the public money which becomes scarcer and scarcer.

Against this background terms like cluster, regional fields of competence and regional centres of innovation found its way into the regional development agencies' vocabulary. Cluster-management is attached high importance within a cluster-oriented strategy; its task is to develop

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measures to support supra-regional relevant nucleuses of industry and to put them into practice. Beyond it the cluster-management can – as a controlling- and monitoring-institution – take care of benchmarking and observe the changes of markets so that the cluster can react early. But before a cluster-oriented regional policy like this can be implemented two other problems must be solved:

- As regional development agencies hardly will succeed in creating new clusters but only in activating respectively mobilising existing cluster potentials the first problem will be the identification of regional fields of competence (namely, potential clusters)[1].
- As clusters cannot be ordered as an instrument of regional policy, but need the firms' assistance, the second problem is whether firms are willing to interact on the regional level and whether there is a "cluster-friendly milieu".

The present paper not only deals with some methodological questions but also describes some results and their consequences. Under methodological points of view a method for solving both sketched problems repeatedly used by the Niederrhein University of Applied Sciences will be described. The first step deals with the identification of the regional fields of competence (part 2)[2]. In the second step firms of the identified regional fields of competence have been addressed by surveys as to their willingness for interaction and networking: The questions dealing with co-operation in networks and with the regional orientation of such networks as well as with subjects and partners in networking (Part 3) are on the one hand side part of the methodological proceeding, on the other hand side they include results which might be of general interests. The paper ends with a summary and some hints for the regional development agencies' activities (Part 4).

2. Identification of Regional Fields of Competence[3]

If one talks about clusters in economics this means a concept shaped by Michael E. Porter. On his internet page he defines it in the following way: "Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or region" (Porter, o.J.). Clusters are a co-determinant of regional economic development. For a cluster's success it is essential to obtain a competitive and innovative advantage and to improve it continuously. The concentration of successful firms, causes self-dynamic and self fortifying processes in three different ways from which finally the location of the cluster is benefitting (cp. Ketels 2003, p. 2).

- First the firms belonging to the cluster can benefit from a „pool" of specialized location conditions and factors of production (e.g. high qualified labour force, supply of capital, capital equipment, intermediate inputs and production-oriented services) and achieve synergetic effects by this.
- Secondly they can reach a higher rate of innovation by co-operation with research facilities.
- Thirdly the number of business start-ups is increasing. Start-ups are especially depending on external suppliers and partners which they can find in a cluster.

On principle regional centres of growth and innovation are the starting-point of a cluster-oriented regional policy (cp. Rehfeld 2005, p. 5). This term indeed does not imply a precise definition but aspects as quantitative importance (measured by local shares of employment), dynamics (measured by employment growth), intensity of added value (measured by added value per employee), intensity of research and development (measured by R&D expenditures), potentials for start-ups, potentials for synergies and the ability to export (cp. Kiese 2005, p. 22) are potential criteria for selection. Meanwhile there are many studies dealing with the

[1] In this paper a 'field of competence' is defined as a branch respectively a complex of branches that features the necessary requirements for a cluster-oriented regional policy.
[2] The empirical procedure used here partly relies on L. de Propris 2005, p. 197ff.
[3] The following considerations only can give a short introduction into cluster-theory. For a much more comprehensive work on that subject cp. Asheim/Cooke/Martin 2006.

identification and analysis of clusters. In their analysis of East-German production-clusters Krätke and Scheuplein have tried to systematize the methods in use for cluster identification. Principally they distinguish two procedures (cp. Krätke/Scheuplein (2001), p. 198-202):

- Either global trends of development are chosen as a starting-point of cluster identification. Afterwards cluster-oriented policy tries to develop the regional potentials of the branches favoured by these global trends.
- Or the regional potentials by branches are analysed and provide the starting-point of a cluster-oriented policy. In this case one expects that the competences existing in the region are capable of development and will achieve an adequate dynamic.

The advantage of the first procedure is a comparatively small input. The disadvantage is that all studies will identify the same trends that afterwards are projected onto the regional level. The second alternative better allows for regional specifics and in particular it can reveal regional linkages between different competences. The second method is more elaborate, however, and the results do not always relate to the global trends.

The Niederrhein University of Applied Sciences meanwhile has elaborated several studies[4] for north rhine-westphalian regions which had the intention to identify the regions' future fields of competence (cluster potentials). The procedure chosen in all these studies uses logical-deductive and empirical-inductive elements of analysis and is a combination of both procedures described before; in doing so the advantages should be used and the disadvantages be avoided.

2.1. Logical- deductive identification

In a dynamically developing economy there are interdependencies between economic growth and structural change. Different branches will develop at very different growth-rates. So relative shifts of importance between the sectors will be normal and that means structural change by branches of industry. The loss of significance of shrinking branches and the increase of significance of expanding branches in turn increase the macroeconomic growth potential. The exhaustion of these growth potentials is the motor of the structural change. The reasons for structural change principally can be assigned to three groups[5]: Structural change can be caused by the supply side, by the demand side or by institutional aspects: In its co-action the determinants of structural change determine the long run structural development of national economies and their regions. The resulting structural changes can be analyzed by means of logical deduction. Just this is the subject of the first step. At first global trends will be elaborated – examples are the internationalization of production, the globalization of markets, the aging of the society or the stronger emphasis on quality of life and sustainability. Based on these trends branches and complexes of branches are identified by logical-deductive considerations that let expect an above-average growth in the future – e.g. bio- and gene technology, new materials or information and communication technologies. Of course such considerations are no exact prognoses, they only can provide strategical information for decision makers (e.g. for the regional development agencies) and they lead to a better understanding of those factors that determine long-run economic development. They also can be impulse for further discussions on future developments and innovations (Cp. Meyer-Krahmer 2002, p. 34).

2.2. Empirical-inductive identification

An empirical-inductive analysis completes the deductive analysis. Its intention is the identification of future fields of competence which can be aimed at by a cluster-oriented

[4] These studies deal with the cities of Mönchengladbach, Krefeld and Leverkusen as well as the district of Viersen; cp. Hamm/Wenke 2003, Hamm/Pflipsen/Wenke 2007, Hamm/Kaldasch/Wenke 2007 and Goebel/Hamm 2007.

[5] For a similar systematic cp. Meißner/Fassing 1989, p. 60ff.

regional policy. In the mentioned studies a future field of competence for a region is defined as a branch or a complex of branches,

- ... that is of more than average importance on the regional level in comparison to the national or state level.
- ... where a more than average economic development can be expected so that it can become a regional motor of growth.[6]

In order to empirically identify the fields of competence a great number of indicators is available that all can be calculated on basis of employees, enterprises or turnovers (cp. Krätke/Scheuplein 2001, p. 38-71):

- **Importance:** Quotas by branches can give a first impression of the regional importance of branches (complexes of branches). Beyond it statistics on relative concentration as for instance location coefficients can give additional information about potential clusters. Statistics on the regional distribution of economic activity within a region (Lorenz-curve, Gini-coefficient) also might give helpful information but are less concrete and more difficult to interpret.
- **Dynamics of growth:** As the calculation of projections by branch on the regional level were not taken into consideration because of its high input regional dynamics by branches are analysed only ex-post. In doing this growth rates, regional growth-elasticities and shift-share-analysis are the usual instruments. Aside, the discussion of regional perspectives of development has to be carried out against the background of existing projections by branches on the national level.

At Niederrhein University of Applied Sciences a method has been chosen that makes use of indicators simple to interpret that all are based on employment data.[7] Starting with "2- digits" of the NACE-classification the method more and more goes into detail – so it could be called "top-down-approach". Main focus is on the importance and the past development by branches:

- To identify the branches of industry that are of special importance in the analysed region the quotas by branches are calculated; they provide information as to the absolute importance of branches. Aside the location coefficients[8] are used as a source of information; as a relation of regional and national quotas by branches the localisation coefficients give information about the importance of a branch in the analysed region in comparison to the supra-regional level (in this case to the state of North Rhine-Westphalia).
- In addition, the analysis of employment growth by branches gives information about the dynamics of development. In this part of the analysis changes on absolute and percentage bases as well as regional growth elasticities are considered.[9] The regional growth elasticities show growth differences between the analysed region and the supra-regional level.

In order to classify the branches portfolio-analyses are elaborated, too. They consider the regional concentration by branch – measured by the location coefficient – and its dynamics of development – measured by absolute change of employment. Branches with employment

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[6] In extension of the original idea of clusters branches/complexes of branches that do not let expect an above-average development are characterised as viable for the future if they are of traditional importance for the analysed location, possess a specialised innovation potential and thus can contribute to the stabilisation of regional economic development. Examples are the textile and clothing industry at Niederrhein Area or the textile mechanical engineering industry at Mönchengladbach.

[7] Statistical basis are the employment data stemming from the German social insurance differentiated by branches according to the NACE-classification for the years 1999 to 2005.

[8] For a definition cp. e.g. Schätzl 2000, p. 63-65.

[9] Regional growth elasticities measure the growth differences between a region and the supraregional level, e.g. national. They are defined as: $_{R,G} = (1 + w_R)/(1 + w_G)$, where w_R is the regional growth rate and w_G: is the national rate of growth. If the regional growth elasticity is above one it means that the analysed region shows a better development than the national economy; the elasticity is identical to the regional factor of a shift-analysis. Cp. Schätzl 2000, p. 77-85.

growth and a location coefficient above one are called „motors of employment“, those with employment growth but a location coefficient below one are called “climbers”. “Problem branches” show a decreasing employment and a location coefficient above one. Industries with decreasing employment and a location coefficient below one are excluded from further considerations.

Based on the analysis of the “2-digits” of the NACE classification the analysis is widened to the “3-digit-branches”. This shall give confirming hints for previous conclusions and concretize them if necessary. In the analysis of the “3-digit branches” all industries are excluded from consideration, whose part of total employment is below 0,2 %. In the second step all those branches are identified that show an employment growth, a regional elasticity above 1 and a location coefficient of at least 1,2.[10] Finally, even information about “4-digit-branches” is used in a few cases.

As the future fields of competence identifiable on basis of logical considerations (e.g. biotechnology, information and communication technology, environmental technology, new materials) often do not exist as a branch of the official NACE classification, these cross-sectional-industries were defined using official classification in a further step[11] to study its regional relevance and growth-dynamics afterwards.

Clusters do not only consist of one “core industry”, but include important providers of intermediates as well. Therefore, important forward and backward linkages of the regional fields of competence are analysed in a supplementary step. As these linkages at the regional level are not known in detail, national input-output tables are used for this purpose[12]. Even if the national forward and backward linkages usually will not be identical to the regional ones, their analysis can give some hints about possible linkages on the regional level.

In all cases the described quantitative analysis made it possible to identify regional fields of competence and their possible regional linkages – including for example textile and clothing industry and mechanical engineering in Viersen and Mönchengladbach, materials on textile, chemical and metallic basis in Krefeld, materials on chemical basis in Leverkusen. But only the existence of competences inside of regional structures by industry does not tell too much about the firms’ willingness for co-operation in regional networks, which is necessary to realise the synergetic effects in practise that are supposed by cluster theories.

3. The firms’ willingness for interaction

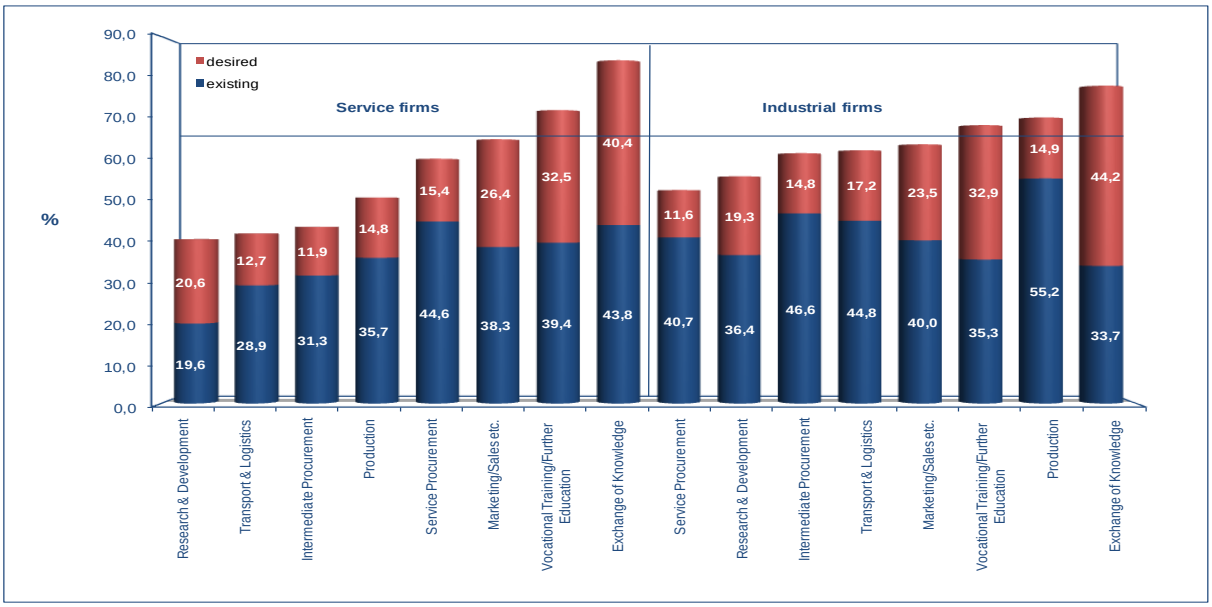
To find out whether there is only a more or less accidental accumulation of enterprises of one value chain at a location, whether these firms are already linked with each other or rather want to build up such linkages in the future, the identified fields of competence must be subject of further qualitative analyses. Therefore, written surveys of enterprises were carried out. The surveys were limited to possible addressees of a cluster-oriented regional policy, namely to enterprises that can be assigned to the previously identified fields of competence. The main aim of these surveys was to get information about potentials for the development of regional networks. The questionnaires were sent out during the second half of 2006. The response rates in the analysed regions reached values between 12 and 15 %. For this paper responses of all analysed regions were pooled in order to find out similarities in response behaviour[13] that can be

[10] To be included branches should be represented (“noticeably”) above average in the region; it was relatively arbitrarily assumed, that this is the case if the value of the location coefficient exceeds 1,2.
[11] In most cases it was possible to find definitions already used in literature.
[12] For the keynote of this procedure cp. Feser/Bergmann 2000.
[13] Though the surveyed regions are situated to each other in spatial proximity, induced biases in response behaviour by this should be rather low. Biases due to the existence of large firms were not observable in the sample either. Thus, the generalisation of the results should be possible.

generalised. 300 responses make it possible to differentiate at least between production and service industries.

First question to be cleared is the level of the firms' interest in co-operation and networking. To answer this question and to get an overview of the already existing and the desired structures of co-operation and networking by spheres of action, the enterprises were firstly asked for their network contacts. Co-operations/contacts in a network are defined as formal and informal contacts that go behind pure purchase and sale of products and services. Figure 1 summarizes the firms' answers. In the diagram the sum of firms involved in networks and of those firms that wish an intensification of networking is regarded as an indicator for the firms' total interest in networking. Depending on the subject these sums are between 40% and 84% in the case of services and between 52% and 78% in the case of industrial firms. According to this, the interest in networking of the firms belonging to the fields of competence is relatively high. Apparently the exchange of knowledge is seen as the most important sphere of cooperative action by both groups of enterprises. The share of the existing plus desired co-operations in this field of action is 77.9 % (industrial firms) or rather 84.1% (service firms). In fields "production" and "vocational training and further education" more than two-thirds of the interviewed industrial enterprises already participate in existing networks or rather want to take part in it. And in the fields "transport and logistics", "marketing/sales/advertising/design /trade fairs" and "intermediate procurement" the accumulated shares of the industrial firms are barely below two-thirds. This information not only tells a lot on the firms' willingness for networking but also identifies the mentioned topics as important spheres of action for co-operation. As to service industries in addition to the exchange of knowledge "further education" and „marketing/sales/advertising/design/trade fairs" are important spheres of action for networking. The service firms' interest in co-operations in other spheres of action is recognisably less pronounced; for them co-operations in "research and development" are of little interest with a share of merely 40%.

Figure 1: Co-operations by Spheres of Action (Industry and Services)

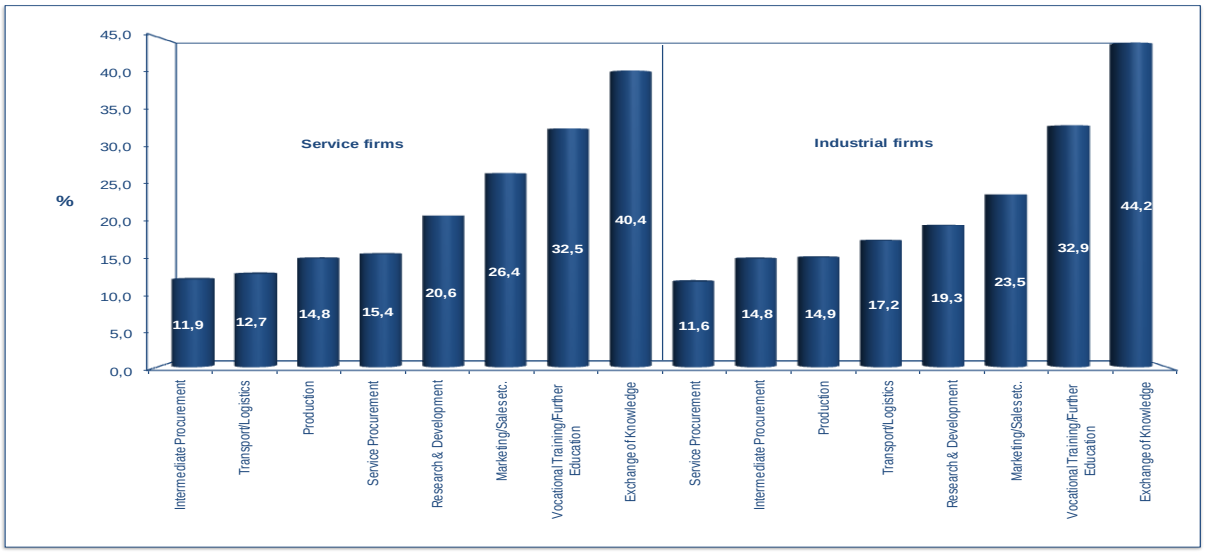


If in the next step one differentiates between already existing and additionally desired co-operations, one can notice that the intensity of the industrial firms' co-operation in the field of production is the highest – more than 55 % of the firms already make use of such possibilities. The shares of the firms already involved in co-operations are anyway around 45 % in the fields of "intermediate procurement" as well as in the field "transport/logistics". All in all, in none of the subjects the share of firms cooperating with others is below one third. Service enterprises are involved in co-operations to a comparable extent. This especially applies to "procurement of

services" (44.6%) and the exchange of knowledge (43.8%). But also in the areas of "further education" (39.4 %), "marketing/sales/advertising/design/trade fairs" (38.3%) and "production" (35.7%), more than one third of the firms already work on co-operations. These figures explicitly prove that firms see benefits of co-operation and the setting up of networks; the figures also show that they already make use of these advantages.

Figure 2 shows which spheres of action additional potentials of co-operation can be found. For industrial firms, the topics "exchange of knowledge", "further education" and "marketing/sales/advertising/design/trade fairs" belong to the subjects with the highest additional potentials for co-operation. In these spheres of action, between 23.5% and 44.2% of the firms wish for additional possibilities of co-operation and/or networks. For service companies, a very similar result can be seen: Between 26.4% and 40.4% of the service providers wish for further possibilities of co-operation in these spheres. The wish for co-operation in "research and development" is worth mentioning; for industrial firms and service industries as well the potential of co-operation reaches about 20%. As to all other spheres of action there is indeed a smaller interest in additional co-operation, but the shares lie between 10% and 20% after all. The smaller interest can partly be due to a high grade of already realised co-operations. Generally, the results show that the enterprises want to take advantage of networking and co-operation more intensively. It remains unexplained here, whether public authorities (e.g. municipal development agencies) should intervene and support networking. If this question deserves an affirmative answer, the support of knowledge exchange will be a reasonable starting point for building up or strengthening firm networks. The firms' statements also indicate "further education" as a possible departure for action. Because of the already existing co-operations it would be possible in both cases to build upon experiences at hand and to integrate firms into already established networks.

Figure 2: Desired Co-operations by Spheres of Action (Industry and Services)



Beside the spheres of action the firms' potential partners for networking and co-operation are of interest, too. Figure 3 gives an overview of the firms' existing network partners and their wishes for intensifying these contacts. Again, the sum of the existing and desired co-operations can give an impression of how the importance of networks and co-operations is judged by the enterprises: The lowest percentage shown in the figure is 52.5% (networks of industrial firms with firms of other branches). This value again underlines the importance of co-operation for the enterprises. A look into the details shows that at least two third of industrial firms desire companies from related branches, the chambers of industry and commerce or rather the chambers of handicrafts, universities and research institutes, companies of the same branch and

the regional development agencies as partners for networking. Furthermore, the service industries similar often mention federations of enterprises and firms of other branches as partners of choice in networks.

Figure 3: Networks by partners (Industry and Services)

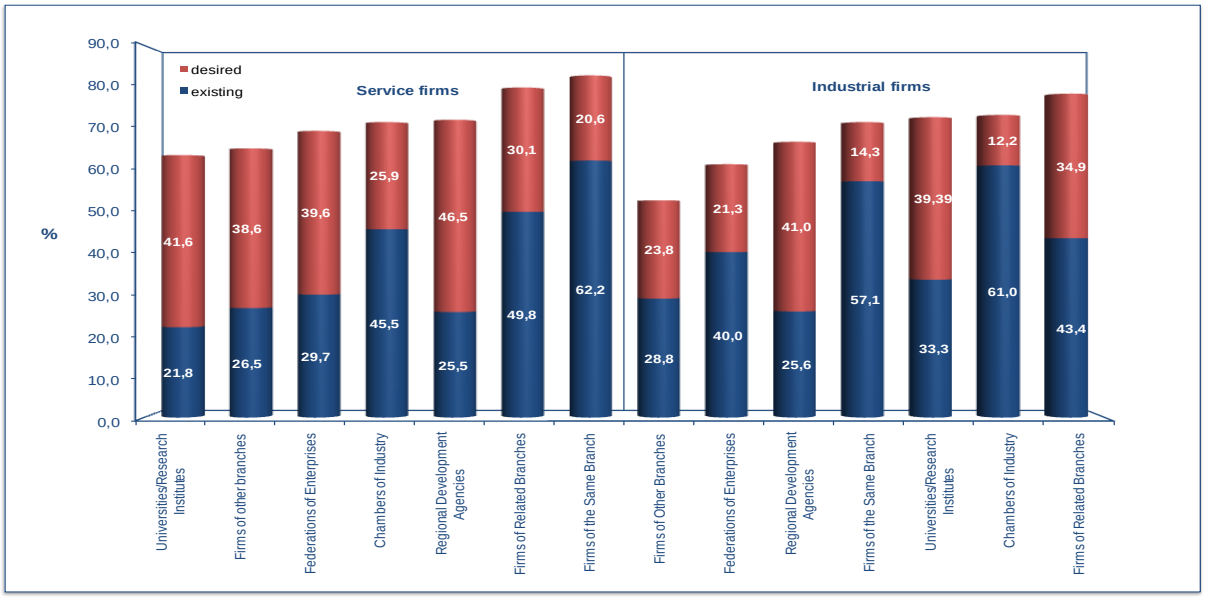
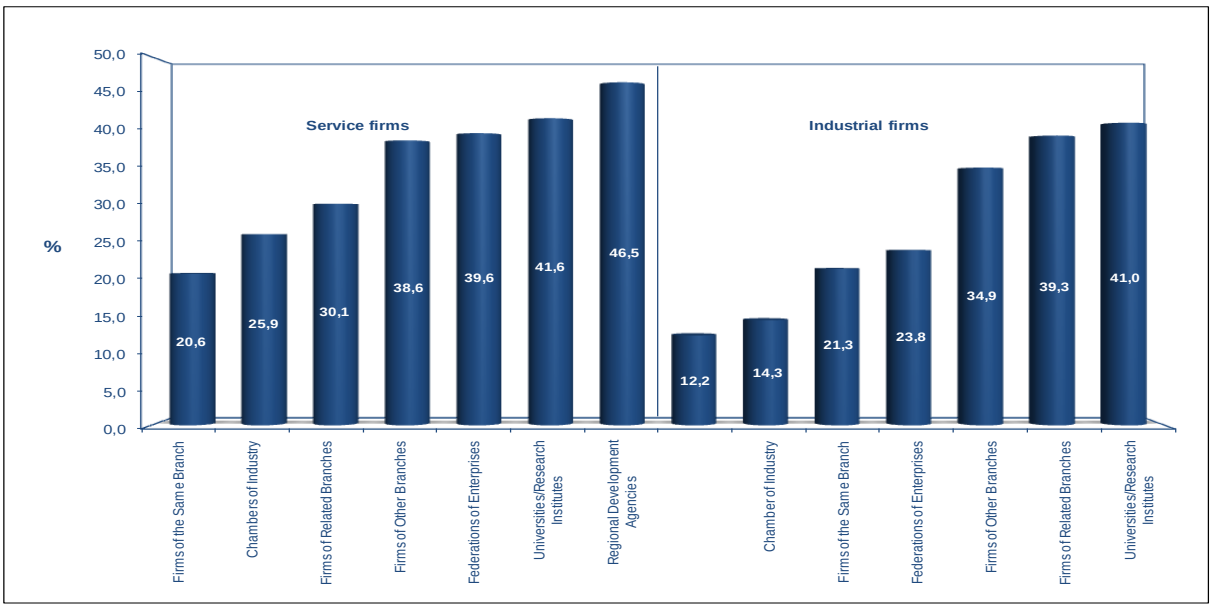


Figure 4: Desired networks by partners (Industry and Services)



To identify more properly the potential for an expansion of co-operations and networks, the additionally by the firms desired partners are again dealt with separately. Figure 4 shows that in principle this potential is higher for service industries than in manufacturing. For both groups of enterprises additional co-operations with regional development agencies are of special importance. This indicates that the firms regard the representation of regional interests within functioning networks as relatively important. As to universities and research institutes both groups of enterprises wish a higher degree of co-operation. Beside this, firms from related branches are most interesting for manufacturing firms; for the service industries additional

potentials for co-operation exist with federations of enterprises and with firms of other branches.
Regarding the desired partners of co-operation the results complete the previous picture. According to this, networks with other firms (of the same, of related, but also of other branches) are most important for enterprises, if the exchange of knowledge moves into focus. Regional development agencies could take the task of moderating and co-ordinating, because the wish for intensifying contacts with them is definitely recognizable by both groups of firms. In contrast, universities and research institutes could be important networking partners in areas as "further education" or "research and development".

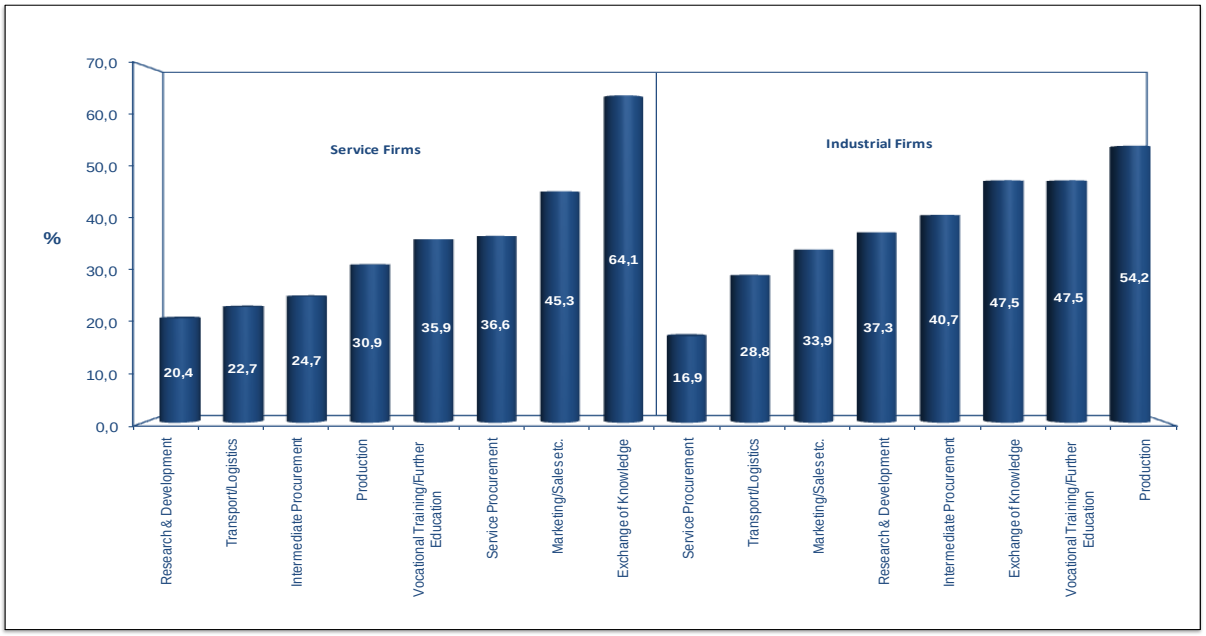
Table 1: The role of spatial proximity for networking contacts

	Service Firms - %			
	very important	important	less important	unimportant
Firms of the Same Branch	18,1	25,9	40,4	15,5
Firms of Related Branches	11,9	37,8	35,7	14,6
Firms of Other Branches	12,0	34,8	34,8	18,5
Universities and Research Institutes	15,5	36,5	27,6	20,4
Federations of Enterprises	14,4	42,8	25,7	17,1
	Industrial firms - %			
	very important	important	less important	unimportant
Firms of the Same Branch	11,8	14,1	49,4	24,7
Firms of Related Branches	9,4	36,5	32,9	21,2
Firms of Other Branches	6,1	26,8	37,8	29,3
Universities and Research Institutes	17,6	42,4	24,7	15,3
Federations of Enterprises	11,9	36,9	31,0	20,2

Finally, the question of the networks' spatial dimension arises. Therefore, the enterprises were asked to evaluate the importance of spatial proximity to their networking partners. In doing so a four-stage-scale of evaluation (very important, important, less important, and unimportant) was used; the results of the survey are presented in table 1. If one only looks upon the average evaluations, this could give the impression that the relevance of spatial proximity should not be overestimated: Average evaluations in the range between 2.4 and 2.9 on a scale going up to 4 indicate that the firms consider spatial proximity as desirable, but not as urgently necessary. The details listed in the table give some more insight than the average evaluations. They firstly show that the relevance of spatial proximity is evaluated in different ways depending on the co-operation partners. Spatial proximity is most important in case of industrial firms' co-operations with universities and research institutes; 60% of all firms consider spatial proximity as important or even very important in this case. These figures demonstrate a remarkable potential for co-operations between industry and universities in the nearby region. Spatial proximity plays a minor role for co-operations between industrial firms of the same branch – only 26% of the industrial firms think this to be important and very important. In case of the other potential co-operation partners, 33% (firms of other branches), 47% (firms of related branches) and 49% (federations of enterprises) of the industrial firms state that spatial proximity is very important or important for co-operation. In case of service companies, similar evaluations of spatial proximity can be found for all potential co-operation partners – the average evaluations only show a very small variation. Depending on the co-operation partners, between 47% (firms of other branches) and 57% (federations of enterprises) of service companies consider spatial proximity as important or very important. So – if one does not take into account universities and research institutes – spatial proximity of the co-operation partners appears to be of less importance for service companies than for industrial firms. In principle, the results confirm the conclusion, which was pointed out for small firms by Arndt and Sternberg, namely that the

benefits of co-operations on the regional level might be quite high in spite of numerous networks on national and international level (cp. Arndt/Sternberg 2000, p. 465).[14]

Figure 5: Spheres of action for an intensification of co-operations



The firms' answers to the question, whether and in which spheres of action they can imagine an intensified co-operation with other enterprises on the regional or local level, further confirm the importance of spatial proximity. For altogether about half of the industrial firms and even 80 % of the service companies show interest in intensified co-operation on regional level. The differences between industry and service companies are quite comprehensible – in spite of an increasingly supra-regional orientation, service procurement still has a higher degree of regional orientation than industrial production. Figure 5 illustrates on which spheres of action local or rather regional networks should concentrate from the firms' point of view. First of all, it can be noticed that the ideas of industrial firms and service companies are partly identical and partly different. Both groups have a high interest in a general exchange of knowledge on the regional level. This can also be explained by the fact that the exchange of knowledge is a sort of essential pre-stage of an intensified co-operation. In addition to this, service companies have the highest interest in an intensification of local networks in the areas of "marketing/sales/advertising/design/trade fairs" and "service procurement" as well as in the field of "further education", while industrial firms mention "production", "further education", "intermediate procurement" as well as "research and development" as the most important spheres of action.

4. Concluding Remarks

More and more regional and municipal economic development agencies think about reorienting their activities in terms of cluster-oriented approaches or already have realised this. Before cluster-oriented concepts can be realised, the regional fields of competence have to be identified (as potential clusters), however, and the willingness to interact of regional firms belonging to the identified fields of competence has to be ensured.

On the one hand, this article describes a solution for these both problem fields. In doing so, the potential clusters of a region (fields of competence) are identified by combining logical-

[14] For a theoretical discussion of the role of spatial proximity cp. Boschma 2005, p. 61ff.

deductive and empirical-inductive elements of analysis. This rather quantitative analysis for the identification of fields of competence is complemented by qualitative analyses based on a firm-survey. The main aim of these qualitative analyses is to get information about the general willingness for interaction in (regional) networks and about possible fields for co-operations. As a result of this procedure, the regional development agencies not only get information about the regional "strengths to be strengthened", but also about the questions whether firms assigned to the fields of competence are interested in regional networks and which field of action is most important for them.

On the other hand – based on the results of the firm-survey – this article also allows (or rather confirms) some conclusions that can be generalised and that might be helpful for development agencies:

- The interest of the firms in co-operations and networking can be classified as being high up to very high. On the one hand, this is due to the fact that firms are to a noticeable extent already integrated in networks; but on the other hand this is also due to the fact that the firms wish for additional co-operations and networks. Apparently, the firms see advantages of co-operation and the creation of networks; they already make intensive use of these advantages, but they want to benefit from these advantages still more intensively in the future.
- Other firms – from the same branch or from related branches – are the most important partners in networking and co-operations. Both from the industrial firms' perspective and from the service companies' perspective, an increased involvement of regional development agencies in networks is of special importance. The reason for this can be that the development agencies only play a subordinated role in existing networks up to now. But the result is also a clear indication of the fact that the firms consider representation of regional interests within an efficient network as comparatively important.
- With respect to universities and research institutes, firms wish for more co-operations and networks. Those networks could make a contribution to the strengthening of regional competitiveness by increasing innovation as well.
- For the already existing networks as well as for additional desired networks, the mere exchange of knowledge is considered as the most important sphere of action by the enterprises. Beside this the main focus of existing co-operations is rather on areas such as "production" and "procurement of services and intermediates", while "vocational training and further education" as well as "marketing" still offer remarkable potentials for additional network co-operations.
- A relatively high part of the firms apparently consider regional networks and spatial proximity as not urgently necessary, but nevertheless the firms see clear benefits from them. From the region's point of view, this can be a chance; if it is not used, there is the risk that the firms indeed utilise the synergies of co-operation in their own interest, but this will at best coincidentally benefit the regional economic development.

While to take advantage of the "regional opportunity", the development agencies could take over important functions: After the identification of regional fields of competence (cluster potentials) by an accurate analysis, development agencies could care for the cluster-management and by their activities, they could contribute to lead a field of competence to an efficiently working cluster. For this, it would apparently be helpful to initiate and to intensify the exchange of knowledge between the firms within a field of competence; something that starts with the exchange of knowledge, can definitely give way to further co-operations in other subject areas. The involvement of regional universities and research institutes in networks seems to be particularly important, because firstly it is desired by the firms and secondly improves the position and the development perspectives of the respective university/institution which again can contribute to the increase the regional innovation potentials.

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ESTIMATING TECHNICAL INEFFICIENCY: AN EMPIRICAL APPROACH TO EU INDUSTRIES

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Abstract:
This paper estimates, incorporating a Transcendental Logarithmic Production Function, the technical efficiency level of different industries in selected E.U. countries. The paper considers panel data for inefficiency effects in stochastic production frontier based on Battese and Coelli (1995), providing translog effects, as well as industry effects. The empirical model accommodates not only heteroscedasticity but also allows the possibility that an industry may not always produce the maximum possible output, given the inputs. Unlike most studies, the paper estimates time – varying technical efficiencies (incorporating 'learning – by doing' behaviour) as industry-specific fixed effects. Furthermore, the model decomposes total factor productivity (TFP) growth into two components: technological growth (essentially, a shift of production possibility frontier, set by best-practice enterprises) and inefficiency changes (i.e., deviations of actual output level from the production possibility frontier).

Key Words: Efficiency, Technical Inefficiency, Stochastic Frontier Model

1. Introduction

The main core of modern economic theory is based on the assumption of optimising behaviour, either from a producer or a consumer approach. As far as producer behaviour is concerned, economic theory assumes that producers optimise both from a technical and economic perspective:

1. From a technical perspective, producers optimise by not wasting productive resources.
2. From an economic perspective producers optimise by solving allocation problems involving prices.

However, not all producers succeed in solving both types of optimisation problem under all circumstances. For this reason it is important to analyse the degree to which producers fail to optimise and the extent of any resulting distances from the frontier of full technical and economic efficiency. Based on this assumption, one of the main analytical approaches to efficiency measurement is the analysis of production frontiers. This chapter presents an empirical model application dealing with productive efficiency estimation. This paper has four distinct goals:

1. develop a model of efficient producer behaviour and investigate possible types of departure from full technical efficiency level
2. develop an analytical econometric technique for examining the above
3. analyze the level and the development of an industry's productive efficiency along with the determining factors
4. to demonstrate the obtained results and come to safe conclusions as far as modelling producer behaviour at industry level (applied production analysis) is concerned.

The main research questions arising could be summarized into what are the reasons for diverging efficiency in a production industry, which factors contribute to production industries

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efficiency differences, and finally, how the efficiency of a production industry evolves over time, with respect to technical progress and other related determining environmental factors.

2. Stochastic Frontier Production Function

Our research approach is based on the framework of a stochastic frontier model [as firstly independently proposed by Aigner et al. (1977) and van den Broeck (1977)]. As described in Movshuk (2004), while early stochastic frontier models were mainly implemented with cross – sectional data, Battese and Coelli (1995) model is formulated for panel data (which may also be unbalanced). Moreover, the model not only estimates inefficiency levels of particular industries, but also explains their inefficiency in terms of potentially important explanatory variables. The model decomposes TFP growth into two components: technological growth: a shift of production possibility frontier set by best – practice industries, and inefficiency changes: deviations of actual output level form the production possibility frontier.

In our model analysis, we follow the approach of modelling both the stochastic and the technical inefficiency effects in the frontier, in terms of observable variables, and estimating all parameters by the method of maximum likelihood, in a one - step analysis[1]. Thus, we undertake an (one – step) estimation of the stochastic frontier model in conjunction with the parameters of the variables included to explain efficiency effects, as developed by Battese and Coelli (1992, 1995)[2]. The model is a time – varying stochastic frontier model given a sample of *N* industries for *t* time periods[3]. The industries are assumed to produce a single output ($x_{i,t}$) from inputs of capital ($K_{i,t}$) and labor ($L_{i,t}$). The basic specification is of a flexible (second – order) transcendental logarithmic (translog) production function model (Kumbhakar, 1989, 2000)[4] with time variable included in the stochastic production function:

$$\ln Y_{it} = \alpha_0 + \sum_j a_j \ln X_{jit} + \alpha_t t + \frac{1}{2}\sum_j \sum_k \alpha_{jk} \ln X_{jit} \ln X_{kit} + \frac{1}{2}\alpha_{tt} t^2 + \sum_j \alpha_{jt} \ln X_{jit} t + v_{it} - u_{it}$$

In this model:

- Y_i is the production (or the logarithm of the production) of the i^{th} industry
- x_i is a k×1 vector of input quantities of the i^{th} industry

[1] Battese and Coelli (1995) suggested that under the assumption of truncated normal one-sided error term, the mean of the truncated normal distribution could be expressed as a function of certain covariates, a closed form likelihood function can be derived, and the method of maximum likelihood may be used to obtain parameter estimates, and provide inefficiency measures.

[2] When employing regression analysis in the second step to explain the variation of the efficiency scores, it is likely that the included explanatory variables fail to explain the entire variation in the calculated efficiencies and the unexplained variation mixes with the regression residuals, adversely affecting statistical inference. The use of a stochastic frontier regression model allows for the decomposition of the variation of the calculated efficiencies into a systematic component and a random component.

[3] Finally, our model employs panel data set. In contrast to other stochastic frontier specifications, the major advantage of this approach is that it does not require any *a priori* assumption regarding the distribution of efficiency across decision making units (Stephan et al., 2008).

[4] As far as the functional form of the stochastic production Function is concerned, estimation of the Stochastic Production Function requires a particular functional form of the production function to be imposed. A range of functional forms for the production function frontier are available, with the most frequently used being a translog function, which is a second order (all cross-terms included) log-linear form. As broadly described in Khalil (2005), the translog function is an attractive flexible function. This function has both linear and quadratic terms with the ability of using more than two factor inputs. Moreover, this is a relatively flexible functional form, as it does not impose assumptions about constant elasticities of production nor elasticities of substitution between inputs. It thus allows the data to indicate the actual curvature of the function, rather than imposing *a priori* assumptions.

- t is a time – specific effect
- ln represents the natural logarithm
- the subscript i represents the i^{th} industry
- β is a vector of unknown parameters
- V_i are the random variables which are assumed to be iid. $N(0, \sigma_v^2)$ and independent of the U_i which are non – negative random variables, accounting for technical inefficiency in production, and assumed to be iid. $N(0, \sigma_U^2)$.

As a double - log form model (where both the dependent and explanatory variables are in natural logs), the estimated coefficients show elasticities between dependent and explanatory variables, relaxing the restrictions on demand elasticities and elasticities on substitution Fried (2008)[5]. The stochastic frontier production function and the technical inefficiency models are jointly estimated by the maximum-likelihood method.

3. Model Description

To investigate the determinants of the productive efficiency, we distinguish between two variable groups used in the econometric analysis:

1. First, variables internal to the industry, representing industry - type effects
2. Second, variables external to the industry, namely environmental variables, representing country – type effects

As far as the industry – specific variables are concerned, following a value added approach, and the analysis comprises:

1. Output (in Gross value added, volume indices, 1995 = 100)
2. Labour input (in Labour services, volume indices, 1995 = 100
3. Capital input (in Capital services, volume indices, 1995 = 100)
4. Moreover, the model includes a time variable to capture the effect of technical progress, namely representing technical efficiency across countries in the years 1980 - 2005.

For this analysis, the output is the dependent variable while the explanatory variables are the factors of production which are inputs into the production process. However, as an innovative approach, our analysis includes time as a specific variable, in order to capture evolution and differences in technical progress. Technical progress is a major value added determinant as new technologies allow the automation of production processes which lead to many new and improved products, allow for better and closer links between industries, and can help improve information flows and organization of production. At the same time, technical progress can be embodied in new equipment and trained workers may only be fully productive if there is the appropriate equipment with which to work. Increases in physical capital are clearly necessary as there are spillovers from capital investment to productivity growth. Generally, it is the combination of these three factors and the way in which they are organized and managed within the industry which determines the extent of productivity growth.

[5] However, the generality of the functional form produces a side effect: they are not monotonic or globally convex, as in the Cobb – Douglas model.

Maximum likelihood techniques are used to estimate the frontier and the inefficiency parameters. We adopt the standard flexible translog functional form to represent the technology, including the time variable *time* in order to account for technical change effects. More specifically, in our model, the three - input translog production function presenting both linear and quandratic terms and it may be written as follows:

$$\ln va = \alpha_0 + \beta_K \ln cap + \beta_L \ln lab + \beta_T time + \tfrac{1}{2}\beta_{KK} \ln cap^2 + \tfrac{1}{2}\beta_{LL} \ln lab^2 + \tfrac{1}{2}\beta_{TT} time^2 +$$

$$\beta_{KL} \ln cap \ln lab + \beta_{KT} \ln captime + \beta_{LT} \ln labtime + (v_{it} - u_{it})$$

where, α_0 is the intercept of the constant term, β_K, β_L, β_T are first derivatives, β_{KK}, β_{LL}, β_{TT} are own second derivatives and β_{KL}, β_{KT}, β_{LT} are cross second derivatives

4. Parameter Estimation

The parameters of the stochastic frontier model and the inefficiency effects model are estimated using maximum likelihood estimation (MLE), which is the preferred estimation technique whenever possible (Coelli, Rao and Battese 1998, Battese and Coelli, 1993)[6]. The parameters estimated include β, λ and σ^2 where $\lambda = (\sigma_u / \sigma_v)$ and $\sigma^2 = (\sigma_u^2 + \sigma_v^2)$. Moreover, the model estimation results provide the joint probability density function (pdf) also known as the likelihood function. The likelihood function expresses the likelihood of observing the sample observations as a function of the unknown parameters β and σ^2. The maximum likelihood (ML) estimator of β is obtained by maximizing this function with respect to β[7]. Specifically, the maximum likelihood estimator can be shown to be consistent and asymptotically normally distributed with variances that are no larger than the variances of any other consistent and asymptotically normally distributed estimator (i.e. the ML estimator is asymptotically efficient).

4.1 Existence of Technical Efficiency: The parameter λ

A main instrument to measure the inefficiency component of the model is the parameter $\lambda = \frac{\sigma_u^2}{\sigma_v^2}$. The statistical significance of λ obtained from the ML estimates indicates the existence of a stochastic frontier function (Schmidt and Lin, 1984)[8]. If λ is statistically different from zero, it implies that the difference between the observed and the frontier production is dominated by technical inefficiency[9]. If λ is not statistically significant from zero, it implies that any difference in the production is attributed solely to symmetric random errors. In other words, industries operating on the frontier are accepted to be technically efficient and except for random disturbances, are receiving maximum output response for the combinations of the inputs used.

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[6] According to Battese and Coelli (1995), the explanatory variables can include intercept terms or any variables in both the frontier and the model for the inefficiency effects, provided the inefficiency effects are stochastic.

[7] Thus, in the special case of the classical linear regression model with normally distributed errors, the ML estimator for β is identical to the OLS estimator.

[8] If the parameter λ is significant, this indicates that the use of the frontier production function is appropriate.

[9] The parameter λ is an indication that the one sided error term u dominates the symmetric error v, so variation in actual production comes from differences in industries management practice rather than random variability.

4.2 Measurement of Technical Efficiency: The parameter γ

Technical efficiency can be measured using a variance ratio parameter denoted by γ as follows (Battese and Corra, 1977): $\gamma = \frac{\sigma_u^2}{\sigma^2}$, where $\sigma^2 = \sigma_u^2 + \sigma_v^2$, $\sigma = \left(\sigma_u^2 + \sigma_v^2\right)^{1/2}$ and $0 \le \gamma \le 1$. Using the composed error terms of the stochastic frontier model, γ defines the total variation in output from the frontier level of output attributed to technical efficiency[10] indicating the ratio of the unexplained error and the total error of the regression (Aigner, Lovell, Schmidt, 1977). The variance parameter γ captures the total output effect of technical efficiency, suggesting the percentage (%) of the residual which is due to inefficiency. Considering the variance parameter γ lies on the interval [0,1], if the estimate is close to 1 and significant, this indicates that most of the total variation in output is attributable to technical efficiency.

4.3 Measurement of Technical Efficiency: The LR – test parameter

Before proceeding with the estimation of the SF models, it is important to ascertain statistically whether technical inefficiency effects are indeed present in the model. The model for inefficiency effects can only be estimated if the inefficiency effects are stochastic and have a particular distributional specification. Hence, there is growing interest to test the null hypotheses that the inefficiency effects are not stochastic; the inefficiency effects are not present and the coefficients of the variables in the model for the inefficiency effects are zero. These null hypotheses are tested through imposing restrictions on the model and using using the generalized likelihood ratio statistic (LR - test) to determine the significance each of the restrictions (Greene, 2003, Coelli, 1998). The generalized likelihood ratio statistic (LR - test) is given by: $LR - test = -2\{\ln[L(H_0)] - \ln[L(H_1)]\} = -2\ln\left[\frac{L(H_0)}{L(H_1)}\right]$, where $\ln[L(H_0)]$ and $\ln[L(H_1)]$ are the values of the log-likelihood function for the frontier model under the null and alternative hypotheses[11]. The LR - test indicates the ratio of standard deviation attributable to inefficiency relative to the standard deviation due to random noise. A straightforward implication of LR - test $\to 0$ is that either σ_u^2 goes to zero or σ_v^2 goes to infinity. Hence, no inefficiency exists and all deviations are due to random noise. Likewise, for LR - test $\to \infty$ we note that either $\sigma_u^2 \to \infty$ or $\sigma_v^2 \to 0$, which implies that all deviation are explained by inefficiency. Then, inefficiency is deterministic and resembles approaches excluding random noise[12], such as DEA (Koetter, 2006).

5. Empirical Implementation: Data Sources

Our analysis is based on estimating efficiencies as industry - specific fixed - effects at industry level of selected countries within European Union, during 1980 – 2005, employing the econometric software program LIMDEP 9.0. The countries selected to be included in the model are: Austria, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, and United Kingdom, in order to create a data set including both countries with strong industrial productive base, such as Germany and France, as well as countries with low industrial productive base, such as Spain. The data used come from the EU KLEMS data base of sectoral accounts for productivity analysis (O' Mahony et al., 2008). We use the EU KLEMS sectoral classification,

[10] A value of γ = 0.12 implies that 12% of the discrepancies between the observed and frontier values of output is due to technical inefficiencies.

[11] Various tests of null hypotheses for the parameters in the frontier production functions and in the inefficiency models are performed using the generalised likelihood-ratio test statistic.

[12] An insignificant estimate of LR - test means that no inefficiency prevails and all of the error is due to random noise and specification of a stochastic frontier model is inappropriate.

NACE 2 – digit level of industry disaggregating, comprising 13 manufacturing sectors: Electrical and optical equipment (30 - 33), Food products, beverages and tobacco (15 - 16), Textiles, textile products, leather and footwear (17 - 19), Manufacturing nec; Recycling (36 - 37), Wood and products of wood and cork (20), Pulp, paper, paper products, printing and publishing (21 - 22), Coke, refined petroleum products and nuclear fuel (23), Chemicals and chemical products(24), Rubber and plastics products (25), Other non-metallic mineral products (26), Basic metals and fabricated metal products (27 - 28), Machinery, nec (29), Transport equipment (34 - 35).

6. Description of the Variables

The model variables are transformed into natural logarithm forms, as presented in the table below. The depended variable is the natural logarithm of the product *(lnva),* namely, value added. The independent variables are set to be the labour *(lab)* and capital services *(cap),* along with time *(time),* denoting technical progress. Employing the model data set, we form the logarithmic variables:

Table 1: Description of Variables

Variable	Notation
Gross value added, volume indices, 1995 = 100	va
Labour services, volume indices, 1995 = 100	lab
Capital services, volume indices, 1995 = 100	cap
Natural logarithm of VA	lnva
Natural logarithm of LAB	lnlab
Natural logarithm of CAP	lncap
0.5 * (Natural logarithm of LAB * Natural logarithm of LAB)	lab2
0.5 * (Natural logarithm of CAP * Natural logarithm of CAP)	cap2
0.5 * (Time *Time)	time2
Natural logarithm of LAB * Natural logarithm of CAP	labcap
Natural logarithm of LAB * Time	labtime
Natural logarithm of CAP * Time	captime

Source: Own estimation

Furthermore, the industry dummy variables for the 13 industries (*ind1 – ind13*), as well as the industry composite dummy variables (denoting industry – specific effects) are created. In the first empirical analysis phase, all countries and sectors are included in the model simultaneously (composite dummies) to allow for technology differences, creating a dataset of 2704 observations. However, due to data - set irregularities, we exclude countries 1 and 2, as well as sector 7 from our current sample and also skip any missing values, resulting into o sample of 1872 observations – cases. Then we form the panel data set specification, for fixed – effects model, and proceed to estimation.

7. Empirical Model: Extended Translog Frontier Model

The analysis so far provides a solid background for further development of the model. Moreover, since any industrial sector may have in principle a different production function we add to the specification *m-1* intercept dummies for the industries aggregated. More specifically the model is extended in order to include industry specific effects (by employing industry composite dummies), so as to examine differences in efficiency level among different industries. For this reason, our model is estimated including the industry – specific composite dummies, as created above:

$$Y_{it} = \alpha_0 + \sum_{j=1}^{m-1} \alpha_j * Ind_j + \beta_1 K_{it} + \beta_2 L_{it} + \beta_3 T_{it} + v_{it} - u_{it}$$

However, this solution is not completely satisfactory as industry production functions may also differ in input marginal productivities. We therefore estimate the model including the cross products of industry dummies, as well as the first input products with the industry dummies. So the model becomes:

$$Y_{it} = \alpha_0 + \sum_{j=1}^{m-1} \alpha_j * Ind_j \sum_{j=1}^{m-1} \alpha j * Ind * input + \beta_1 K_{it} + \beta_2 L_{it} + \beta_3 T_{it} + v_{it} - u_{it}$$

We multiply the first and the cross – products by the industry dummies. In order to allow for industry – specific effects in the computation of the output elasticity for inputs, we have provided for the industry dummies to interact with the first – order terms. Two goals, first to account for different industry production function (*ind1 – ind12*), and second to account for different marginal input productivities (cross – products with industry dummies). The *ind 1 – ind12* dummies actually enter the equation by multiplying *lncap* to *time* by these variables and then entering these composite dummies to investigate whether factor inputs differ by industry.

Furthermore, one of the underlying objectives is to examine how environmental performance of the industries has an impact on the industry's technical efficiency. It is therefore important to explore what happens to the estimated model in the presence of environmental performance dummy variables. In order to analyze the determinants of productive efficiency, we relate the estimated productive efficiency to a number of explanatory variables and this is achieved when environmental performance dummy variables are included in the estimation. Under this model specification, we estimate different variations, so to investigate alternative model specifications. In this translog function we estimate the frontier model incorporating the industry dummies, as well as the industry - specific cross products, considering the variable *time* as explanatory variables in the inefficiency term. The results are as follows:

Table 2: Limited Dependent Variable Model

Limited Dependent Variable Model - FRONTIER	
Dependent variable	LNVA
Number of observations	1872
Log likelihood function	1748.065
Number of parameters	57
Info. Criterion: AIC	-1.80669
Finite Sample: AIC	-1.80475
Info. Criterion: BIC	-1.63817
Info. Criterion:HQIC	-1.74461
Variances: Sigma-squared(v)	.00782
Sigma-squared(u)	.35681
Sigma(v)	.08845
Sigma(u)	.59734
Sigma	.60385

Source: Own estimation

The model is a frontier model estimated with panel data. The Stochastic Production Frontier is denoted as: e=v-u, whereas the time varying efficiency is denoted as: u(i,t)=exp[eta*z(i,t)]*|U(i)|. Table (3) presents the empirical results.

Table 3: Empirical Results

Maximum Likelihood Estimates					
Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.61231161	2.76463153	.221	.8247	
LNCAP	-1.53590514	1.04912420	-1.464	.1432	4.53813827
LNLAB	2.24809667	.88569539	2.538	.0111	4.64818191
TIME	.07787319	.04320160	1.803	.0715	13.5000000
LAB2	-.41749862	.26931712	-1.550	.1211	10.8158946
CAP2	.21626666	.24352679	.888	.3745	10.3307444
TIME2	.00145739	.00037297	3.908	.0001	119.250000
LABCAP	.12750300	.19718155	.647	.5179	21.0930324
LABTIME	-.00546179	.00876350	-.623	.5331	62.3692144
CAPTIME	-.01178820	.00890251	-1.324	.1855	62.8256562
IND1	1.59124129	.55315646	2.877	.0040	.08333333
IND2	1.20735416	2.65524722	.455	.6493	.08333333
IND3	2.82617018	.84863628	3.330	.0009	.08333333
IND4	.49870893	.50758200	.983	.3258	.08333333
IND5	1.65176018	.60937735	2.711	.0067	.08333333
IND6	-.18807742	1.30616174	-.144	.8855	.08333333
IND8	2.62893768	.65304159	4.026	.0001	.08333333
IND9	-2.31829478	.56257237	-4.121	.0000	.08333333
IND10	-.99593474	1.17762351	-.846	.3977	.08333333
IND11	1.10415113	1.26767380	.871	.3838	.08333333
IND12	-.96021987	.66428505	-1.445	.1483	.08333333
LNCAPD1	-.25021330	.09739517	-2.569	.0102	.37753423
LNLABD1	-.14431649	.09532048	-1.514	.1300	.38837574
TIMED1	.01855404	.00354949	5.227	.0000	1.12500000
LNCAPD2	.30373226	.37146868	.818	.4136	.37617450
LNLABD2	-.47188219	.26791478	-1.761	.0782	.38535840
TIMED2	-.02662133	.00444067	-5.995	.0000	1.12500000
LNCAPD3	-.28758516	.17536909	-1.640	.1010	.38133607
LNLABD3	-.23098084	.11656763	-1.982	.0475	.38972613
TIMED3	-.02452837	.00503878	-4.868	.0000	1.12500000
LNCAPD4	-.38220997	.11930744	-3.204	.0014	.37960654
LNLABD4	.29580579	.11590306	2.552	.0107	.38383682
TIMED4	-.00401915	.00261014	-1.540	.1236	1.12500000
LNCAPD5	.32260660	.17165433	1.879	.0602	.38112430
LNLABD5	-.61467125	.14258846	-4.311	.0000	.38450072
TIMED5	-.01679339	.00765052	-2.195	.0282	1.12500000
LNCAPD6	.32297109	.16440959	1.964	.0495	.37286709
LNLABD6	-.19233467	.17343394	-1.109	.2674	.38400415
TIMED6	-.02393778	.00417977	-5.727	.0000	1.12500000
LNCAPD8	.00766992	.09123279	.084	.9330	.38079571
LNLABD8	-.54236140	.11041434	-4.912	.0000	.39087342
TIMED8	-.00717799	.00280822	-2.556	.0106	1.12500000
LNCAPD9	1.81865666	.32534989	5.590	.0000	.37480414
LNLABD9	-1.13731518	.32313174	-3.520	.0004	.38228242
TIMED9	-.04895054	.01447722	-3.381	.0007	1.12500000
LNCAPD10	.64598592	.23494940	2.749	.0060	.37896495
LNLABD10	-.35734708	.09825019	-3.637	.0003	.38765447
TIMED10	-.02114090	.00258184	-8.188	.0000	1.12500000
LNCAPD11	-.01068996	.24513770	-.044	.9652	.38435061
LNLABD11	-.12634486	.10583010	-1.194	.2325	.38898708
TIMED11	-.02512525	.00451094	-5.570	.0000	1.12500000
LNCAPD12	.76113424	.14608294	5.210	.0000	.38044290
LNLABD12	-.47142583	.10465387	-4.505	.0000	.38900706
TIMED12	-.02449134	.00546854	-4.479	.0000	1.12500000
Variance parameters for compound error					
Lambda	6.75335710	.03861506	174.889	.0000	
Sigma(u)	.59733899	.05726644	10.431	.0000	
Coefficients in u(i,t)=[exp{eta*z(i,t)}]*|U(i)|					
TIME	-.13299303	.00663005	-20.059	.0000	

Source: Own estimation

The log – likelihood value (1748.065) shows that the translog function provides good fit. However, only a number of the estimated coefficients are statistically significant for the two equations. The variance parameters λ and σ_u are both statistically significant, then there is evidence of technical inefficiency in the data. The variance parameter, γ, is approximately 0.97. This implies that of the total variation captured by sigma squared, 97% is as a result of the technical inefficiency in production processes while 3% could be attributed to other stochastic errors. The negative sign in the time trend means that overall technical inefficiency tends to decrease, since there is technical progress which decreases the inefficiency level.

8. Concluding remarks

This paper discusses the empirical findings of the technical and environmental efficiency of European Union industries in selected member - countries. The paper begins with a description of the model used, the data set used in the analysis and the definition of the variables. Then the empirical model is formed with estimation results. The results include reporting the estimated technical efficiency and the related explanatory variables. The paper provides the industry -level estimates of technical efficiency using the time-varying inefficiency model within a composite error framework.

From the analysis, it is evident that industries in the sample are far from being efficient. There is evidence that industries could improve their technical efficiency by being more technical efficient which entails choosing inputs and use them efficiently. Even though there is a notable improvement in technical efficiency after accounting for variations, technical inefficiency remains significant which calls for further investigation of the variations regarding to the alternative explanatory variables.

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PRODUCTIVE SPECIALIZATION AND REGIONAL DEVELOPMENT AT STATE LEVEL IN INDIA

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Abstract:
The purpose of this paper is to analyse the specialization of Indian productive structures in 2006, using specialization indicators, namely localization quotient estimation, in order to assess both the relative degree of concentration of a given activity in a certain area and the specialization coefficient, that helps characterize a region's economy according to its degree of specialization. Reference variables for specialization analysis purposes are Gross Domestic Product at factor cost at constant price (Base=99-00) and Employment for 2001 and 2006, in an attempt to compare differences observed between productivities, which, in turn, are related to purchasing power evolution within each territorial unit. The main aim of this study was, then, a thorough research into the time-spatial relationship between specialization, productivity and development.

Key-words: Sector Specialization; Regional Development; Specialization Index; Location quotient; Specialization Coefficient

1. INTRODUCTION

Productive specialization has always been at the heart of economic and regional development studies and recently produced regional science literature can provide some very good examples of it. It is the case of Akgüngör and Falcioğlu (2005), who addressed the question of the relationship between Turkey's transforming industry regional specialization patterns and European integration; Michaels (2006), who elaborated on the consequences of a resources-based specialization especially when it lasts for a long period; Alexiadis (2010) examined the localisation effects on regional convergence in Greece and Ezcurra et al, (2004), who wrote on regional integration in the E.U. examining the productive specialization in European Union's regions over the period from 1977 to 1999, using the information provided by various methodological instruments. The results obtained reveal a process of convergence in regional productive structures during the twenty-two year period considered.

Regarding regional integration and industrial localization, Traistaru and Iara (2002) developed research based on central and Eastern Europe countries within a project financed by E.U. Phare Program. The authors examine productive specialization in European Union regions over the period from 1977 to 1999, using the information provided by various methodological instruments. The results of their study point to a process of convergence in regional productive structures during the same period.

For Portugal Diniz and Sequeira (2009) analysed how the specialization of Portuguese productive structures has evolved between 1995 and 2004, using specialization indicators, namely

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localization quotient estimation, to assess both the relative degree of concentration of a given activity in a certain area and the specialization coefficient, that helps characterize a region's economy according to its degree of specialization.

Finally, Desrochers (2007) points out some shortcomings of traditional approaches to the study "knowledge spillovers" and suggests an alternative based on how knowledge is actually created and exchanged by individuals. Evidence is drawn from the history of technology, some Baltimore research-related activity cases conducted at the Johns Hopkins University and from a survey of Southern Quebec inventors, stressing the fact that regional specialization has long been thought of as both the logical outcome of market competition and the best geographical setting for innovation.

Partly as a result of this belief, policies promoting regional specialization through "industrial clusters" have enjoyed worldwide popularity in the last decade. In recent years, however, a heated debate as to whether local diversity or specialization of economic activity is the best incubator of technological change and economic growth has been raging.

According to Ahluwalia (2002) regional development has always been one of the declared objectives of national policy in India and so it is relevant to ask whether economic reforms have promoted this objective. India's federal democracy has been increasingly characterised by regionalization at state level, turning economic performance of individual states into an issue of potential electoral importance.

Recently a number of studies have established that regional disparity in India has widened, especially during the 1990s e.g. Ahluwalia (2000 and 2002); Shand and Bhide (2000). However, these studies have used pre-revised state domestic product (SDP) data.

For Lahiri (1969), regional disparities become clear when one compares proportionate distribution of population and industrial employment.

With recourse to specialization indicators, such as the localization quotient, which allows to assess the relative degree of concentration of a given activity in a given region and the specialization coefficient, which enables the characterization of a region's economy according to its higher or lesser specialization, it was possible to analyse the specialization evolution of Indian regional productive tissue in 2006. The reference variables chosen were Gross Domestic Product at factor cost at constant price (Base=99-00) for 2001 and 2006 and Employment for only 2006. The differences found were compared with productivities, which, in turn, were related to GDP per worker within each territorial unit. The main purpose of this study was, thus, to go deeper into the spatial and time relationship between specialization, productivity and development.

2. METHODOLOGICAL ASPECTS

2.1. Variables analysed

Productive specialization indicators used in this study focussed on two variables: - GDP and Employment in 2006. The territorial unit comprised Indian States and the reference unit was the whole of India's national territory.

In the case of employment, the origin of the worker is taken into consideration. That leaves room to three different types of analysis. Rural and urban employment can be dealt separately as well as together.

Data were collected from "Employment and Unemployment Situation in India 2005-06" National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and State Analysis Service.

Concentration/distribution of economic activities was analysed based on data for GDP and Employment concerning primary, secondary and tertiary sectors, respectively.

2.2. Productive Specialization indexes

Specialization indicators are statistic analysis measures which allow us to infer thesis and conclusions about the productive structure specialization of each territorial unit at two levels. On the one hand, they measure each territorial unit specialization compared against a reference model, both in global terms and for each of the activity sectors taken into consideration. In this case we are before relative specialization indicators, of which both the localization quotient and the specialization coefficient are two examples. On the other hand, it is possible to build absolute specialization indicators for each territorial unit, which will deal with characteristics revealed by the variable sectoral distribution in that territorial unit.

Localization Quotient

This indicator (LQ) is a localization measure, in the sense that it allows us to assess the relative concentration degree of a given activity (k) in a given region (i). Analytically $LQ_{ik} = (x_{ik}/x_j)/(x_k/x)$, where the numerator measures the concentration of the gross value added of region i in sector k and the denominator measures the concentration of the reference region's gross value added in sector k. The reference basis is the unit. Thus:

- ✓ $LQ_{ik} < 1$ – means that sector k in region i is not very significant, and that the region is not particularly specialized in sector k;
- ✓ $LQ_{ik} = 1$ – in this case the relative importance of sector k in region i equals its importance in the reference region;
- ✓ $LQ_{ik} > 1$ – means that sector k in region i plays an important role, and that the region is relatively specialized in sector k.

Localization quotients are useful tools to characterize regions internally and to compare them both among themselves and to the reference territorial unit. Additionally the analysis of their evolution in time, namely using descriptive statistical measures, allows us to approach the regions' internal dynamics as well as their inter-relationships, (Delgado and Godinho, 2005).

Specialization Coefficient

Determining the region's specialization coefficient (SCi) requires calculating its employment percentage in each sector, x_{ik}/x_i, and the same percentage relative to pattern x_k/x, determined by the following expression: $SC_i = \sum_{k=1}^{k} \left[\left| (x_{ik}/x_i) - (x_j/x) \right| \right] / (k-1)$.

The index allows us to characterize the region's economy in terms of its higher or lower specialization regarding its productive structure, when compared to the patterns with a variation in the interval $[0,1[$. If $SC_i = 0$, there is no specialization in region i compared to the pattern. The nearer the SC_i value is to 1 the higher the specialization of region i compared to the reference pattern (Delgado and Godinho, 2005).

2.3. Multiple Linear Regression

In order to establish a relationship between development, productivity and regional specialization a multiple linear regression is also performed, using SPSS statistical software.

As explaining variables we selected productivity, measured by the GDP per worker. As regards specialization, of the various indicators considered, Localization Quotient (LQ) concerning industry produced the best results. Because of an obvious multicolinearity problem and in view of the results obtained we decided to eliminate Rural Employment Localization Quotient for the primary sector, Urban Employment Localization Quotient for the tertiary sector, Rural/Urban Employment Localization Quotient for the primary sector and GDP Localization Quotient for the secondary sector. The data refer to 2006.

3. ECONOMETRIC RESULTS AND ANALYSIS

Further considerations are based on the analysis of results obtained by calculating the indexes presented before. The different States of India composed the territorial units to be studied and were taken in relation to the whole of the national territory for 2006.

3.1 Localization Quotient (L.Q)

Employment

- Primary Sector

- Rural

When rural persons are taken into consideration, this sector plays a more significant role in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himchal Pradesh, Kamataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttaranchal, i.e., each of these States is relatively specialised in the primary sector than all India. The level of specialisation is 10% above all India one only in Kamataka, Madhya Pradesh and Maharashtra. All the other Sates but Uttar Pradesh, are not so specialized in the primary sector. That Sate has the same pattern as all India.

- Urban

Delhi, with a LQ=0 for the primary sector, proves to be predominantly a Service city, where the central government is based. Most of the Sates followed the pattern of all India. Well above that pattern are Bihar and North-eastern States (LQ>2). In the primary sector is less important than all India's pattern for urban persons.

- Rural/Urban

When all the persons come into analysis, employment in the primary sector indicates that the specialisation is far below the pattern of all India in only three Sates, namely in Delhi, where the location quotient is almost zero. A similar situation can be seen in Goa and in the Group of UT's States, where LQ<0.4.

- Secondary Sector

- Rural

The secondary sector is well above all India (LQ>1.5) in Goa, Kerala, in the Group of UT's. Tamil Nadu, and Jharkand. The same patterns as in all India can be found in Himchal Pradesh, Gujarat and Uttar Pradesh. All other States are more than 10% below the pattern of all India, the most distant being Chhattisgarh.

- Urban

Two thirds of the States follow the pattern of all India when a combination of both rural and urban population in the primary sector is analysed. In Uttaranchal and in the North-eastern State the secondary sector plays a relatively minor role, with a Location quotient lower than 0.5.

- Rural/Urban

In exactly one third of all States, the secondary sector is less significant than in the all India pattern. Assam and Chhattisgarh have a localisation quotient lower than 0.5. All the other States have either a similar pattern or the secondary sector is more significant, when both rural and urban workers are taken into consideration. Goa and the Group of UT's have a LQ > 1.5 which can be accounted for by their relative weight in all India and, in the case of Goa, by the importance of its mining activity, which is included in the secondary sector.

- Tertiary Sector

- Rural

Delhi (LQ<5) followed by Kerala (LQ>2) and the Group of UT's (LQ>1.5) are the Sates where the tertiary sector is more important than in all the country. Delhi attracts rural population to work on the

services sector. Himchal Pradesh, Orissa, and Jharkhand have almost the same pattern as all India. Chhattisgarh is the State which is the most distant from the pattern.

- Urban

In all the Sates the pattern for all India is present for urban persons employed in the Service sector. Urban areas are places where this sector definitively flourishes.

- Rural/Urban

In about one third of all Sates of India, the tertiary sector is less important than the pattern of all country. Except for Chhattisgarh with an LQ equal to 0.51, all the other six States (Bihar, Himchal Pradesh, Jharkhand, Madhya Pradesh, Orissa and Rajasthan) have a LQ > 0.7.

The rest of the Sates follow the pattern of all the country. Delhi has a location quotient a little above 3 and Goa above 2. This can be explained by the presence of the central government ministries and other governmental departments in Delhi and the importance of the tourism sector in Goa.

Therefore, it is possible to say that India is becoming a services' economy, thus accompanying the pattern of developed countries.

GDP

- Primary Sector

For 2006, in most of the primary sector, Gross Domestic Product at factor cost at constant price share is above the pattern of all India, although the value of localization quotient does not exceed 1.6.

Only in seven States (Delhi, Goa, Gujarat, Jharkhand, Kerala, Maharashtra and Tamil Nadu) is the primary sector less important than in all India. For all of the States but Delhi, the localization quotient is above 0.5. Delhi presents a very low LQ, around zero, which means that the primary sector's contribution to the formation of Gross Domestic Product is residual.

When one calculates the Localization Quotient in a more disaggregated sector approach, one can clearly see that the Agricultural sector shows a significant level of relevance only in Punjab and Uttar Pradesh, compared to the situation in the whole of India. Notwithstanding the highest LQ value, 1.71, is for Punjab, in 2006.

Forestry and logging is significant in Bihar, Himachal Pradesh, Karnataka, Rajasthan and Uttarakhand. Localization quotient value is a little higher than 2 only in Bihar, in 2006. In Delhi, Goa and Gujarat forestry is the least important economic activity.

Fishing is the most important economic activity in Andrha Pradesh, Goa, Kerala and West Bengal. In these States the LQ is higher than 3 for 2001 and 2006. In Kerala the Fishing sector lost some of its importance between 2001 and 2006 and was replaced by the Construction sector, which indicates a change in this State's specialization pattern. This sector shows the least degree of specialization in Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Uttarakhand and Uttar Pradesh.

- Secondary Sector

For 2006, 11 States follow the pattern of all India in this sector, with a localization quotient between 0.8 and 1. Another three States (Bihar, Delhi and West Bengal) have a LQ higher than 0.5, but they do not exceed 0.75.

In the rest of the Indian regions, the secondary sector plays a more important role than in all India. The most industrialized ones are Chhattisgarh, Goa, Gujarati and Jharkhand, with an LQ in the interval of [1.4, 1.7].

Comparing the situation which occurred between 2001 and 2006, when the localization quotient is calculated for the sub-sectors of Mining and Quarrying, Manufacturing, Electricity, Gas & Water Supply and Construction, the situation is as follows: 1- Mining and Quarrying is more significant than the all India pattern in Assam; Chhattisgarh; Jharkhand; Madhya Pradesh and Orissa. In Chhattisgarh this sector is over 7 times more important than in the whole of the country for both 2001 and 2006; 2- Manufacturing is well above the all India pattern in Gujarat, Haryana, Tamil Nadu and the North-eastern States both in 2001 and 2006. In the latter, the share of the GDP of this sub- sector is 4 times more than the whole of India; 3- Electricity & Gas and Water Supply is significantly more relevant in Jammu & Kashmir than in all India.

For the secondary sub-sector of Mining and Quarrying, the least important Sates are: Bihar, Karnataka, Kerala, Punjab and Tamil Nadu and for Manufacturing this pattern can be found in Andhra Pradesh, West Bengal, North-eastern States and the Group of UT's.
Orissa and Chhattisgarh are the States where construction has less relevance. In 2001 in Orissa and in 2006 in Assam and Chhattisgarh, Trade, Hotels & Restaurants and Finance-related activities play the least important role in terms of specialization pattern.

- Tertiary Sector

In what concerns this sector, the situation is most similar to the one observed for the all India pattern. Localization quotient is lower than 1 in eight states, although it never drops below 0.7.

The regional pattern of the tertiary sector may be said to have a tendency to overcome its importance in relation to the all India pattern. Indian economy is treading on the same path as the most developed countries.

Delhi confirms its position as a service region with a localization quotient of 1.53. As referred above, in the analysis for the Employment localization quotient for Goa, due to the relevance of tourism as an economic activity, the region follows Delhi. However when Gross Domestic Product at factor cost becomes the variable in question, the situation no longer remain the same. Goa has an LQ = 0.95. This reinforces the idea that the real role of tourism as a strategic economic activity for the regional development process should be questioned. Not everything that shines is gold, indeed.

Delhi and Maharashtra, most certainly on account of Mumbai, are the Sates where Finance, Insurance, Real Estate and Business services are the financial heart of India and finally, Community services and Personal services is the most important activity in the Group of UT'S.
Trade, Hotels & Restaurants in Orissa, in 2001, and Finance, Insurance, Real Estate and Business services in Assam and Chhattisgarh are the least important activities regarding specialization, compared to the situation of the whole of India.

Transport, Storage & Communication and Community services and Personal services are activities regarding which no State in particular has a significant degree of specialization.

3.2. Specialization Coefficient (SC)

We should bear in mind that SC*i* ε [0 - 1]. In the case of the limit inferior, both the territorial unit *i* and the reference space have identical specialization profiles; therefore that territorial unit has no relative specialization. The higher the specialization coefficient (closer to 1), the more the territorial unit *i* has a specialized productive structure compared to the productive structure of the reference space, since the specialization profile of territorial unit *i* is very different from what the reference territorial space shows.

Precisely because we are dealing with a relative specialization measure, a low specialization coefficient does not necessarily entail a diversification of the regional productive structure but rather a proximity between specialization profiles both of the territorial unit *i* and of the reference space.

Employment

In view of the results obtained by calculating the Specialization Coefficient (SCi Employment), it is not clear whether a specialization of the Indian economy is actually taking place. Figures are far from 1, which means that the level of specialization is not significant at State level. Delhi could be the exception, with a SC above 0.5, when both rural and urban workers are in analysis. The fact that it is the rural situation of the workers which contributes most for differentiation in the specialization pattern may be construed as a paradox. Services and to a lesser extent industries are attracting rural man-power to urban areas, thus creating problems which have to do with these areas being unable to cope with a rural exodus, such as housing, water and electricity supply as well as hygienic conditions. Then it becomes legitimate to ask oneself whether the strong, ongoing growth process that is now occurring in India can be translated into a development process with the inherently well being of all of the population.

GDP

If terms of employment, Specialization Coefficient does not show a clear evidence of a regional specialization; the same occurs when Gross Domestic Product at factor cost is taken into consideration. The values of SCi are below 0.3 for all the States, with Delhi again having the highest value, 0.29 and 0.27, in 2001 and 2006, respectively.

3.3. Regression estimation

$$Y = \beta_0 + \beta_1\ LQII\ E-R + \beta_2\ LQIII\ E-R + \beta_3\ LQI\ E-U + \beta_4\ LQII\ E-U +$$
$$\beta_5\ LQII\ E-R/U + \beta_6\ LQIII\ E-R/U + \beta_7\ Sci\ E-R + \beta_8\ Sci\ E-U +$$
$$\beta_9\ Sci\ E-R/U + \beta_{10}\ LQ\ GDP-I + \beta_{11}\ LQ\ GDP-III + \mu_i$$

where Y is the dependent variable (Productivity) and the others variables are explanatory variables; μi the stochastic disturbance term of ith observations; β0 is the constant term which gives the average effect of all the variables on Y; and β1…… β11 are regression coefficients.

As expected, there is a positive relationship between productivity on fifteen independent variables. The data set of analysis of multiple regression of 4 independent variables are highly correlated; therefore it represents multicollinearity i.e. tolerance is very low in collinearity (see Table 1).

Table 1- Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	LQ I E- R	.[a]	.	.	.	.000
	LQ III E - U	.[a]	.	.	.	.000
	LQ I E - R/U	25.961[a]	.353	.731	.106	1.021E-6
	LQ GDP - II	-298.320[a]	-.397	.699	-.119	9.767E-9

a. Predictors in the Model: (Constant), LQ GDP - III, LQ II E- R, LQ I E - U, LQ II E - U, LQ GDP - I, Sci E -R/U, LQ III E -R, Sci E- U, LQ III E- R/U, Sci E- R, LQ II E- R/U

b. Dependent Variable: Productivity

According to table 1, 4 independent variables were excluded, namely LQ I E- R, LQ III E – U, LQ I E - R/U & LQ GDP – II. The eleven independent variables analysis based on the R2 value is 0.94, which means that 94 percent of the variation in productivity is explained by eleven variables (see Table 2).

The regression model explains the variation in the dependent variable fairly well; the adjusted R^2 is 0.882. The ANOVA tables shows the F value, which is the proportion of variation explained by variables in the model, is significantly good i.e. p value = .000 (see Table 3). Also, if the overall model is significant, then at least 1 or more of the individual variables will most likely have a significant relationship with the dependent variables. In individual significance, only two predictors were positively related to the outcome variable, such as (Localization Quotient Tertiary Sector Employment Rural/Urban) LQ III E- R/U (β = 1.77, p = .05), (Specialization Employment Rural/Urban) Sci E -R/U (β = 6.387, p = .08) and rest of other independent variables are non significant. The 1.532 intercept value means that if the value of independent variables were fixed at zero, the mean productivity would be about 1.532 (see Table 4). It can be concluded that there was a positive significant relationship between LQ III E- R/U & Sci E -R/U. Furthermore, 94% of the variability in productivity could be explained by explanatory variables.

Table 2 – R^2

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.969	0.939	0.882	0.456

Table 3 – ANOVA[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	37.851	11	3.441	16.652	.000[a]
Residual	2.480	12	.207		
Total	40.330	23			

Table 4 – Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.532	1.997		.767	.458
LQ II E- R	-.675	1.357	-.267	-.497	.628
LQ III E -R	-.076	.386	-.054	-.196	.848
LQ I E - U	-.366	.240	-.146	-1.526	.153
LQ II E - U	-.570	1.798	-.095	-.317	.757
LQ II E- R/U	.784	2.344	.221	.335	.744
LQ III E- R/U	1.766	.823	.776	2.146	.053
Sci E- R	-3.700	3.482	-.402	-1.062	.309
Sci E- U	-3.922	4.060	-.203	-.966	.353
Sci E -R/U	6.387	3.438	.651	1.858	.088
LQ GDP - I	-.511	.391	-.139	-1.306	.216
LQ GDP - III	-.853	1.109	-.109	-.769	.457
Dependent Variable: Productivity					

4. FINAL REMARKS

This paper was motivated by a first approach to the time-space relationship between productive specializations, on the one hand, and productivity and the level of territorial development measured by the productivity per worker, on the other hand.

India is a vast and heterogenic country. The tradition of heterodoxy has a clear relevance for democracy and secularism in India, and may have helped Indian Philosophy as well as other sciences, but it also raises some questions like the recognition of inequalities if regional peace is to be easily pursued. The features of Indian's unity vary greatly with the context. For instance, the statistical argument that more than four-fifths of Indian citizens are Hindus in terms of standard classification cannot be used as enough ground for an immediate identification of India as pre-eminently Hindu country. Is historical reasoning behind seeing India as mainly a Hindu country not to consider the role of other religions (Muslim and Buddhism) in the construction of the Indian identity?

Two most meaningful Indian ideologists, Tagore and Gandhi, had different views which were expressed by Jawaharlal Nehru in his prison dairy, when learning of Tagore's death in 1941 "Gandhi and Tagore two types entirely different from each other and yet both of them typical of India, both in the long line of India's great men..." Tagore had a great admiration for Mahatma Gandhi as a person and as a political leader, but he was also highly sceptical of Gandhi's form of nationalism and his

conservative instincts regarding the country´s past traditions. Tagore diverged from Gandhi, for example, on the merit of Gandhi's forceful advocacy that everyone should spin at home with the "charka", the primitive spinning wheel. For Gandhi, this practice was an important part of India's self civilization. "The spinning wheel gradually became the centre of rural uplift in the Gandhian scheme of Indian economics" Nanda, B. R. (1958) Tagore, on the contrary, found the alleged economic rationale for this scheme quite unrealistic.

Two main conclusions may be drawn from this paper: first, the results do not allow us to say that there is a strong degree of specialization in industry at State level in India, when employment and GDP are taken into consideration; and, second, it is employment in the tertiary sector which contributes most to productivity.

Can today's India be considered a modernized country? Or is it still an ancestral country, holding fast to traditional ways of organizing its economy?

Clear and precise answers to these questions are not to be found in this piece of research. More detailed data either on employment or GDP in each State or, better still, on smaller territorial units are essential to refine the analysis so that it may lead to the confirmation or refusal of present results. It will also be interesting to have an annual evolution of a longer period, in order to observe changes in pattern, taking into consideration the time factor.

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Data Bases: State Analysis Service (India)

Annex 1 - Indian Sates Localization Quotient (Lqik) - Employment - 2006

	LQE I - R	LQE II - R	LQE III -R	LQE I - U	LQE II - U	LQE III - U	LQE I - R/U	LQE II - R/U	LQE III - R/U
Andhra Pradesh	1,03	0,88	0,97	0,85	1,01	1,02	1,04	0,91	0,97
Assam	0,98	0,45	1,66	0,38	0,52	1,37	1,10	0,40	1,22
Bihar	1,06	0,62	1,10	2,18	0,56	1,10	1,22	0,53	0,84
Chhattisgarh	1,26	0,38	0,37	1,30	0,81	1,07	1,38	0,43	0,51
Delhi	0,12	1,30	5,04	0,00	0,76	1,28	0,02	1,33	3,19
Goa	0,46	2,38	2,21	0,99	0,88	1,07	0,29	1,69	2,21
Gujarat	1,05	0,99	0,77	0,71	1,19	0,93	0,96	1,15	0,97
Haryana	0,89	1,19	1,34	0,90	1,06	0,98	0,88	1,16	1,18
Himchal Pradesh	1,01	1,00	0,97	1,86	0,93	0,92	1,16	0,86	0,72
Jammu & Kashmir	0,85	1,40	1,31	1,03	0,97	1,01	0,89	1,22	1,10
Jharkhand	0,89	1,58	0,92	1,11	0,92	1,03	0,97	1,31	0,83
Kamataka	1,10	0,76	0,78	1,20	1,05	0,94	1,07	0,89	0,91
Kerala	0,58	1,72	2,32	1,90	0,92	0,92	0,61	1,43	1,62
Madhya Pradesh	1,21	0,55	0,41	1,14	0,91	1,03	1,24	0,66	0,69
Maharashtra	1,12	0,66	0,74	0,94	0,98	1,02	0,99	0,91	1,10
Orissa	1,02	1,01	0,90	1,24	0,99	0,98	1,12	0,91	0,77
Punjab	0,85	1,17	1,55	0,85	0,99	1,03	0,77	1,18	1,42
Rajasthan	1,02	1,30	0,62	0,88	1,04	0,99	1,07	1,16	0,71
Tamil Nadu	0,86	1,53	1,15	1,21	1,09	0,92	0,76	1,46	1,22
Uttaranchal	1,06	0,88	0,85	0,85	0,35	1,40	1,11	0,69	0,99
Uttar Pradesh	1,00	0,99	1,01	0,96	1,08	0,96	1,04	0,98	0,91
West Bengal	0,79	1,64	1,39	0,58	1,11	0,99	0,77	1,45	1,22
North-eastern States	0,97	0,68	1,46	2,26	0,44	1,15	1,05	0,58	1,21
Group of Uts.	0,55	2,26	1,92	0,81	0,87	1,10	0,40	1,68	1,96
All India	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Note: Primary sector excluding "Mining and Quarrying". Mining and Quarrying is included in the estimates of secondary sector. Number of workers includes all the workers with principal and subsidiary activities
Source: "Employment and Unemployment Situation in India 2005-06" National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and own calculations.

Annex 2 - Indian States - Localization Quotient (Lqik) – State Gross Domestic Product at factor cost at constant price (Base=99-00) – 2001

2001	**Agriculture, F & F**	Agricuture	Forestry & L	Fishing	**Industry**	Mining & Q	Manufacturing	Elelectricity, G &W S	Construction	**Services**	Trade, Hotel & Rest.	Trans., S. & Comm	Fin., I , R S & BS	Comm. S.& P S
Andhra Pradesh	**1,23**	1,18	0,99	2,31	**0,89**	1,55	0,79	0,92	0,92	**0,95**	0,95	0,95	0,89	1
Assam	**1,38**	1,38	1,27	1,45	**0,71**	2,98	0,44	0,4	0,82	**0,96**	0,86	0,78	0,49	1,6
Bihar	**1,58**	1,59	1,59	1,21	**0,42**	0,13	0,4	0,47	0,54	**1,01**	1,06	0,91	0,53	1,46
Chhattisgarh	**0,81**	0,73	2,12	1,23	**1,49**	7,69	0,97	2	0,61	**0,85**	0,79	0,85	0,7	1,04
Delhi	**0,05**	0,06	0	0,03	**0,76**	0,01	0,71	0,44	1,25	**1,59**	1,51	1,48	2,27	1,08
Goa	**0,45**	0,38	0,16	2,19	**1,65**	1,92	2,1	0,64	0,96	**0,94**	0,87	1,45	0,99	0,7
Gujarat	**0,61**	0,6	0,35	1,03	**1,58**	1,39	2	1,03	0,87	**0,89**	0,95	0,99	0,91	0,77
Haryana	**1,23**	1,31	0,71	0,12	**1,1**	0,18	1,36	0,49	1,04	**0,84**	1,05	0,9	0,76	0,67
Himachal Pradesh	**1,01**	0,95	3,18	0,19	**1,44**	0,19	0,84	1,85	3,07	**0,77**	0,65	0,48	0,61	1,2
Jammu & Kashmir	**1,22**	1,2	2,26	0,64	**0,92**	0,07	0,3	3,32	1,52	**0,93**	0,52	0,47	0,8	1,7
Jharkhand	**0,71**	0,7	1,48	0,23	**1,6**	7,59	1,21	0,77	1,12	**0,84**	0,67	1,09	0,52	1,17
Karnataka	**1,15**	1,16	1,49	0,55	**0,95**	0,34	0,94	0,95	1,15	**0,95**	0,82	0,82	1,24	0,87
Kerala	**0,89**	0,81	1,59	1,91	**0,83**	0,17	0,65	0,79	1,46	**1,14**	1,47	1,22	0,97	0,94
Madhya Pradesh	**0,96**	0,96	1,68	0,23	**1,01**	1,91	0,87	1,03	1,08	**1,01**	1,17	0,86	0,85	1,09
Maharashtra	**0,62**	0,63	0,66	0,33	**1,08**	0,47	1,31	0,97	0,79	**1,14**	1,02	1,23	1,54	0,85
Orissa	**1,17**	1,09	2,57	1,41	**0,97**	2,81	0,67	1,08	1,09	**0,93**	0,66	0,99	0,73	1,35
Punjab	**1,49**	1,6	0,31	0,24	**0,91**	0	1,02	1,16	0,8	**0,81**	0,89	0,67	0,67	0,92
Rajasthan	**1,16**	1,19	1,54	0,06	**1,09**	1,24	0,88	1,5	1,36	**0,88**	0,99	0,74	0,76	0,95
Tamil Nadu	**0,68**	0,66	0,41	1,25	**1,2**	0,26	1,37	1,06	1,12	**1,06**	1,09	1,19	0,98	1,03
Uttarakhand	**1,12**	1,14	1,91	0,05	**0,88**	0,36	0,78	0,67	1,39	**1**	1,23	0,97	0,7	1,07
Uttar Pradesh	**1,38**	1,45	0,86	0,34	**0,89**	0,55	0,86	1,39	0,85	**0,87**	0,9	0,97	0,76	0,89
West Bengal	**1,18**	1,1	0,74	3,33	**0,71**	0,73	0,7	0,61	0,8	**1,06**	1,06	1	1,08	1,06
North-eastern States	**0,94**	0,94	1,17	0,73	**0,94**	4,62	0,12	1,13	1,72	**1,06**	0,67	0,81	0,99	1,63
Groupe of UT's	**1,13**	1,09	1,99	1,13	**0,75**	0,31	0,26	1,1	1,89	**1,07**	0,68	0,76	0,63	2

Source: State Analysis Service and own calculations.

Annex 3 - Indian States - Localization Quotient (Lqik) – State Gross Domestic Product at factor cost at constant price (Base=99-00) – 2006

2006	**Agriculture, F. and F.**	Agricuture	Forestry & L.	Fishing	**Industry**	Mining & Q.	Manufacturing	Elelectricity, G a&W.S.	Construction	**Services**	Trade, Hotel & Rest.	Transport, S. & Comm.	Finance, i. , R.S. & B:S:	Community S. & P. S.
Andhra Pradesh	1,24	1,2	0,88	2,42	0,9	1,61	0,78	0,93	0,95	0,96	0,9	1,06	0,87	1,04
Assam	1,34	1,33	1,22	1,55	0,8	2,47	0,66	0,76	0,68	0,97	0,97	0,83	0,44	1,7
Bihar	1,39	1,34	2,08	1,75	0,54	0,06	0,35	0,44	1,04	1,09	1,37	0,78	0,54	1,61
Chhattisgarh	1,09	1,06	1,67	1,3	1,41	7,86	1,02	1,42	0,63	0,75	0,76	0,72	0,54	0,98
Delhi	0,04	0,05	0	0	0,72	0	0,61	0,48	1,18	1,53	1,5	1,32	2,11	1,05
Goa	0,5	0,39	0,18	2,88	1,48	2,13	1,99	0,71	0,6	0,95	0,55	1,87	1,11	0,56
Gujarat	0,85	0,87	0,33	0,8	1,47	1,08	1,96	0,97	0,79	0,81	0,96	0,89	0,79	0,6
Haryana	1,06	1,12	0,64	0,13	1,1	0,2	1,29	0,56	1,12	0,92	1,09	1,05	0,9	0,67
Himachal Pradesh	1,14	1,1	3,14	0,16	1,39	0,18	0,81	2,83	2,32	0,73	0,61	0,43	0,6	1,26
Jammu & Kashmir	1,39	1,39	2,4	0,59	0,9	0,09	0,39	2,4	1,59	0,89	0,54	0,65	0,68	1,72
Jharkhand	0,62	0,6	1,5	0,32	1,69	5,86	1,71	0,5	1,06	0,78	0,72	1,03	0,47	1,04
Karnataka	0,91	0,91	1,34	0,46	1,07	0,52	1,11	0,91	1,18	1	0,88	0,91	1,31	0,84
Kerala	0,8	0,74	1,46	1,44	0,87	0,25	0,49	0,75	1,77	1,15	1,36	1,29	0,93	1,05
Madhya Pradesh	1,28	1,31	1,85	0,25	0,93	2,01	0,67	1,37	1,03	0,93	0,98	0,84	0,8	1,08
Maharashtra	0,63	0,65	0,49	0,3	0,97	0,41	1,25	1,03	0,55	1,17	1,1	1,02	1,63	0,81
Orissa	1,2	1,14	2,35	1,38	0,97	3,59	0,81	1,27	0,57	0,93	0,81	1,15	0,62	1,28
Punjab	1,59	1,71	0,31	0,37	0,88	0,01	0,97	1,34	0,78	0,83	0,87	0,84	0,63	1
Rajasthan	1,33	1,37	1,93	0,07	1,09	1,26	0,8	1,19	1,56	0,82	0,92	0,78	0,68	0,9
Tamil Nadu	0,61	0,59	0,4	1,23	1,12	0,28	1,33	0,64	1,08	1,09	1,18	1,19	1,01	1,02
Uttarakhand	0,96	0,97	1,81	0,04	1,12	0,78	0,83	1,38	1,66	0,95	1,09	0,98	0,56	1,22
Uttar Pradesh	1,4	1,47	1,04	0,42	0,96	0,6	0,85	1,5	1,07	0,86	0,76	1,02	0,71	1,04
West Bengal	1,21	1,1	1	3,37	0,72	0,67	0,65	0,77	0,84	1,07	1,01	1,02	1,12	1,11
North-eastern States	1,01	1,02	1,4	0,58	1	4,61	0,31	1,29	1,35	1	0,69	0,86	0,8	1,66
Groupe of UT's	1,23	1,2	1,9	1,17	0,87	0,39	0,23	1,36	2,02	0,98	0,56	0,73	0,59	2,07

Source: State Analysis Service and own calculations.

Annex 4 - Indian States - Specialization Coefficient (SCik) - Employment -2006

	Sci-E- R	Sci-E -U	Sci -E- R/U
Andhra Pradesh	0,02	0,01	0,03
Assam	0,10	0,21	0,11
Bihar	0,06	0,15	0,13
Chhattisgarh	0,18	0,07	0,22
Delhi	0,62	0,16	0,57
Goa	0,38	0,04	0,41
Gujarat	0,04	0,06	0,03
Haryana	0,08	0,02	0,07
Himchal Pradesh	0,00	0,07	0,09
Jammu & Kashmir	0,10	0,01	0,06
Jharkhand	0,09	0,03	0,06
Kamataka	0,07	0,03	0,04
Kerala	0,30	0,07	0,22
Madhya Pradesh	0,15	0,03	0,14
Maharashtra	0,09	0,01	0,02
Orissa	0,02	0,02	0,07
Punjab	0,10	0,02	0,13
Rajasthan	0,06	0,01	0,07
Tamil Nadu	0,10	0,05	0,14
Uttaranchal	0,04	0,23	0,06
Uttar Pradesh	0,00	0,03	0,03
West Bengal	0,15	0,04	0,14
North-eastern States	0,07	0,19	0,08
Group of Uts.	0,32	0,06	0,35
All India	0,00	0,00	0,00

Note: Primary sector excluding "Mining and Quarrying". Mining and Quarrying is included in the estimates of secondary sector. Number of workers includes all the workers with principal and subsidiary activities
Source: "Employment and Unemployment Situation in India 2005-06" National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and own calculations.

Annex 5 - Indian States - Specialization Coefficient (SCik) – State Gross Domestic Product at factor cost at constant price (Base=99-00) – 2001 and 2006

State	Sci GDP 2001	Sci GDP 2006
Andhra Pradesh	0,06	0,05
Assam	0,09	0,07
Bihar	0,15	0,13
Chhattisgarh	0,12	0,13
Delhi	0,29	0,27
Goa	0,17	0,13
Gujarat	0,10	0,13
Haryana	0,11	0,04
Himachal Pradesh	0,05	0,14
Jammu & Kashmir	0,05	0,08
Jharkhand	0,15	0,19
Karnataka	0,04	0,02
Kerala	0,07	0,07
Madhya Pradesh	0,01	0,06
Maharashtra	0,09	0,09
Orissa	0,04	0,04
Punjab	0,12	0,12
Rajasthan	0,06	0,09
Tamil Nadu	0,08	0,08
Uttarakhand	0,03	0,03
Uttar Pradesh	0,09	0,08
West Bengal	0,07	0,08
North-eastern States	0,03	0,00
Groupe of UT's	0,06	0,05

Source: State Analysis Service and own calculations.

REGIONAL DEVELOPMENT AND DIVERSITY/VARIETY OF FIRMS: THE CASE OF ROMANIA

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Abstract:
In this paper we try to find empirical evidence regarding the region diversity by firm characteristics, using spatial data from Tempo (INS Romania database) at NUTS 1, 2 and 3 region level for the period 1997-2008. Using instruments of statistical analysis of spatial data (Anselin, Varga) we try to sketch the spatial pattern of firm agglomerations and the values of the main firm's characteristics (size class according to employee's number and economic activity by NACE Rev.1 sections). Starting point is represented by the discussion made by Saviotti [1] regarding the efficiency versus diversity/variety in economic development respectively development versus growth. The pattern variation of the regions' "profile" by diversity/variety of the firms could offer an image of the structural transformation of economic development tendencies in the last decade.

Keywords: region development, diversity/variety, spatial pattern, firm agglomeration

1. Introduction

Regional development could be characterised also under the evolutionary theories of economic development perspective. In this frame the development is not only a process of quantitative growth, but also of qualitative changes. As this is emphasized by Saviotti [1], there is a trade of between efficiency and diversity/variety in economic development respectively development versus growth and the role of variety is both a determinant and a result of growth. We make reference to one of the two hypotheses that link variety to economic development (Saviotti, 1996): "**The growth in variety is a necessary requirement for long-term economic development**." [2]
If we consider variety a changing development mechanism, then every component of the economic system (actors, resources, activities, results) is transformed and dynamically differentiated from the others. In the specialized literature there is some development regarding the concept of variety applications in the "theories of consumption and welfare (Lancaster, 1975, Dixit Stiglitz, 1977) and, increasingly, of economic growth (see for example Romer, 1987, 1990; Bils et al 2001; Funke, Ruhwedel, 2001a, 2001b)."[3]

1.1. Economic development in Romania's regions

The relative position into the NUTS 2 total of 268 EU-27's regions places Romanian regions in the group of the **most lagging regions** (medium stages of development) in Europe with the exception of RO32 region (in intermediate stage of development see Table1):

Table 1
EU Regional Competitiveness Index 2010 RCI scores and ranks RCI scores and ranks, and the Stages of development of EU NUTS 2 regions for Romania

Region Eurostat code	Region NUTS 2 level	Weighted RCI score EU Regional Competitiveness Index 2010	Corresponding rank (low ranks are associated to high RCI scores)[4] from 268 positions	Stages of development of EU NUTS 2 regions [5]	% GDP per capital (PPP per inhabitant as % of EU average)
RO32	Bucuresti - Ilfov	0.339	177	INTERMEDIATE	92.2
RO11	Nord-Vest	1.146	244	MEDIUM	40.2
RO42	Vest	1.193	248	MEDIUM	48.2
RO31	Sud - Muntenia	1.197	249	MEDIUM	34.2
RO21	Nord-Est	1.260	253	MEDIUM	26.6
RO12	Centru	1.294	257	MEDIUM	42.2
RO41	Sud-Vest Oltenia	1.369	259	MEDIUM	32.7
RO22	Sud-Est	1.385	261	MEDIUM	33.8

Under EU RCI 2010 methodology the Romania's position under the CCI (Country Competitivess Rank) is 27 out of 27 items, with the same tendency indicated by the 2009/2010 edition of the Global Competitiveness Index [6] GCI 2009/2010 where the rank is 24 for Romania (in the EU27 selection).
Another tendency is pointed out in the specialized literature: the transition to the market economy increases **regional development inequalities "**Territorial inequalities have increased during the transition period to the marked economy, although their level is still below the one recorded in most European countries [7], [8]". In another paper, authors adapted different statistical measures of variation to the specificity of spatial analyses, many indicators and techniques for territorial comparisons and ranking(at NUTS 3 level), as well as for inequality measurement like Gini index, Herfindahl index and Theil index, "showing a low level of concentration, which suggests a **low amplitude of both inter-regional and intra-regional disparities**, although, the **intra-regional disparities are much higher than the inter-regional disparities.**"[9] Following the crises period and its persistence in 2009-2010, is accentuated this tendency of increasing the „regional disparities". [10]
Under these differences, inequalities and disparities increasing tendencies are new pressures and difficulties in view to implement an efficient cohesion policy. We have to emphasize the essential role of the cohesion policy played "in the development of regions and local communities and in increasing their adaptation capacity in a globalised economy and their role in regional development." [11]

1.2. Some evidence regarding the catching up factors in the regions development

An important subject for the regional policies is the identification of the catching up factors, in order to enhance regional growth and convergence:

1.2.1. Technological differences among regions could be diminished through encouragement of employment in advanced technological sectors. "Catch-up to the leading regions is feasible only amongst those regions whose technological conditions are similar or close to those of the technologically advanced regions. [12]" In terms of activities the technological differences are shaped by high-technology activities and knowledge creating activities (including R&D from universities and scientific and research institutions).

1.2.2. The impact of the past conditions/ different externalities interfere in the present and could shape effects that persists longer or „Individual localities will have limited ability to influence or change what they do, particularly in the short run" [13]. From Henderson's results we mention that "for all industries both localization (Marshall-Arrow-Rome MAR externalities) and urbanization (Jacobs externalities) effects are important. For traditional industries most effects die out after four or five years, but for high tech industries effects can persist longer. The biggest effects are typically from conditions of three to four years ago, in the county and metropolitan area" [13].

1.2.3. The importance of dynamic externalities in favouring the growth of economic activity (Lucio, Herce, Goicolea, 2002). "If specialization is sufficiently high, it seems to be positive for growth as Henderson (1994) argues. On the other hand, if specialization is low, we find a negative effect on growth, a result that coincides with Glaeser et al. (1992). We do not find clear evidence on the presence of diversity (Jacobs type) and competition (Porter type) externalities" [14]. A different

role of diversity as a dynamic externality on growth is find by Glaeser et al.(1992), Lucio et al.(1996) given by the "cross fertilization among different industries amongst others".

1.2.4. The significant role played by the most innovative regions from the knowledge economy perspective. "The key minority of most innovative regions is playing an increasingly significant role in driving not only exports their own economic growth but also that of their national economies. Their role as gateways for the exchange and trading of leading edge ideas and best practice means that they also play a significant part in diffusing this knowledge through their respective national urban and regional hierarchies. As a result regions still matter in a globalized economy because of the differential ways in which knowledge is concentrated and circulated both within and between them." [15]

2. Methodology and data

"In the economic literature, variety is used to describe differentiation within a given product group…but "Structural change can occur for *activities* and *actors* as well as for outputs, thus also for knowledge, and institutions. In biology, the concept of diversity is defined as the number of species existing in a given habitat."[3]

Based on these references the formalisation of variety is represented as a number of distinguishable entities. Making the analogies with the biodiversity approach leads us to the conclusion that diversity/ variety represents the distinguishable number of economic species in the system or that the "variety is the number of actors, activities and objects required to describe the economic system." [2]

2.1. Definition of variety and methodological issues

In order to characterize the regions development by the diversity / variety of the firms we consider:

-Among the actors that develop economic activities we select only the active local units by activity of national economy at level of CANE Rev.1 classes, size classes of number of employees, macro regions, development regions and counties as measured by the INS (National Institute for Statistics from Romania as the indicator **INT101J** provided by the **TEMPO** online database (see Annex 1).

-The exclusion of the institutional actors and the common methodological framework of the measurement permit to consider the units related and in the same time distinctive from each others by the following criteria:

One "species" could be described as a vector with (region NUTS 3, class size according to employees' number, class CANE Rev.1) dimension descriptions.

a. CANE Rev.1 – classes. Because official statistical developments exist we can access the number of items at the most detailed level of the current classification

514 classes

b. Size class according to employees' number

b1. 0-9 employees: microenterprises;

b2. 10-49 employees: small enterprises;

b3. 50-249 employees: medium enterprises;

b4. 250 employees and more: large enterprises;

For the time period 2002-2008, yearly frequency at NUTS 1, NUTS 2 and NUTS 3 regional aggregation level where the regional level represent the "habitat of he analysed species" or the environment where we make the analogy with the natural environment described as the "**ecosystem** is a community of living and non-living things that work together."[16]

2.2. The species richness S

If "the species richness S is simply the number of species present in an ecosystem" [17] then in our case the maximum imposed by the methodology is:

S maximum = 514 classes x 4 firm type by size classes o number of employees = 2056 species of active local units (see Annex 1)

Indexes to measure diversity /variability: Simpson's diversity (see Box 1a [17]) and Hirschman-Herfindahl Index (HHI) (see Box 1b) [18].

In the same idea another source mention that ”Simpson's diversity index: An index of species diversity devised in **1949 by E. H. Simpson**, given by D = 1 − Σpi^2, where D is the diversity index, p_i is the proportion of individuals in the i-th species, and Σ means ‘sum of’.”[19]

Box 1a

Simpson's diversity index

*If p_i is the fraction of all organisms which belong to the i-th species, then **Simpson's diversity index** is most commonly defined as the statistic:*

$$D = \sum_{i=1}^{S} p_i^2$$

This quantity was introduced by Edward Hugh Simpson.

Note that $0 \leq D \leq 1$*, where values near zero correspond to highly diverse or heterogeneous ecosystems and values near one correspond to more homogeneous ecosystems. Biologists who find this confusing sometimes use 1 / D instead; confusingly, this reciprocal quantity is also called Simpson's index. A more sensible response is to redefine Simpson's index as*

$$\tilde{D} = 1 - D = 1 - \sum_{i=1}^{S} p_i^2,$$

(called by statisticians the index of diversity), since

- *this quantity has a simple intuitive interpretation: it represents the probability that if we randomly choose two individuals, that they will belong to distinct species*

2.3. The model

The equivalent of the Simpson‘s diversity index is HHI:

Box 1b

Hirschman-Herfindahl index (HHI)

In economics essentially the same quantity is called the Hirschman-Herfindahl index (HHI), defined as the sum of the squares of the shares in the population across groups (with E as the group size, that is, the number of employees or the number of specimens):

$$D = \sum_{i=1} \left(\frac{E_i}{E}\right)^2.$$

Note that a HHI is also used within sectors, to measure competition.

In order to “decode” the calculated results, the significance of HHI is:
“a HHI index below 0.01 (or 100) indicates a **highly competitive** index.
a HHI index below 0.1 (or 1,000) indicates an **unconcentrated index**.

a HHI index between 0.1 to 0.18 (or 1,000 to 1,800) indicates **moderate concentration**.
a HHI index above 0.18 (above 1,800) indicates **high concentration** (1)."[20]

The limits (assuming infinite categories with equal representation in each category) of the scores for this index are:

-"0" the case of perfectly **homogeneous population**.
-"1" the case of perfectly **heterogeneous population**

In our model then, for every year between 2002 and 2008:

$$\mathbf{HHI}_{\mathrm{NUTSm}}=\sum_{j}^{Sk}\left(\frac{n_k}{N_{NUTS_m}}\right)^2=\sum_{j}^{Sk}\left(\frac{n_{(a_i b_l)\,j}}{N_{NUTS_m}}\right)^2 \quad (1)$$

where:
For every m=1 to 3 , m=1 then NUTS 1 – 4 cases;
m=2 then NUTS 1 – 8cases;
m=3 then NUTS 1 – 42 cases .....54 cases /year
with i= 1 to 514 cases;l= 1 to 4 cases; j=1 to 2056 cases.

2. Results

The results for the 54 scores for the HHI index for each year are presented in the Table 2 and Figure 1. The scores of the HHI index calculated at regional level indicate **an unconcentrated index** situation as general characteristic (with values of HHI below 0.1). As shown in figure 1, these areas are presented in red with higher diversity of units and also a high competition level. **A homogeneous population with some exceptions** is indicated where HHI index is 0.1 to 0.18 and indicates a situation considerate with moderate **concentration** (the case of Teleorman at NUTS 3 level for the years 2002-2005 and Tulcea for 2002).

Table 2

a. The Hirschman-Herfindahl Index (HHI) and the grade of "S - species richness" at NUTS 1 level by CANE Rev.1class and firm dimension

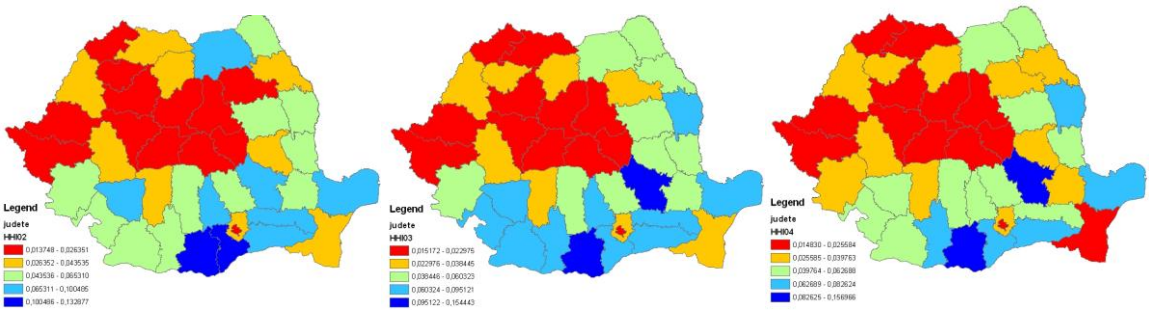
MACRO	HHI02	HHI03	HHI04	HHI05	HHI06	HHI07	HHI08	GRS02	GRS03	GRS04	GRS05	GRS06	GRS07	GRS08
Macroreg1	0,020	0,020	0,018	0,018	0,017	0,017	0,016	62,6	63,9	63,9	64,5	64,6	65,3	66,1
Macroreg2	0,046	0,049	0,045	0,040	0,037	0,033	0,030	58,8	61,0	60,9	59,4	59,4	59,8	60,7
Macroreg3	0,035	0,029	0,026	0,024	0,023	0,021	0,020	68,6	68,8	68,7	70,2	70,6	71,0	71,1
Macroreg4	0,035	0,036	0,032	0,029	0,027	0,024	0,022	56,0	58,5	58,6	59,1	59,1	60,1	60,5

b. The Hirschman-Herfindahl Index (HHI) the grade of "S - species richness" at NUTS 2 level by CANE Rev.1class and firm dimension

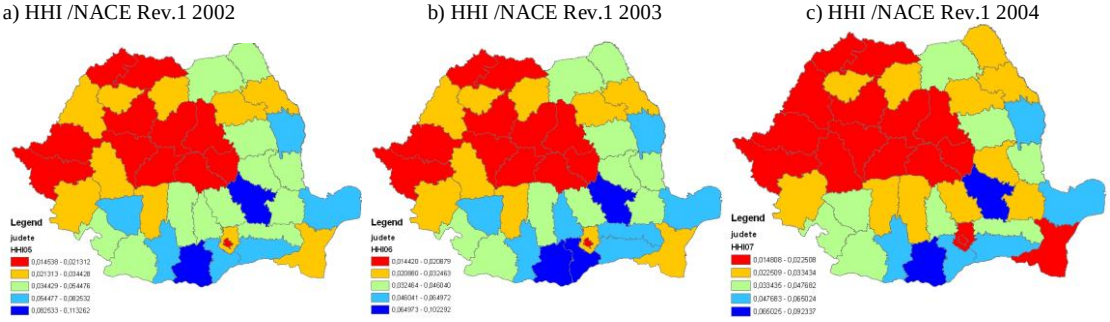
REGIUNE	HHI02	HHI03	HHI04	HHI05	HHI06	HHI07	HHI08	GRS02	GRS03	GRS04	GRS05	GRS06	GRS07	GRS08
RegBucuresti_Ilfov	0,020	0,017	0,017	0,018	0,018	0,017	0,016	62,2	62,4	62,8	64,2	64,7	65,1	65,0
RegCentru	0,019	0,019	0,018	0,017	0,017	0,016	0,016	53,9	55,4	56,1	56,5	56,3	56,6	58,1
RegNE	0,044	0,047	0,043	0,039	0,036	0,032	0,030	49,8	51,5	51,9	51,4	51,5	52,0	53,9
RegNV	0,022	0,021	0,019	0,018	0,018	0,018	0,017	52,8	55,4	55,2	55,9	55,7	55,6	57,1
RegSE	0,049	0,051	0,049	0,041	0,038	0,035	0,031	49,2	51,2	50,8	50,0	50,5	50,0	50,8
RegSud	0,072	0,066	0,058	0,052	0,047	0,041	0,037	50,5	52,7	52,7	52,1	53,0	53,4	54,8
RegSV	0,053	0,061	0,054	0,049	0,044	0,039	0,034	42,5	44,9	46,0	45,7	45,9	46,6	48,2
RegV	0,023	0,022	0,020	0,019	0,018	0,017	0,016	49,5	51,5	51,7	52,5	52,8	53,7	54,1

c. The Hirschman-Herfindahl Index (HHI) and the grade of "S - species richness" at NUTS 3 level by CANE Rev.1class and firm dimension

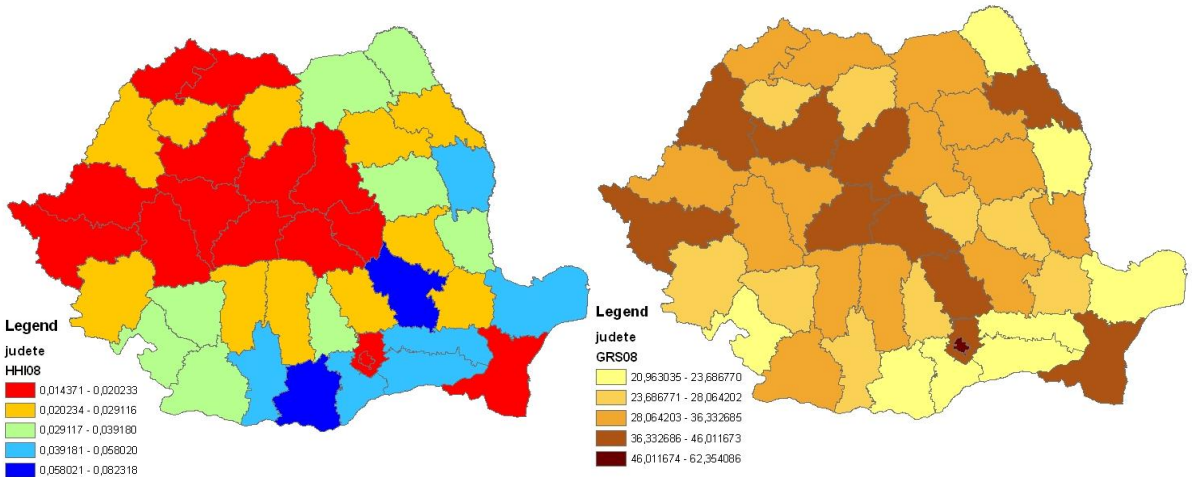
JUDET	HHI02	HHI03	HHI04	HHI05	HHI06	HHI07	HHI08	GRS02	GRS03	GRS04	GRS05	GRS06	GRS07	GRS08
ALBA	0,016	0,020	0,020	0,019	0,019	0,019	0,019	27,0	29,4	29,8	29,9	29,6	30,0	31,2
ARAD	0,014	0,015	0,015	0,015	0,016	0,016	0,016	31,8	33,7	34,0	34,7	34,9	34,6	35,6
ARGES	0,060	0,056	0,048	0,042	0,037	0,033	0,029	30,4	32,1	32,7	33,0	34,2	34,4	36,3
BACAU	0,048	0,052	0,046	0,042	0,040	0,037	0,033	31,3	32,9	32,7	33,0	32,2	32,8	33,8
BIHOR	0,044	0,032	0,028	0,026	0,024	0,023	0,022	34,6	36,5	36,3	37,2	37,6	38,0	38,7
BISTRITA-NASAUD	0,035	0,035	0,033	0,033	0,030	0,028	0,026	22,9	25,1	25,1	25,6	26,0	26,8	27,4
BOTOSANI	0,062	0,050	0,044	0,041	0,038	0,033	0,032	21,0	22,5	23,3	22,8	22,8	23,1	23,7
BRAILA	0,046	0,041	0,040	0,038	0,035	0,032	0,029	24,4	26,4	26,7	27,1	27,0	27,0	27,7
BRASOV	0,024	0,020	0,018	0,017	0,017	0,016	0,015	38,2	40,1	40,9	41,9	41,7	42,3	42,9
BUCURESTI	0,019	0,016	0,017	0,018	0,018	0,017	0,016	59,9	60,2	60,5	62,0	62,5	62,4	62,4
BUZAU	0,083	0,154	0,157	0,113	0,102	0,092	0,082	26,0	27,2	28,3	28,5	28,3	29,0	30,8
CALARASI	0,076	0,081	0,079	0,072	0,065	0,057	0,051	18,5	20,0	20,6	21,0	21,7	22,0	22,8
CARAS-SEVERIN	0,047	0,041	0,036	0,034	0,032	0,029	0,027	21,4	22,6	23,0	23,6	23,5	24,0	24,9
CLUJ	0,015	0,018	0,017	0,016	0,015	0,016	0,016	40,3	42,9	42,7	43,6	44,0	44,4	46,0
CONSTANTA	0,030	0,027	0,026	0,024	0,023	0,022	0,020	36,0	37,5	37,5	37,6	38,2	37,1	38,7
COVASNA	0,022	0,023	0,022	0,021	0,021	0,020	0,019	22,8	23,9	24,9	24,1	24,5	24,9	26,6
DAMBOVITA	0,088	0,067	0,059	0,054	0,049	0,044	0,039	24,0	26,1	27,7	26,6	26,9	27,9	28,1
DOLJ	0,058	0,063	0,055	0,050	0,045	0,040	0,034	30,7	32,3	33,3	33,9	34,4	34,2	36,1
GALATI	0,065	0,056	0,049	0,045	0,041	0,036	0,032	28,4	31,5	31,5	31,9	32,2	32,5	33,2
GIURGIU	0,133	0,095	0,083	0,083	0,078	0,065	0,058	17,5	19,8	19,8	20,0	20,2	20,3	21,3
GORJ	0,081	0,071	0,063	0,058	0,051	0,044	0,039	21,9	23,2	23,6	23,3	23,2	23,2	24,7
HARGHITA	0,018	0,019	0,020	0,019	0,019	0,018	0,018	27,0	27,5	27,9	28,7	28,9	29,1	30,8
HUNEDOARA	0,036	0,029	0,028	0,026	0,023	0,021	0,019	29,5	31,1	31,4	31,5	32,2	32,3	32,8
IALOMITA	0,079	0,064	0,059	0,054	0,051	0,048	0,043	17,8	19,8	20,0	20,6	20,5	20,6	21,0
IASI	0,037	0,041	0,037	0,032	0,029	0,026	0,023	33,2	35,0	35,6	36,1	37,0	37,9	39,0
ILFOV	0,037	0,036	0,030	0,026	0,023	0,021	0,020	28,6	31,5	33,2	35,1	36,0	38,4	40,2
MARAMURES	0,027	0,022	0,020	0,020	0,020	0,021	0,020	29,9	32,2	31,5	31,3	31,6	31,5	32,5
MEHEDINTI	0,050	0,063	0,056	0,051	0,046	0,040	0,035	18,2	18,9	19,7	20,3	20,1	21,6	21,4
MURES	0,021	0,021	0,020	0,019	0,019	0,018	0,017	33,6	34,9	34,6	35,1	35,7	36,3	37,3
NEAMT	0,021	0,030	0,031	0,031	0,030	0,029	0,027	27,8	29,4	30,5	30,0	29,8	30,3	31,4
OLT	0,063	0,083	0,075	0,068	0,060	0,055	0,048	21,1	21,9	22,5	21,9	22,7	23,5	24,8
PRAHOVA	0,056	0,052	0,044	0,039	0,036	0,033	0,029	38,1	40,1	40,9	40,4	41,4	41,7	42,3
SALAJ	0,026	0,030	0,028	0,027	0,026	0,026	0,024	20,1	21,8	22,7	23,3	24,0	24,3	24,6
SATU-MARE	0,021	0,018	0,018	0,018	0,019	0,020	0,019	27,0	27,9	28,5	29,0	29,9	29,8	30,3
SIBIU	0,014	0,015	0,015	0,015	0,014	0,015	0,014	33,1	34,4	34,4	35,8	36,4	37,5	37,9
SUCEAVA	0,077	0,060	0,053	0,046	0,041	0,037	0,034	26,6	28,4	28,6	28,7	28,4	29,1	30,8
TELEORMAN	0,120	0,129	0,120	0,105	0,096	0,085	0,073	18,5	19,4	19,6	20,5	20,8	21,4	22,9
TIMIS	0,021	0,020	0,018	0,017	0,017	0,017	0,016	39,3	41,3	41,6	42,7	42,9	44,0	44,8
TULCEA	0,100	0,071	0,066	0,058	0,053	0,050	0,043	19,2	21,3	21,2	21,2	21,9	21,8	23,0
VALCEA	0,033	0,038	0,035	0,032	0,030	0,027	0,025	24,5	26,6	27,1	26,8	28,0	28,3	30,2
VASLUI	0,048	0,069	0,071	0,067	0,062	0,054	0,052	19,8	21,1	20,6	21,8	21,9	21,9	22,8
VRANCEA	0,033	0,042	0,039	0,037	0,034	0,031	0,028	21,1	22,8	23,8	23,5	23,2	23,4	24,6



a) HHI /NACE Rev.1 2002 b) HHI /NACE Rev.1 2003 c) HHI /NACE Rev.1 2004



d) HHI /NACE Rev.1 2005 e) HHI /NACE Rev.1 2006 f) HHI /NACE Rev.1 2007



g) HHI /NACE Rev.1 2008

h) GRS08 the grade of "S - species richness" at NUTS 3 level by CANE Rev.1 class and firm dimension as proportion from the maximum number of class - 2056

Figure 1. Hirschman-Herfindahl index (HHI) variation at NUTS 3 level during the period 2002-2008 *(using Arc Gis 9.0) with data from TEMPO data base INS Romania*

3.1. **Local Spatial Autocorrelations characteristics for the HHI in 2008 compared to 2002, at NUTS 3 level**.

Figure 2 and Table 3 presents the situation of Local Spatial Autocorrelations characteristics for the HHI in 2008 compared to 2002, at NUTS 3 level using Arc GIS 9.3. (Arc GIS Catalog and Arc MAP)[21]. With the Arc GIS software the NUTS 2 region's map for Romania (the map for development regions) was aggregated into NUTS 1 region's map for Romania (the map for macroregions). Spatial econometrics (Varga) [22] through the GeoDa software [23] has some applications like the spatial Lag Construction LISA using rook contiguity weight file.
The cluster map, the significance map the Moran scatter plot and the box plot (p= 0.05 are not reliable then the location with significant local Moran statistics are the location with at least p=0.01) (Anselin) [24]. There are two visible cores for the spatial clusters:

Table 3

	2002	2008
Low-Low	**Bihor, Alba**, Salaj, Cluj, Mures	**Bihor, Alba, Mures**, Salaj, Cluj, Sibiu, Arad
High – High	**Teleoman, Giurgiu, Dimbovita**	Teleoman, Giurgiu

In our cluster map is a positive situation the blue counties /judete described in the Low-Low case.
Bihor, Alba and lately Mures represent core clusters for the locations where diversity index (calculated as 1-HHI) is higher.

3. Conclusions

Admitting that "the growth in variety is a necessary requirement for long-term economic development" then also the region as a host or environment for activities, actors outputs, knowledge or institutions are extremely important in view to support the variety creation and the richness of "species" from both perspective natural and artificial.
Region as environment is a complex and dynamic structure. The HHI annual variation (at NUTS 1, 2, and 3 levels) could indicate the development tendencies of the regions. Another useful characteristic for the region is represented by the possible quality of the region to be a core cluster as a result of Local spatial Autocorrelation Analysis.
One important limit of our model is represented by the only one dimension perspective –the active local units by activity of national economy at level of CANE Rev.1 classes, size classes of number of employees.
Next to this dimension at the regional level there are "other" many species waiting to be integrated in order to better understand how to build a sustainable development for every region.

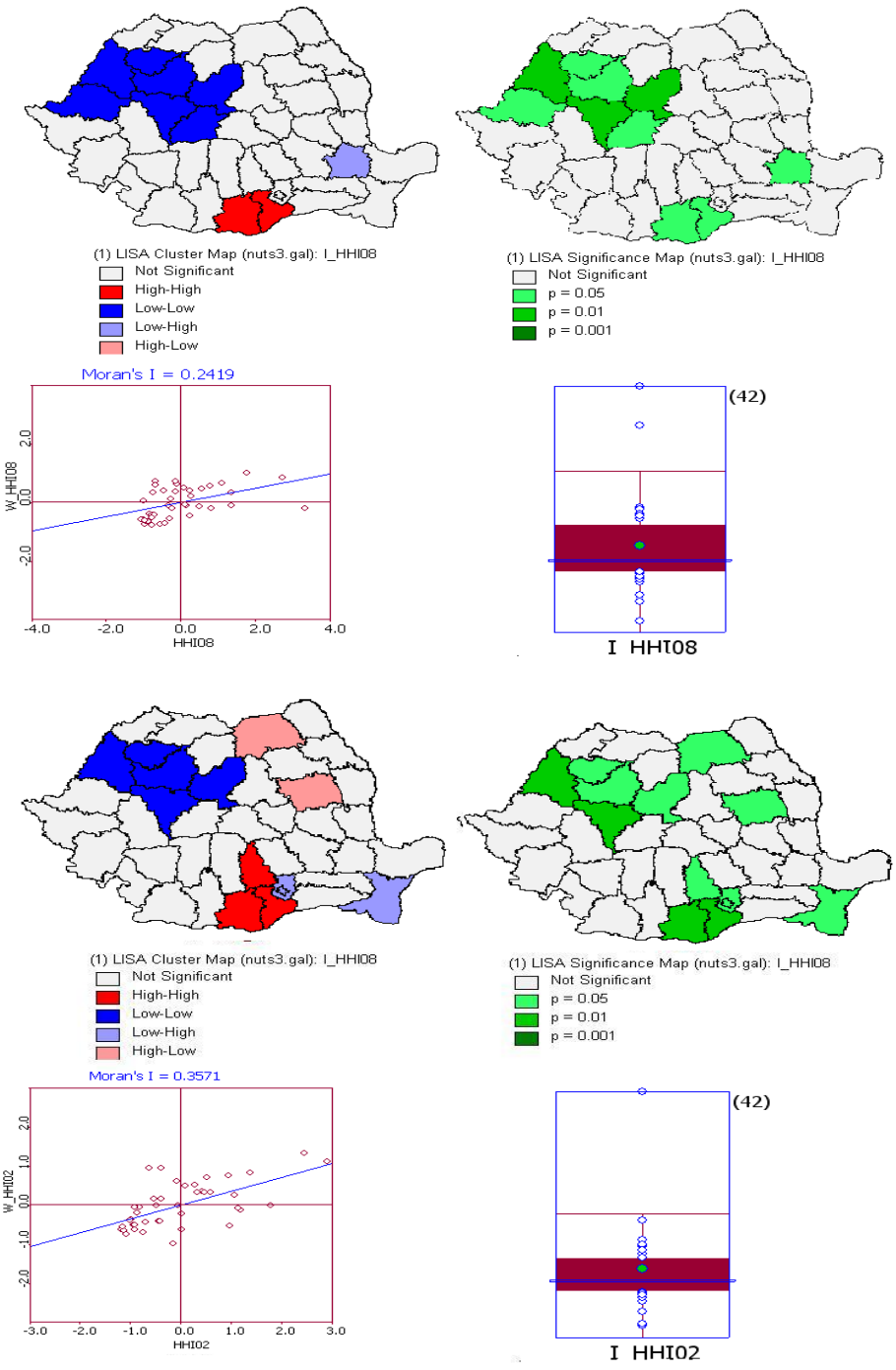


Figure 2. Local Spatial Autocorrelations characteristics for the HHI in 2008 comparing to 2002, at NUTS 3 level.

The cluster map, the significance map the Moran scatter plot and the box plot (p= 0.05 are not reliable then the location with significant local Moran statistics are the location with at least p=0.01) (Anselin). {using rook contiguity weight file) There are visible two cores for the spatial clusters:

	2002	2008
Low-Low	**Bihor, Alba**, Salaj, Cluj, Mures	**Bihor, Alba, Mures**, Salaj, Cluj, Sibiu, Arad
High – High	**Teleoman, Giurgiu, Dimbovita**	Teleoman, Giurgiu

The values of the HHI for neighbours of this core clusters are similar with the HHI value for the core clusters (as summarized by the weighted average of the neighbouring values, the spatial lag).

"The global Moran's I statistic is the mean of the local Moran statistics."(Anselin)[24]

Annex 1
Methodological issues [25]

TEMPO-Online, NATIONAL INSTITUTE OF STATISTICS Romania, database selection of the indicator:

INT101J - Distribution of active local units by activity of national economy at level of CANE Rev.1 classes, size classes of number of employees, macroregions, development regions and counties	
Definition	Economic unit represents an organisation (consisting of one or several persons) with legal entity, created in order to carry out certain activities according to the Law no. 15 and on Law no. 31 / 1990 with subsequent modifications of Law no. 507/2002 and Decree no. 44/2008. Social unit represents an organisation (consisting of one or several persons) with legal entity, created in order to carry out an activity devoted to social interest. Legal unit represents any economic or social unit having its own patrimony, which could conclude, on own account, contracts with third parties and defend their interests in justice (has legal entity). Legal units are either natural persons or family associations (as entrepreneurs) or legal persons. Enterprise is the group of legal units set up as an organisational entity producing goods, trading services or social interest services, enjoying decisional autonomy, particularly for ensuring its current resources. Active enterprise is the entity which, from economic viewpoint is active (during the observation period), namely it produces goods or provides services, outlay and draws up the balance sheet.
Periodicity	Annual
Data sources	Statistical business register managed
Methodology	Local unit is an enterprise or part thereof (workshop, factory, warehouse, office, mine or station a.s.o) situated in a geographicaly identified place.
Last update	DEC 08, 2009
Observations	The data are available since 2002. Because administrative sources are developted in time, for 1990 - 2001 period the completed sources of data are not available. The activities - Education or Health and social assistance - include only the local units with activities related to education or health and social assistance, organised as companies. Due to structural changes between CANE Rev.1 and CANE Rev.2 (such as aggregation and/or detail of the classification entities of CANE Rev.1) may occur changes of the number of companies related to one or more sectors of activities. So, it is possible that the number of enterprises calculated for a particular sector of CANE Rev.2 to be higher than the number of enterprises calculated for the same segment of CANE Rev.1.
Interruption	Last period of this series: Year 2008. After this period, the series continue with the **INT101U matrix**
Responsible person	Iacob Gh Georgeta Octavia, Tel. 1488, geta.iacob@insse.ro

Annex 2

Selection from the UN Questionaire regarding the National Classifications, CAEN Rev.1 [26], Country / Area: Romania; Classification category: Activity Classifications

	Question	Answer
1	Name of the current national classification (Original)	Clasificarea Activităților din Economia Națională rev.1(CAEN rev.1)
2	Name of the current national classification (English)	Classification of Activities of National Economy rev.1 (CANE rev.1)
3	Link to international classifications (Give the name of the international standard classification the current classification is linked to or derived	CANE rev.1 comply with NACE Rev.1.1
4	Levels in the structure: Is the structure identical to international standard or, if not, how does it differ? Have additional levels been added or have changes been made, e.g. aggregations or additional breakdowns?	5 levels. All levels are identical to NACE Rev.1.1
5	Number of items at the most detailed level of the current classification	**514 classes**
6	Name of institution / office responsible for the elaboration and maintenance of the classification	National Institute of Statistics (NIS)
7	Contact address, phone number, e-mail or website for public information and inquiry	Http://www.insse.ro/NOMENCLATOARE
8	Implementation date: Please state the date of the first official adoption and the programme for the implementation of the various statistical applications.	CANE rev.1 is approved by Order No 601/Nov.2002 of NIS President, on base of Government Decision No. 656/Oct. 1997, published in the Official journal 908/13.12.2002. It came into force on January 1st, 2003.
9	Plans for revision or update of the current classification. Please state if plans are made to revise the classification (e.g. due to national needs not reflected in the international classification).	CANE rev.1 will be updated in 2007 according with the revisions of international classifications
10	Users of the classification for statistical purposes Please state in which statistics (surveys etc.) this classification is used and if there are users outside of the Statistical Office.	It is used for grouping the statistical indicators from all branches. Institutions and bodies with statistical activities grouping indicators by activity criterion.
11	Statistical data collected according to the current classification Please describe for which statistical surveys or indicators the classification is used and, if not used at the most detailed level, indicate the level or aggregates used.	- Structural Survey in Industry, Construction, Transport and Services. - Business Survey in Manufacturing and Trade. - Survey on Goods Retail and Vehicle Sales. - Statistical Reports (goods and passengers transport; researchand development; labour force-employees and incomes; investments, construction and geological works; wholesale; market services rendered to economic units and population; energy and fuels use). All data are collected at class level.
12	Statistical data published according to the current classification Please describe for which statistical surveys or indicators the classification is used and, if not used at the most detailed level, indicate the level or aggregates used.	The results are published at the level of divisions, sub-sections and sections.

13	In which languages is the classification available?	CANE rev.1 is available in Romanian language.
14	Is the classification available in electronic form?	It exists as handbook and in electronic form
15	Do the conversion key(s) exist in electronic form?	Yes, between CANE and CANE rev.1
16	Have national explanatory notes and recommendations been elaborated?	Yes
17	Problems occurred during the period of use of the current classification Please describe the kind of problems that have occurred (interpretation, methodology, etc.)	- Description of activities for each CANE rev.1 classes (the same of NACE rev.1.1) does not exhaustively define the respective classes, entailing sometimes difficulties when framing the units in the nomenclature; - The methodology of main activities is the same NACE rev.1.1 The diversity of activities carried out by the units affect the algorithms to define the main activity
18	Users of the classification for non-statistical purposes Please give the names of institutions that use the classification for non-statistical purposes (as opposed to statistical purposes in question 13). Also indicate the kind of use (e.g. tax offices, social security, customs, enterprise register etc.)	CANE is used for non-statistical purposes by the Trade Register, the Ministry of Finances, various institutions of public administration, economic agents registering, balance sheets drawing out, some fiscal or social regulations, trade agreements, and prices setting up - aggregate and detail levels
19	Alternative classifications used by other institutions of the economy Please indicate if these classifications are available and useful for the Statistical Office.	No
20	Link of former classification to international classifications	No

Source: UN questionnaire, 7/30/2004

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[5] Paola Annoni and Kornelia Kozovska, EU Regional Competitiveness Index 2010, Joint Research Centre JRC Scientific and Technical Report, European Commission, EUR 24346 EN - 2010, pg.273, Appendix F – Stages of development of EU NUTS 2 regions. GDP thresholds for RCI computation, EU NUTS 2 regions are classified into different development stages:

a. Stage of development „medium" <75% GDP per capital (PPP per inhabitant as % of EU average) - regions eligible for funding under the Convergence criteria of the EU Regional Policy 2007-2013 framework
b. Stage of development „intermediate" ≥ 75% and < 100% GDP per capital (PPP per inhabitant as % of EU average);

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GEOPOLITICS OF ENERGY IN THE KASTELORIZO - CYPRUS – MIDDLE EAST COMPLEX: BASED ON THE EXISTING GEOPHYSICAL AND GEOLOGICAL INDICATIONS OF HYDROCARBON DEPOSITS.

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Abstract:

The geophysical and geological submarine features (pockmarks, gas chimneys, salt domes, etc).,identified by multi-beam echosounders and sidescan sonars ,seismic surveys in the region South, South-west and South-east of Cyprus, as well as the corresponding international interest of investors, especially in the marine region of the Levantine Basin, lead to the conclusion that, from a geopolitical standpoint, Greece must be urged to accelerate the consolidation of its sovereign rights and understand anew and in practical terms, that "Cyprus is not far away, not at all actually". With respect to Kastelorizo and the submarine area of its EEZ, we note that detailed geophysical and bathymetric surveys have confirmed the fact that the region of the submarine Anaximander Mountains presents active mud volcanoes that are linked to the presence of gas hydrates. Samples of gas hydrates were collected by means of indicative samplings in mud volcanoes thoroughly mapped in sub-seabed layers that do not exceed 1.5 m. These "ice-crystal" like features will probably have a significant socioeconomic impact in the near feature as an energy resource. New mud volcanoes were also discovered ("Athens" and "Thessaloniki"). Gas hydrates were found in samplings conducted in the "Thessaloniki" M.V. According to preliminary assessments, the total capacity of the mud volcanoes of the Anaximander mountains complex is estimated between 2.56 - 6.40 c. km.

Keywords: Geopolitics of Energy, Cyprus, Israel, Levantine, multi-beam echosounders, side scan sonars, pockmarks, gas chimneys, salt domes, Exclusive Economic Zone/EEZ.

1. Indications of fluid seeps in deep water environments

Indications of fluid hydrocarbon seabed seeps detected in offshore areas have increased considerably with the evolvement of acoustic imagery/sub bottom profile (survey) systems and geo-morphological imagery technologies from the 1970's until today (Hovland et al., 1998, Milkov, 2000, Kopf, 2002). These phenomena, usually referred to as "cold vents" and "cold mud volcanism", have been observed in various regions of different physiography, varying from accretionary wedges in active margins up to salt-bearing passive margin segments, shelves, and deep-sea fans. Submarine mud domes and cold seeps were observed for the first time, at the convergence boundaries of the lithospheric plates (Deville et al, 2003, Griboulard et al., 1998, Griboulard et al., 1991) or for example at the Mediterranean Ridge accretionary wedge (Cita et al, 1981, Cita et al, 1989, Limonov et al, 1994). The cold seep emissions are substantially differentiated, whether they spurt from the seabed and are diffused into the marine environment, or they are gathered through seeps and vents, and probably altered considerably in time. In regions with compressive settings, the thrust planes were considered until recently as fundamental factors of seep emissions to the seabed (Camerlenghi et al, 1995). The case of Eastern Makran (Pakistan) is reported as an example in literature, where according to recent data most mud domes are located above transcurrent faults which are also consequences of accretionary wedges fast growth (Rabaute et al, 2005). The passive continental margins are also

identified as regions of a possible appearance of important fluid seeps. Mud volcanoes and the seeps linked to them have been observed in regions with important sedimentation (e.g. Mississippi, the Delta of Niger and Nile) (Hovland et al., 1996, Milkov, 2000, Milkov et al., 2000), where fluid seeps and gas emissions on the seabed are most probably due to tectonic factors. Special structures, such as deep channels, most probably release large quantities of fluid quite early as far as the historical development of their burial is concerned (Gay, 2002). All these regions present a high fluid production of biogenous or thermogenous origin (or even both simultaneously).

1.a. The geographical distribution and geophysical indications of seeps in the Eastern Mediterranean

The indications originate mainly from data gathered by multibeam echosounders, which produce high resolution mapping of the seabed morphology and by seismic surveys that have taken place in the Eastern Mediterranean region in recent years.

Modern technology has proved to be a great help in the attempt to locate hydrocarbon seeps as it is based mainly on the alteration of physical attributes of the seabed's surface sediment structures and on the alteration of its local morphology, creating, for example, mud domes and volcanoes or -instead of the previously mentioned elevations- abrupt depressions (e.g. caldera formations). All these formations are henceforth easily recognisable on the seabed due to the high definition attributes of echosounding systems, as well as to the recordings of back scattering signals from sidescan sonars (Behrens, 1998, Bryant et al., 1990, Neurauter et al., 1994).

The presence of hydrocarbons also leaves a characteristic "signature" in the acoustic imagery recordings of the back scattering signal from seismic soundings (Sager et al., 2003, Anderson et al, 1990, Blondel, 1997, Bryant et al., 1990). A general characteristic is that any emission of fluid seep, and the authigenic carbonate crust linked to cold seeps, generally scatters the acoustic energy in a circular or elliptic manner (Sager et al, 1999). From core analyses it recently became evident that the strengthening returns from the seabed are also owed to seep matter (oil and natural gas) located on surface or subsurface sediments, increasing the seabed's acoustic reflection and that of the surface sedimentary cover. On the contrary, regions with low back scattering signal strength, indicate non degraded regions with semi-pelagic sediment. In certain regions, the low back scattering signal, is linked to brine pools on the seabed (Huguen, 2001, Woodside et al., 1996). Many authors link the high reflectivity with mud volcano activity, as in the case of the Mediterranean Ridge (Sager et al, 1996, Woodside et al., 1996). On seismic reflections, standard hydrocarbon seeps are characterized by loss of the seismic signal due to high concentration of gases in the sediments. In the Nile Deep-sea Fan (NDSF), acoustic transparent sections reported in literature as gas chimneys, are relatively frequent (Barsoum et al, 2000, Mascle et al., 2002).

1. b. Reports on fluid seeps in the Eastern Mediterranean

In the Eastern Mediterranean region, there is an abundance of mud volcanoes and hydrocarbon seeps, particularly in the Mediterranean Ridge (MR) region (Figure 1) that are considered to be directly linked to active compressional and transcurrent, tectonic lineaments (Camerlenghi et al, 1995, Huguen, 2001, Woodside et al, 1994).

From geophysical and geological surveys carried out in 1998 and in 2000 on the Nile boundary, more than 150 mud cones were found and characterized, as well as an abundance of large and small spot-like craters (pockmarks and mounds), in the Nile Deep Sea Fan system. At approximately the same time period, there were also reports on the discovery of several active gas chimneys along the higher seawall of the NDSF, while in 2001 indications of cold hydrocarbon seeps appeared, which are linked to minor (of a diameter smaller than 10m) mud mounds and authigenic carbonate crusts (Coleman et al., 2001). (Fig. 1.1)

Finally, the existence of pockmarks is demonstrated – probably associated to faults – in the mountain of Eratosthenes, a large disrupted plateau-like relief that connects the NDSF system in the North-east (Dimitrov et al, 2003). (Fig. 1.2 and 1.3.).

***Fig.1**. Geodynamic description of the Eastern Mediterranean Basin. Mediterranean Ridge (MR). . (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

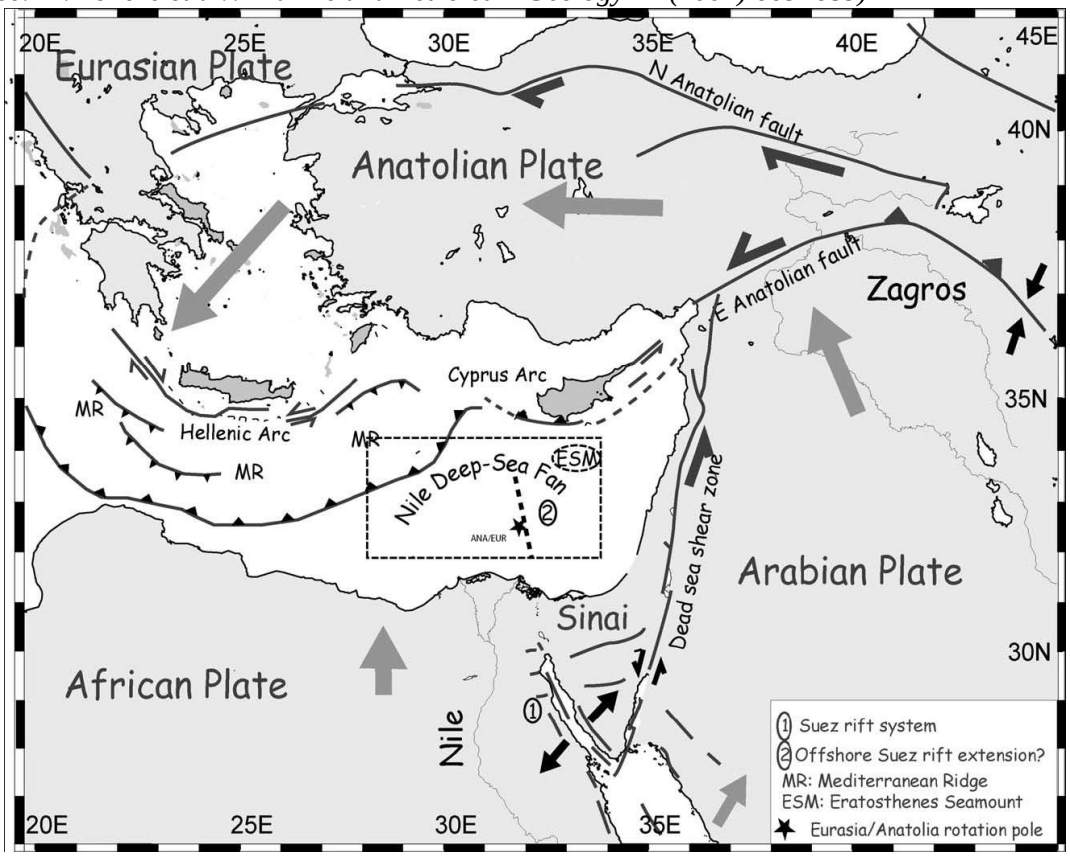


***Fig. 1.1** Schematic interpretation of hydrocarbon seeps in the Eastern Mediterranean basin. . (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

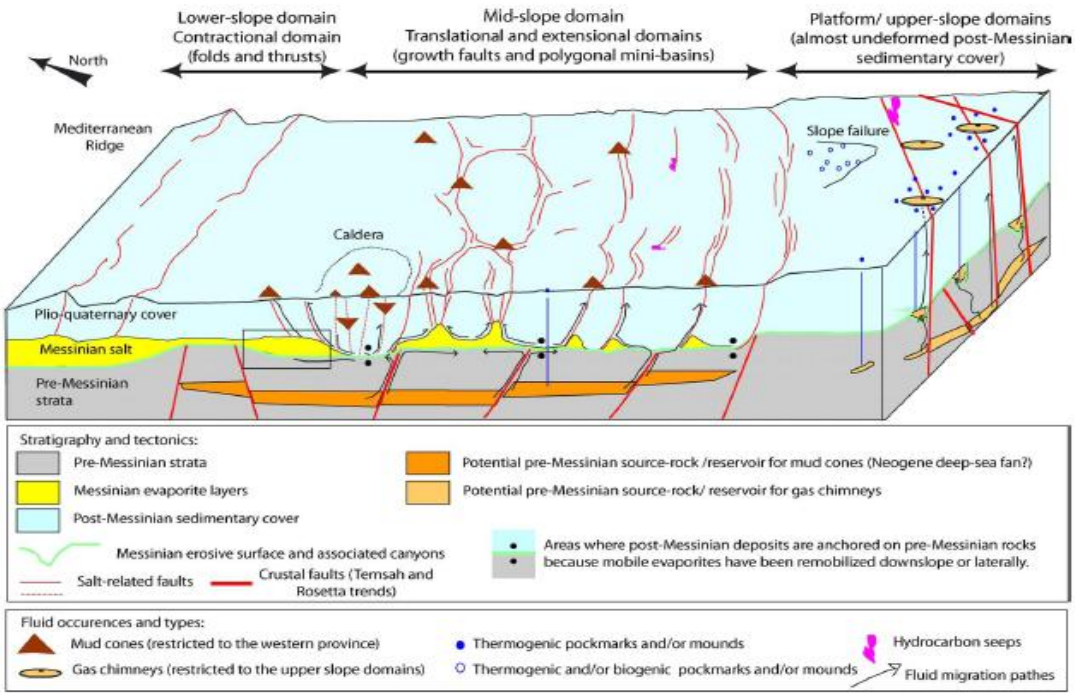


Fig. 1.2 *Multibeam backscattering image of the Eastern Mediterranean basin. The interrupted line represents is the extension of the southern limit of the Messinian Salinity Crisis. (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

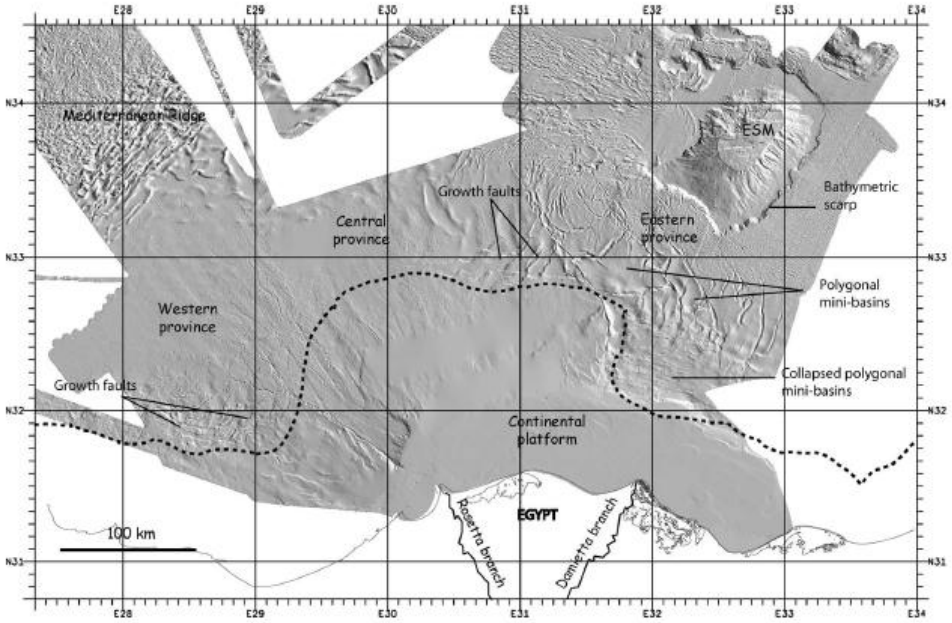
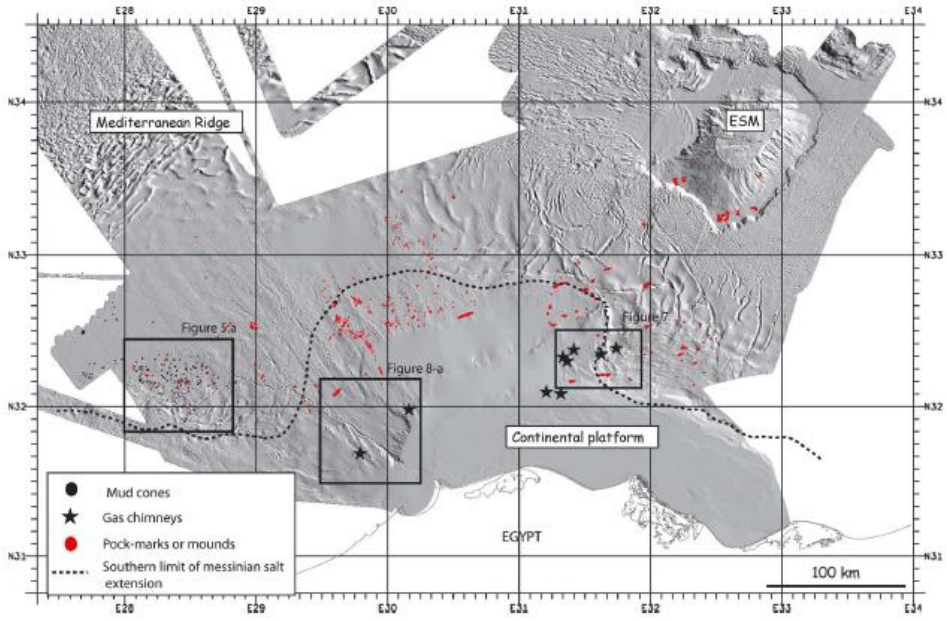


Fig. 1.3. *Geomorphological indications of hydrocarbon seeps on the seabed surface in the Eastern Mediterranean region. (Legend: ESM: Eratosthenes Mountain. (Mud Cones, Gas Chimneys, Pockmarks, Mounds),(Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*



1.c. The offshore area between Cyprus – Egypt with respect to hydrocarbon potential

All the geophysical indications for the existence of hydrocarbons in the broader region of the Eastern Mediterranean and more specifically in the offshore area between Cyprus and Egypt have been well known up to 2004 (Loncke et al., 2004). The Eastern Mediterranean region and particularly that between Cyprus and Egypt has been systematically explored during the last 10 years by petroleum companies and currently stands for an oil and natural gas producing site. Up until the year 2000, natural gas (mainly) and oil reserves -corresponding to 3.8 billion barrels- have been discovered (Abdel et al., 2000 and 2001, Samuel et al, 2003). The main source is located either in the Upper

Cretaceous (black shales), in gas-rich sediments of the Miocene, or even in Pleistocene sapropyl with exceptionally high TOC (Total Organic Carbon) values. It appears that reservoirs are mainly located in land deposits of the Miocene and in channel clusters of the Pleistocene (Samuel et al, 2003). On the seabed surface, incidents of high quality hydrocarbon seeps have been discovered, mainly above large fracture zones in the Eastern section of the NDSF. The presence of hydrocarbon seeps is most probably linked to recent sapropyl degradation (Coleman et al., 2001).

2. Petroleum and natural gas reserves in the Eastern Mediterranean

The land and offshore area of the Eastern Mediterranean Basin (Figure 1.3.) has proved to be quite promising for hydrocarbon production. As stated in numerous publications, up until December of 2006, the oil reserves were 15 bbl and 100 tcf of natural gas. The basin's tectonic development has been interpreted according to the following stages (Peck, 2008) (Figure 2):

- A period of compression-generated tectonic pit formation (Late Triassic to Early Jurassic).
- Middle Jurassic to Early Cretaceous sag period.
- A period of alpic reversal (Late Cretaceous to Early Palaeogene period).
- An internal plate settlement period (Late Palaeogene to Miocene) which is characterised by:
  - The Suez Golf Tectonic pit (Oligo – Miocene).
  - The Red Sea Tectonic pit.
  - The Salinity Crisis (Messinian).
- Flood Period (Pliocene).

The hydrocarbon reserves are distributed in three broader and proven oil systems (Systems A, B and C) (Peck, 2008) (Figure 2.1.). The basin's special characteristics are the following:

Fig. 2. *Offshore Two-dimensional Seismic Measurement Program of the S/E Mediterranean (Source: TGS-NOPEC Geophysical Co).*

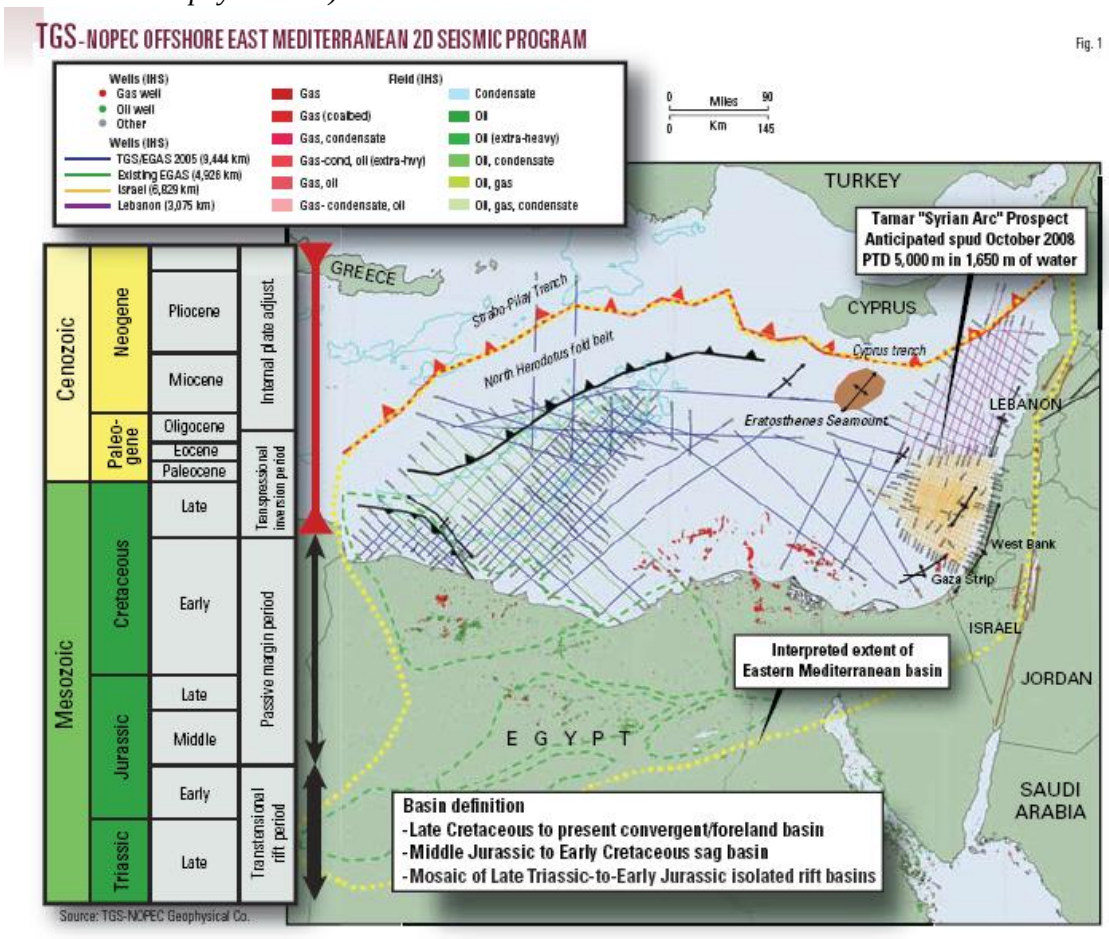
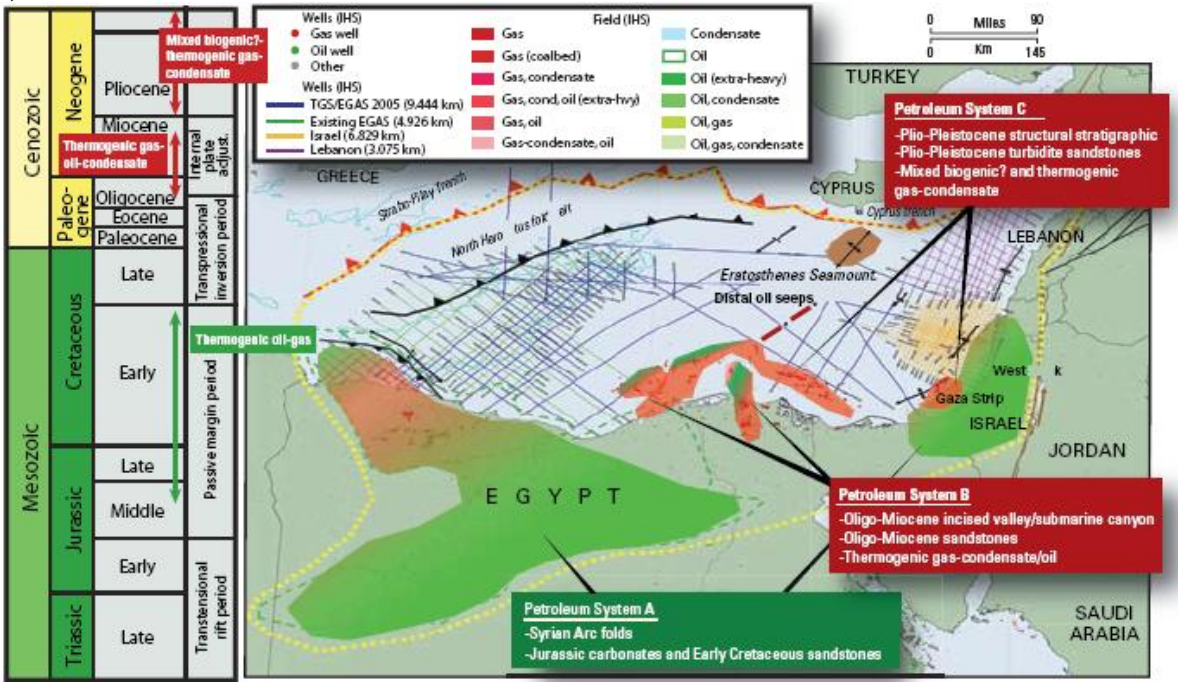


Fig. 2.1. *Petroleum Systems of the S/E Mediterranean: A, B and C (Source: TGS-NOPEC Geophysical Co).*



The offshore section of system C, parts of which are located in front of the Nile and Gaza, are mainly characterized by natural gas reserves. All Pleo-Pleistocene natural gas reserves are close to almost vertical palaeo-fractures extending throughout the length of the layer column. According to company reports, oil seeps from the seabed are linked to the previously mentioned palaeo-fractures that begin from the Mesozoic section until the corresponding Cainozoic (including the Messinian salinity and the overlaying Pleo-Pleistocene section) (Cf. Fig. 2.1.).

In spite of the abundance of Eastern Mediterranean Basin (EMB) reserves, based on the collected literature, the degree to which the deep section of the basin has been researched is unknown. Between 2001 and 2005, TGS-NOPEC Geophysical Co. acquired the data which concern the two-dimensional, 19.256 km long seismic recordings off the coasts of Lebanon, Israel and Egypt. (Figure 2.1).

The company also reprocessed the seismic recording data for a length of 4.526 km, whose rights are held by the EGAS and refer to the offshore region north of Egypt (Figure 2.1).

We must point out for reasons of seismic data reliability, that their linking to data acquired by means of offshore drillings (up to the Mesozoic period) was achieved. All the drillings are relatively close to the coastlines of Egypt and Israel.

3. Mud Volcanoes and gas hydrates in the region south of Kastelorizo

As mentioned in recent publications regarding the region of the Anaximander Mountains: "Detailed geophysical, bathymetric and sediment surveys have confirmed the fact that the region of the submarine Anaximander mountains presents active mud volcanoes that are linked to the presence of gas hydrates" (Lykoussis et al, 2009).

Samples of gas hydrates were collected by means of indicative samplings in mud volcanoes thoroughly mapped in sub-seabed layers that do not exceed 1.5 m. Their form is "ice-crystal". New mud volcanoes were also discovered ("Athens" and "Thessaloniki"). Gas hydrates were found in samplings conducted in the "Thessaloniki" M.V.

According to preliminary assessments, the total mud volcanoes capacity of the Anaximander mountains complex ranges between 2.56 - 6.40 c. Km (Lykoussis et al, 2009)."

3.1 General description

Mud volcanoes are a sovereign geological mechanism for the escape of gases of hydrocarbons in deeply buried sediments. They are mainly located in subduction and orogenic areas where tectonic compressional tendencies are dominant (Milkov et al, 2000, Mascle et al, 1999). Mud volcanoes are linked to the presence of solid gas hydrates which constitute a possible source of an exploitable natural resource but also an environmental pollutant (Woodside et al, 1997, Woodside et al, 1998). The presence of mud volcanoes in the Eastern Mediterranean is widespread in several points of the Mediterranean Ridge (Figure 3.).

Their creation is owed to mud seeps hyperpressured by overlaying methane gas layers, which "spring up" via distorted sediments and reach the seabed surface forming the characteristic form of a "dome". The first mud volcanoes in the Eastern Mediterranean were recorded in the decade of the 1970's (Cita et al, 1981).

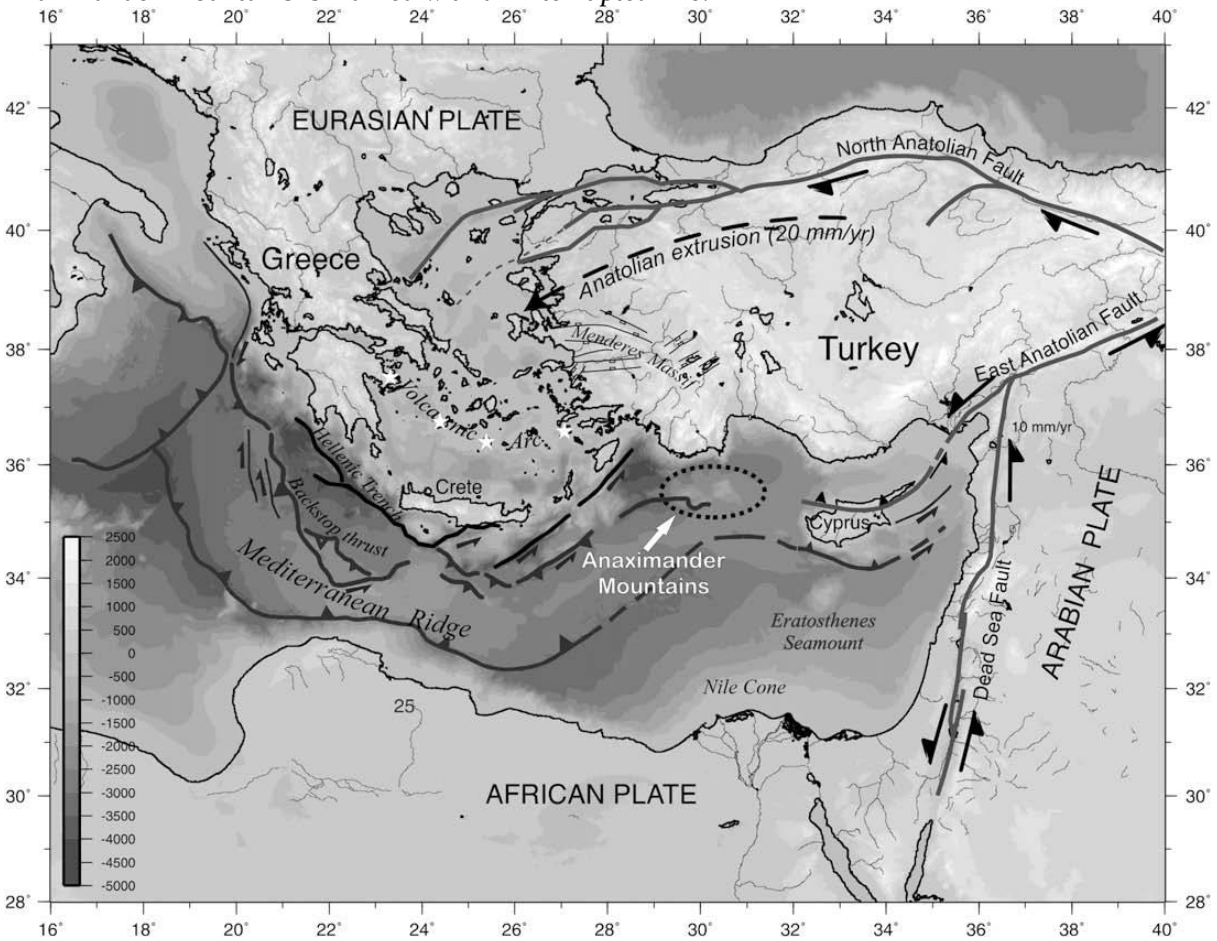
Their linking to the presence of gas hydrates boosted researching and recording them. The Anaximander mountains cluster is located in the region south of Kastelorizo (Figure 3.1) presenting a characteristic geomorphology featuring mud volcanoes and associated gas hydrates.

The region's mapping was carried out within the framework of European programs on the initiative of the INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION (Perissoratis et al., 2003), and the ANAXIMANDER program (EVK3-2001-0001233000). Following below is the description of the results from the oceanographic voyages carried out within the framework of the previously mentioned program in the years 2003 and 2004. A detailed bathymetric surveying of the seabed was conducted and seismic profiles were taken.

3.2 Area geomorphology and description

The research carried out in 2003 produced the seabed's precise morphology and the possibility to determine the sedimentary distribution from the acoustic tone's differentiations which results from analysing the backscattering signal's intensity. The bathymetric map of the region was made on a 100 metre distance grid, while in the regions of interest, the map was made on a more detailed grid of a 20 and 50 metre distance (Fig. 3.1.). The submarine mountain of Anaximenes presents a ridge-like structure with a SW – NE direction and is approximately 1300 metres long, with steep slopes. Contrarily, the mountain of Anaxagoras, which is geographically located eastwards of Anaximenes, has an almost square structure, (approximately 30 km wide and 55 km long) and a relatively irregular topographic bas-relief. Anaxagoras presents three distinguishable geomorphological units on its northern, southern and south-eastern section. The large northern structure has an arc-shaped form, with a slight upwards gradient until a depth less than 1000 m, with a characteristic plateau in smaller depths. The Kula mud volcano presents a downward sediment movement, via the erosive channels which terminate towards the north-west in a deep level sinking. The southern structure is an oblong ridge with a SW-NE direction, bibliographically referred to as "Faulted Ridge" (Zitter et al, 2006).

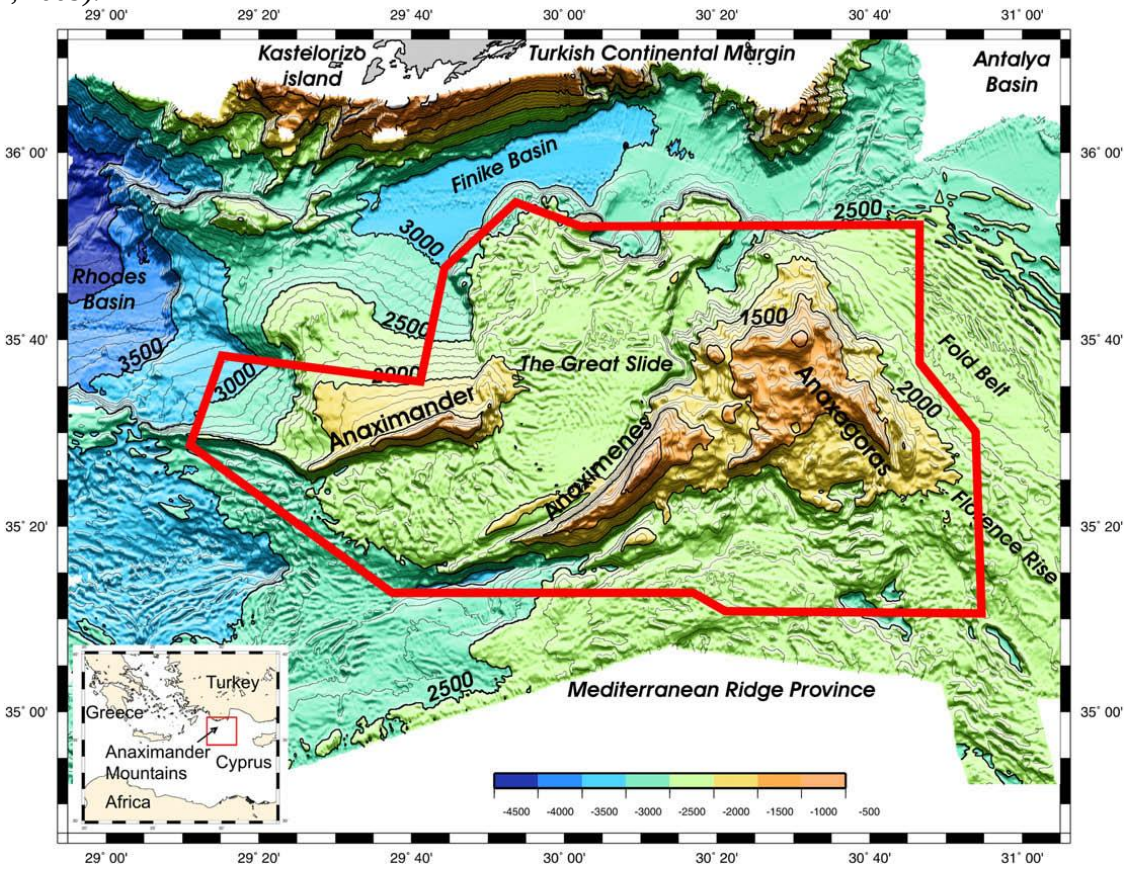
Fig.3. *General geotectonic and bathymetric map of the Eastern Mediterranean. The region of the Anaximander Mountains is marked with an interrupted line.*



Source: (Modified by MEDINAUT/ MEDINETH Shipboard Scientific Parties, 2000; Ten Veen et al., 2004 in Lykousis et al, 2009.).

North of Anaxagoras and northeast of Anaximenes, a linear sinusoidal subduction is formed (Fig. 3.1), starting at the Anaximenes front, with a width of 300 m and heading northeast, with a 10 km span that wears off between the deep basins of Antaleia and Finike Basin. A system of deep canyons, most likely created by avalanches, originates from the northwest section of Anaxagoras and develops towards the channel's east side for a 30 km distance. The closing end of the Mediterranean Rigde is apparent in the same region, in a slightly rippled area that is clearly dissociated from the complex by a deep canal south of Anaximenes, at a depth of approximately 2800 m.

Fig.3.1 *Anaximander Mountains region, S-SE of Kastelorizo (Woodside et al, 1997, 1998;* in *Lykousis et al, 2009).*



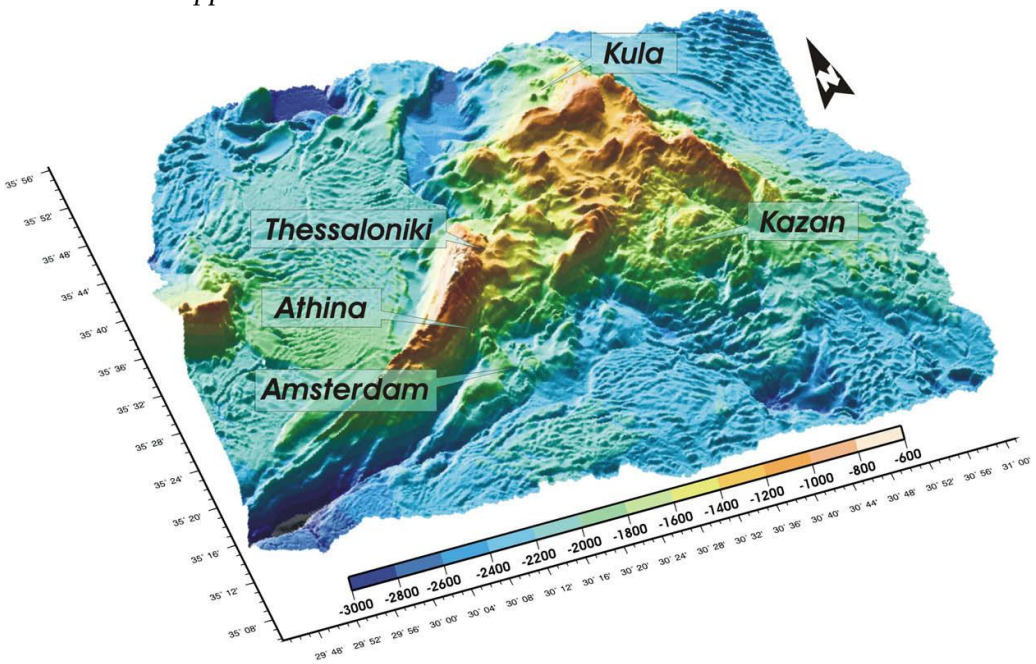
3.3 Description of mud volcanoes[1]

3.3.1. Amsterdam

It features a flat projection of 6 km^2 at the south slope of Anaximenes, at a depth of 2025 m (Fig. 3.1). The detailed bathymetric bas-relief brought up two concentric craters, linked to the characteristic slope and the 400 m deep sub-sea canyon, at the southern part exceeding the depth of 2250 m. In the crater area, 27 mud samplings were taken by means of coring. No presence of pelagic sediments was noted, which indicates the active state of the mud volcano. The set of samplings also demonstrates that gas hydrates are located in the centre and the southern slope of the Amsterdam SM (fig. 3.2.-3.3). Gas hydrates were located at a depth of 0.3-1.5 m, under the seabed surface. Particularly in the case of this specific mud volcano, it must be reported that the seismic profiles revealed a layer, located 40 m under the seabed surface, directly related to highest limit of gas hydrates. The lowest limit of gas hydrates' stability zone is most likely located at approximately 200 m (Woodside et al., 2003). Based on the topographic bas-relief and sampling, the gas hydrates territorial expansion is estimated at 26-28 km^2.

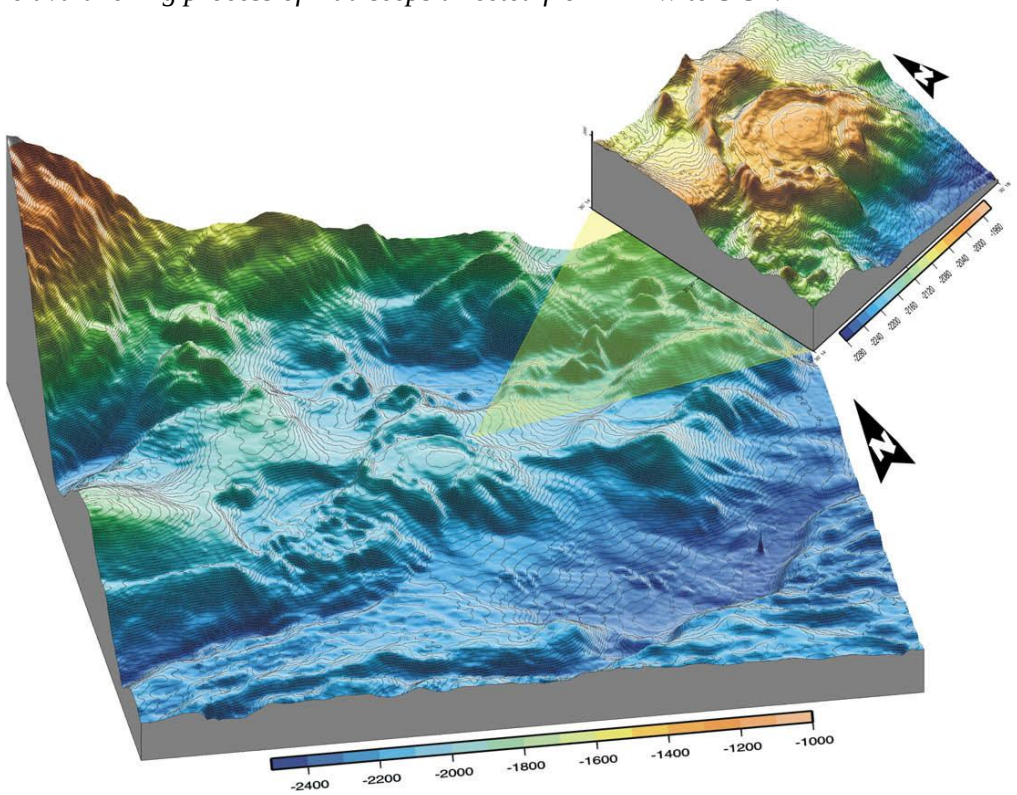
[1] Paragraph 3 describes the physiography of the region and the findings in order to serve the geopolitical view of the authors for the political conclusion that follows. A thorough and more detailed description for the region is found in Lykoyssis et al, 2009.

Fig. 3.2 *Mud volcanoes mapped at the Anaximander mountain*



Source: Lykousis et al, 2009

Fig. 3.3 *Generic and more detailed 3-D bathymetry map. Amsterdam mud volcano. The map clearly illustrates the avalanching process of mud seeps directed from N-NW to S-SE.*



Source: Lykousis et al, 2009

Fig.3.4 *Micro-topographic depiction with shadding of the Amsterdam mud volcano. Sampling locations and points of discovered gas hydrates are identified. 5 cm isobaths.*

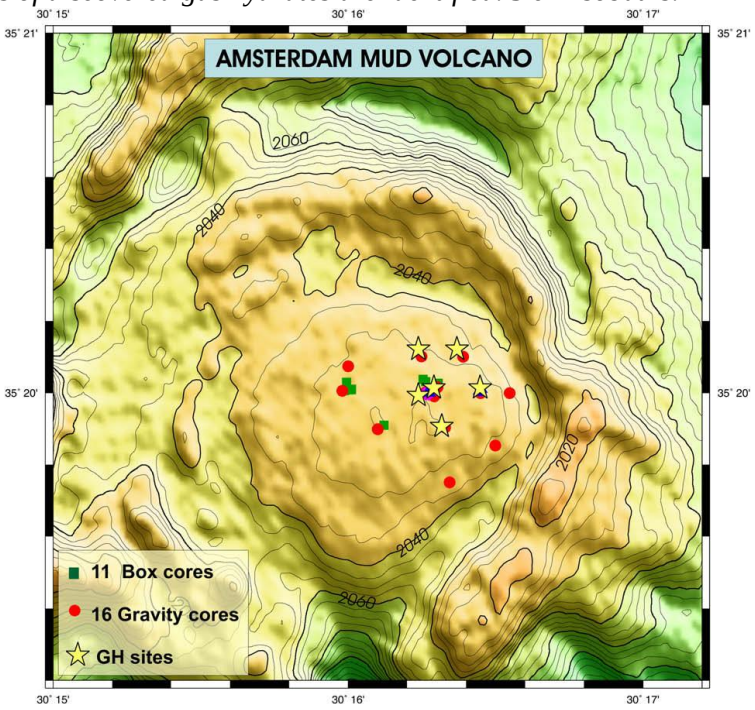


Fig.3.5 *Gas hydrates (8, 5 and 4 cm)(centre) from the Amsterdam mud volcano. Consecutive measurements after retrieving the core receivers produced min. temperatures of 3-4°C.*

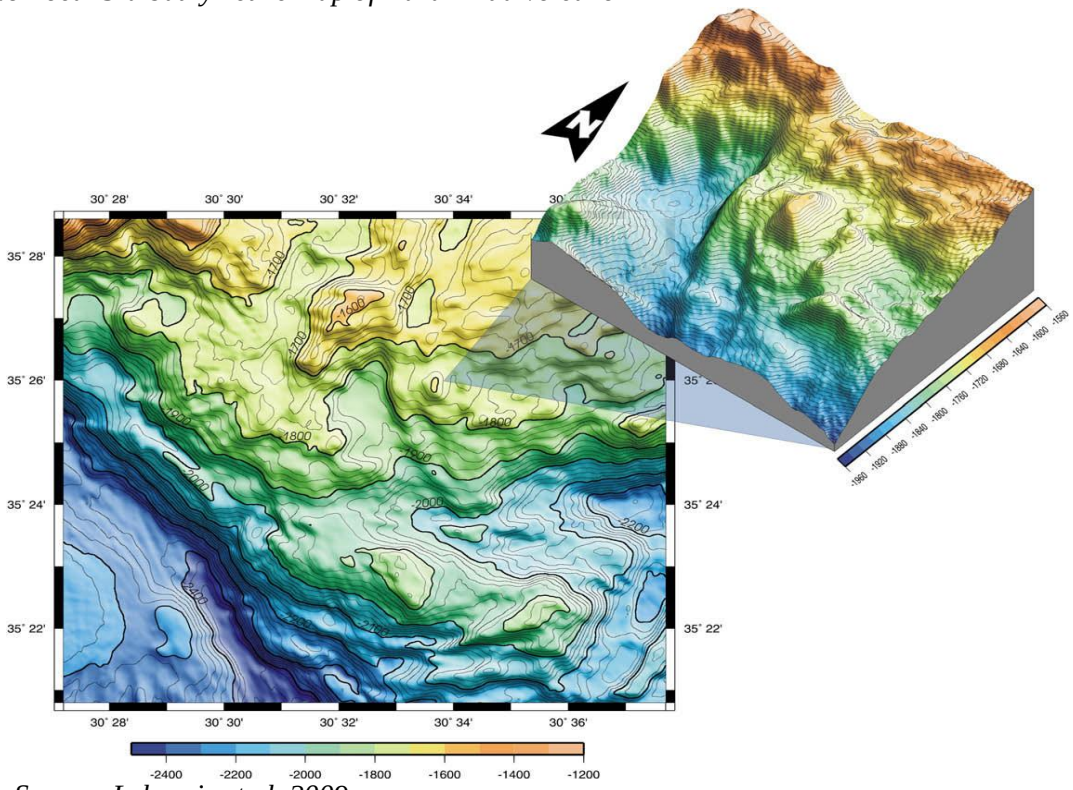
Source: Lykousis et al, 2009

3.3.2. Kazan

The Kazan mud volcano is approximately 50 m tall, located at the edge of a relatively level flattened area, at a depth of 1750 m (Fig. 3.8). It stands at the southern rib of Anaxagoras SM and eastwards of a major fault zone NW-SE separating Anaximenes from Anaxagoras. It presents an oval dome-like shape, aligned to the North-West axis. Its detailed bathymetric depiction clearly demonstrates the avalanching subduction at its sub-circular structure. The back scattering signal's intensity, as recorded by the multi-beam echosounder, varies significantly in the surrounding area. No

smooth mud seeps are apparent on neighbouring slopes. High intensity values are related to the active flow of the mud volcano. The northern limit has two cuspate structures facing north, related to mud seeps towards the north. Mud hydrates were found for the first time after the original site survey/mapping. A total of 6 samples have been taken from four different points of the volcano. Gas hydrates were found at 0.3 m below the seabed surface (Fig. 3.9)

Fig 3.6 *Local 3-d bathymetric map of Kazan mud volcano*



Source: Lykousis et al, 2009

Fig. 3.7 *Micro-topographic depiction with shaded Amsterdam mud volcano. Sampling locations and points of discovered gas hydrates are identified. 5 cm isobaths.*

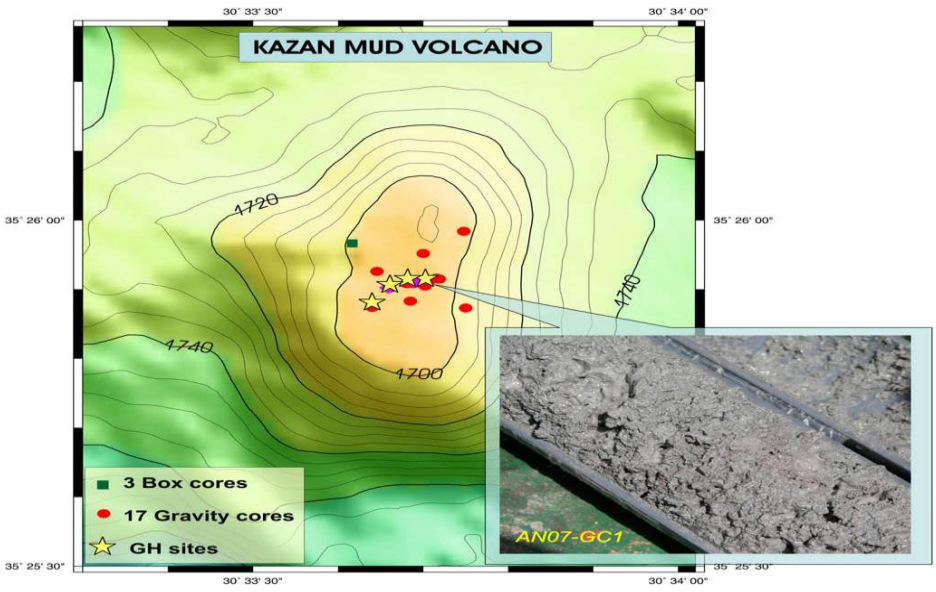
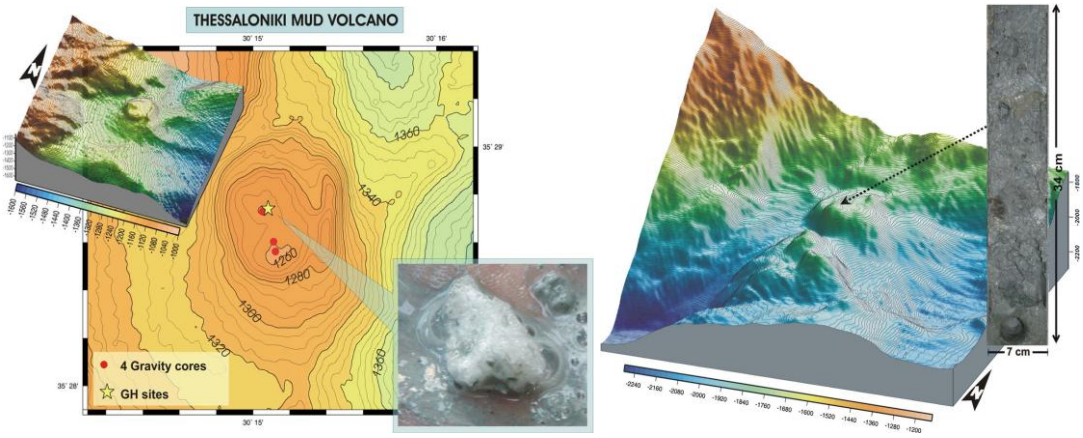


Fig.3.8 *Local 3-d bathmetric map of Athina (left) and Thessaloniki (right) mud volcano*



Source: Lykousis et al, 2009

4. History of actions and statements by interested state actors

A history of actions and statements between Turkey and Cyprus (Skordas. 2007), is presented below as it took place following determination of Cyprus Economic Exploitation Zone and subsequent concession of exploitation rights, coupled with some additional comments by the author.

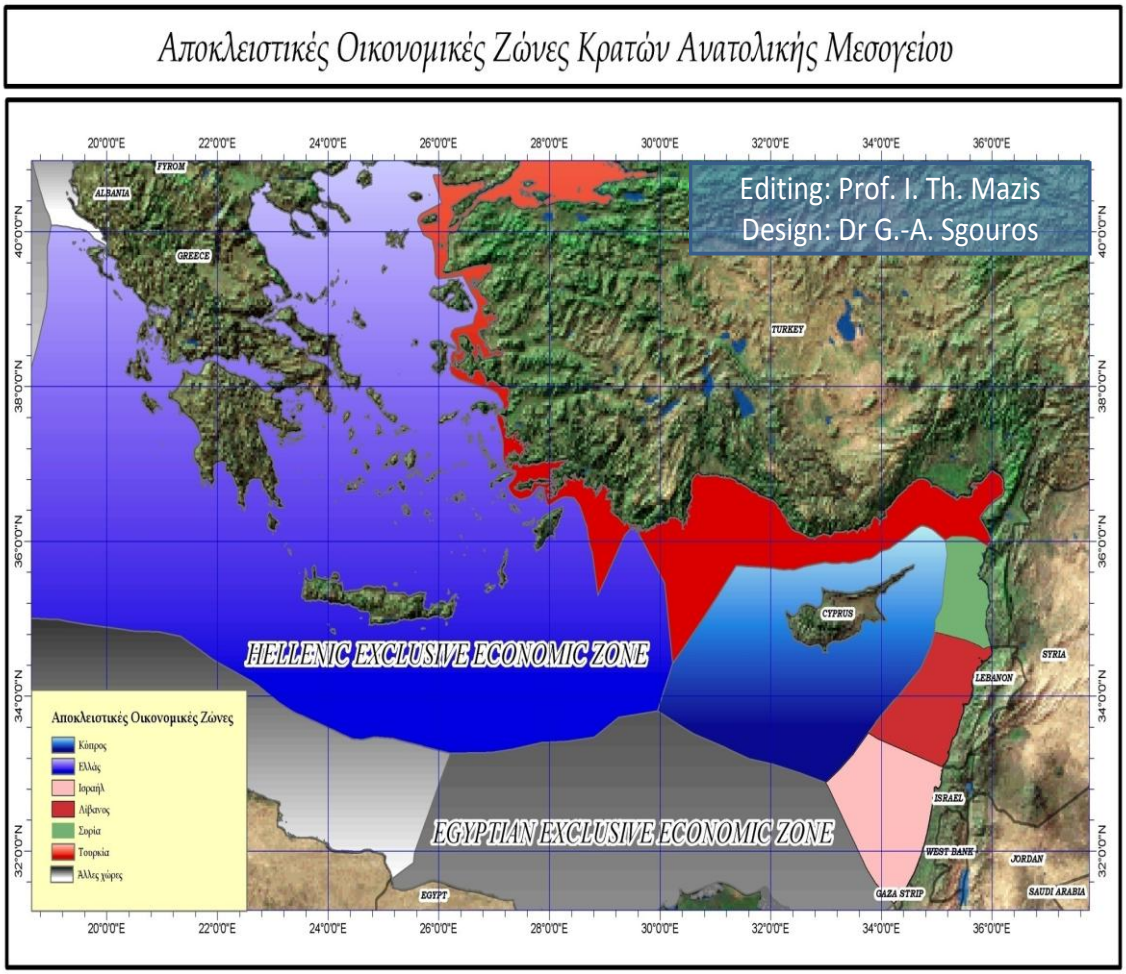
"*1. On February 17, 2003, Cyprus and Egypt signed the Agreement on the Delimitation of the Exclusive Economic Zone (EEZ). According to Article 1, paragraph 1, "the delimitation of the EEZ between the two Parties is effected by the median line of which every point is equidistant from the nearest point on the baseline of the two Parties."*

"2. A similar Agreement was signed on January 17, 2007 between Cyprus and Lebanon. In 2004, Cyprus enacted legislation for the proclamation of the EEZ extending not beyond 200 miles from the baselines from which the breadth of the territorial sea is measured, and contiguous zone, the outer limit of which should not extend beyond the 24 nautical miles from the same baselines.

"3. On February 15th 2007, Cyprus opened a bidding process to license offshore gas and oil exploration. In January 2009, a US-Israeli company announced an 88 bcm natural gas find off the coast of Haifa, according to a Reuters news article (Kambas, 2009). This company holds exploration rights for an adjacent block belonging to Cyprus' Economic Exploitation Zone. Adjacency (distance between 2 countries is merely 250 km)[2] *and geological indications suggest that there may be a link between these neighboring areas with respect to hydrocarbon deposits in this region. All said exploration fields are situated in the South, Southeast and Southwest of the Island, excluding thus any issue of EEZ settlement with Turkey, as seen in Figure 4.1. "Despite this fact, Turkey has sharply protested the move by Cyprus with Greece and the United States […]"*

[2] It seems quite reasonable to have had an already existing settlement of EEZ between Israel and Republic of Cyprus.

Fig. 4.1 *Exclusive Economic Zones of Eastern Mediterranean countries (Based on the Flanders Marine Institute, Belgium Database and the Eurosion GIS Database)*



4. In its statement of January 30, 2007, Turkey argued as follows (Skordas, 2007) "…the TRNC (Turkish Republic of Northern Cyprus) also has rights and authority over the maritime areas around the Island of Cyprus. Moreover, Greek Cypriots do not represent the Island as a whole. Consequently, neither the legislation adopted nor the bilateral agreements concluded by the Greek Cypriot Authorities have any effect. In addition, it must also be kept in mind that Turkey has legitimate and legal rights and interests in the Eastern Mediterranean. Parts of the maritime areas that are subject of bilateral agreements intended to be concluded by the Greek Cypriot Authorities also concern Turkey's stated rights and interests. Turkey is determined to protect its rights and interests in the Eastern Mediterranean and will not allow any attempt to undermine them. In this context, we would like to remind those countries and companies that might consider conducting research for oil and gas exploration, based on invalid licenses Greek Cypriot Authorities may contemplate to issue for maritime areas around the Island of Cyprus, to take into account the sensitivity of the situation as well as the will of the Turkish Cypriots, the other constituent people of the Island.

"5. In a further statement of February 15, 2007, Turkey refined its position: "Accordingly, we expect the Greek Cypriot Authorities to end their calls for international tender which are not based on common understanding among the Eastern Mediterranean states, and thereby creating fait-accomplis, violating the joint rights of the two peoples on the Island on issues like oil and natural gas exploration".

"It is obvious", A. Skordas continues, "the legal arguments of Turkey are not convincing, and there does not seem to be any real legal dispute between Turkey and Cyprus with respect to the latter's EEZ delimitation agreements, apart from potentially overlapping claims on some maritime areas between Turkey and Cyprus. Instead, Turkey attempts to exercise pressure on foreign companies

and neighbouring states to indirectly undermine the effective exploration and exploitation of the resources of the EEZ."

"6. Through identical letters addressed to the United Nations (UN) Secretary General and to the President of the Security Council dated January 31, 2007 (A/61/726-S/2007/52/2 February 2007), Cyprus responded by invoking its sovereign rights: "Turkey has no right whatsoever to challenge the delimitation of the EEZ or the continental shelf between the Republic of Cyprus and its neighbouring States, in accordance with relevant provisions of international law and in areas that are neither opposite nor adjacent to Turkish coasts (…). The Government of Cyprus has no doubts about the sovereignty of the Republic of Cyprus over the maritime areas surrounding the island and the natural resources therein and rejects any claim by the Government of the Republic of Turkey to the contrary".

The United States took a cautious approach, and avoided taking sides. On February 5, 2007, the spokesman of the State Department gave the following answer:

"U.S. policy has not changed. Any dispute here is between the Republic of Cyprus […] and Turkey. The United States is not a party to these agreements. The State Department has no recommendations as to whether American companies should participate in the bidding process. The controversy, however, points to the need for all parties to focus on re-starting the UN's good offices mission to forge a comprehensive Cyprus settlement that reunifies the island into a bi-zonal, bi-communal federation. The next step should be to implement the agreement brokered by the Under Secretary-General Gambari, July 8, 2006. A final settlement will enable all Cypriots to benefit from the island's resources".

2. Delimitation of EZZs

"Stability and viability of the EEZ delimitation agreements lies on the existing agreements between Cyprus, Egypt and Lebanon. There is no doubt that the two agreements have been concluded under international law; they become binding upon the parties by the completion of the ratification process. […] None of them infringes upon Turkey's sovereign rights, according to the presented technical analysis.

An important issue that may amend existing agreements is the -future- way to solve the Cyprus issue[3]*.*

If a future state of affairs in Cyprus takes shape in any form of state succession, it might be asked, whether the successor entity could claim a fundamental revision of the treaties. […] The delimitation agreements concluded by Cyprus followed the median line, which corresponds to the principle of equidistance, as recognized by the law of the sea. This is an additional reason that practically precludes any future controversies on the agreed line" [emphasis added].

Therefore, further delaying of Greece to delimit its EEZ with Cyprus is deemed by Turkey as a token of laxity on behalf of Greece, whose government has already "tacitly" agreed on some sort of new state formation that will not be covered by a Greece-Cyprus delimitation based on current data.

"*The Cyprus-Egypt agreement provides for review of the existing lies in two cases*[4]*: a) if more accurate data are available, thus giving the legal right to any part to ask for redetermination of the*

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[3] To facilitate the reader, Article 83 on continental shelf is quoted:

1. The delimitation of the continental shelf between States with opposite or adjacent coasts shall be effected by agreement on the basis of international law, as referred to in Article 38 of the Statute of the International Court of Justice, in order to achieve an equitable solution.

2. If no agreement can be reached within a reasonable period of time, the States concerned shall resort to the procedures provided for in Part XV.

3. Pending agreement as provided for in paragraph 1, the States concerned, in a spirit of understanding and cooperation, shall make every effort to enter into provisional arrangements of a practical nature and, during this transitional period, not to jeopardize or hamper the reaching of the final agreement. Such arrangements shall be without prejudice to the final delimitation.

4. Where there is an agreement in force between the States concerned, questions relating to the delimitation of the continental shelf shall be determined in accordance with the provisions of that agreement.

Article 74 is identical, differentiated however by the replacement of the term "Continental shelf" with the tem EEZ. When States are adjacent or facing each other, with a distance less than 400 miles, then we have overlapping of sea limits. A useful reference covering major part of delimitation agreements until 1992 can be found in International Maritime Boundaries (Charney and Alexander, 1993), in two volumes, updated in 1996 for the third volume, edition 1998.

[4] http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/regionslist.htm

median line and b) the geographical coordinates […] could be reviewed / extended as necessary in light of future delimitation of EEZ with other concerned neighboring states[5] *[…]*".

This means that should existing lines infringe upon third countries' continental shelf, the counterparts are obliged to proceed with relevant amendments.

We must also add that currently, there are natural gas deposits in the Levantine sea basin and particularly in Israel's EEZ, that US-Israeli company Noble Energy has been contracted to drill. These are the following: i) Tamar: 90 km off Haifa and at a depth of ~1680. Estimated reserves: 142 bcm. ii) Dalit: 13 km east of Tamar deposit. Estimated reserves: 14 bcm. Moreover, it has to be mentioned that hydrocarbon indications, such as pockmarks, gas chimneys etc, highlight the importance of the Levantine basin region with respect to other deposits as well.

So, it is obvious that Israeli oil interests are being covered by the EEZ delimitation between Israel and Cyprus as effected already by the late Tassos Papadopoulos' government. The alignment of Israeli and Cypriot interests in the field of sub-sea hydrocarbons may act as a solid foundation for additional points of concurrence of political-economical interests, and partnerships on security. This is made even clearer in light of two facts:

i) the significant deterioration of the Turkish-Israeli relationships and

ii) the close ties being developed between Turkey and Syria-Lebanon, via the occupied Cyprus territories, which act as transfer belts of Turkey's neo-osmanic-type power on Arabic-Muslim actors, hostile to Israel, located in the inflammable Levantine basin region.

The latter becomes increasingly apparent by the coastal connection already established between occupied Cyprus areas and Tripoli of Lebanon, calling at Lattakia of Syria, inaugurated on August 25th 2009[6].

In any case, the overall state of affairs provides the necessary and sufficient condition that may drive Greece into delimiting its own EEZ with Cyprus, thus ensuring westwards the existing favorable -and legally sound- balance in the Levantine Basin. That would be an act of utter diligence and optimum timing, although we consider it practically improbable.

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[5] The exact phrasing of the agreement in English is given in order to avoid subjective translation into Greek by the author.

[6] "On Thursdays, a passenger carrier will bring 200 people with their vehicles from Tripoli, Lebanon, calling at Lattakia, Syria, to the port of [occupied] Famagusta. The return trip will be conducted on Mondays with a duration of 6 hours. [see "Ancara implements connection agreements with Lebanon, Syria, Iran and Pakistan", *Amintiki Epithehorisi (Defence Review)*, no. 81, September 2009, pg. 10-11.

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CITY MARKETING IN GREECE: THE POST-OLYMPIC USE OF HELLINIKON FORMER AIRPORT SITE

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Abstract:

Despite the appearance of a significant number of publications on the topic of city marketing theory in the last twenty years, there is still a huge gap in the literature with regard to its application in practice. This article aimed to bridge that gap by investigating the role of city marketing in planning the sustainable post Olympic use of Hellinikon former airport site in Athens, Greece. It was found that certain elements of the city marketing theory were attempted to be employed in the design process, however project implementation was seriously hindered as a result of the involvement of various stakeholders with differing and conflicting agendas.

Keywords: City Marketing, Hellinikon, Post-Olympic use, planning, real estate

Introduction

This article aims to bridge the gap between city marketing theory and practice by investigating the role, if any, of city marketing in planning the sustainable post Olympic use of sports facilities. The case study of the Hellinikon Olympic complex in Athens will be employed. First, an overview of the city marketing process will be presented. Then, a detailed analysis of the planning process for the Hellinikon former airport site will follow. Based on the theoretical model of the city marketing process on the one hand and on the detailed analysis of the Hellinikon planning process on the other, an attempt to identify marketing elements in that particular case will be made. Consequently, the extent to which city marketing has been applied in the specific context will be assessed. Finally, general conclusions will be drawn with regard to the course the planning process has taken, as a result of the involvement of various stakeholders.

Methodology and data

As already mentioned in the introduction, a comparison between the theoretical model of city marketing on the one hand and its application in practice on the other will be made. To accomplish this, first an overview of the city marketing process will need to be produced. Towards that end, an analysis concerning the concept of city marketing and its theoretical framework will be made through critical reviewing of the relevant literature. Then, a model of the process of city marketing will be the outcome of the synthesis that will follow. As regards to examining its (possible) application in practice, the planning process for the Hellinikon former airport site will be employed. This will be based on a detailed analysis of all major planning attempts as expressed in research documents commissioned on behalf of central government agencies (such as the Organization for the Regulatory Planning and the Environmental Protection of Athens, the Hellenic Public Real Estate Corporation and the Local Union of Municipalities and Town Councils of Attica - T.E.D.K.N.A.) to independent researchers and planning practitioners. The purpose is to identify (if possible) some of the key elements of the city marketing model within the Hellinikon planning process so as to assess the degree by which city marketing is (or was) attempted to be implemented in Greece.

The City Marketing Process

Introductory Remarks

To begin with, what needs to be stressed is that any attempt to describe a model of the city marketing process will always be dependent on different interpretations of its meaning. Therefore, it seems first of all crucial to establish a basis on which the analysis of the process is going to be built upon. The

first step towards this aim is to provide an indication of the substance of city marketing by means of analyses of various definitions referring to the concept.

Definitions of City Marketing

Various definitions provided by urban scholars such as Page [22], Krantz and Schatzl [20], Ashworth and Voogd [2], Corsico [9], Borchert and Buursink [8], Van den Berg [7], Sforzi [27], Gaido [11] as regards "city marketing", "place marketing", "market planning" have demonstrated a range of interpretations. The extent to which they converge or diverge has provided a basis for their categorization into three broad and roughly defined levels/categories: First, city marketing might be regarded as merely place promotion, best expressed by the phrase "selling what we have got" (pseudo marketing). Second, it can include a process of identification of the needs of potential users and the consequent transformation of the urban product in accordance with these requirements, so that the objective of local economic development is realized. However, it must be noted that only the needs that can be interpreted in terms of profit making will be considered, which also implies that only the groups expressing those needs will be taken into account. This attitude towards urban marketing has mainly been imported from the US experience and differs considerably from the Dutch interpretation, which constitutes the third level of urban marketing. This level refers to the use of urban marketing as a tool of urban management in general, not just as a tool for improving economic performance. It includes the acknowledgements of all people's needs, irrespectively of whether these may be translated in economic terms, and expands itself to areas of societal welfare. The most recent approach to city marketing has been introduced under the term "*city branding"* by Kavaratzis and Ashworth [17]. They argue that the transition from city marketing to city branding has been facilitated not only by the extensive use and consequent success of branding commercial products, but also by the rapidly developed concept of corporate branding mentioned by Balmer [4] and Balmer & Greyser [5]. City branding focuses on people's perception of cities. It aims to influence such perceptions in a way deemed favorable to the present circumstances and future needs of the place. According to Greenberg [12] people's perception is construed not only by the city's material and geographical dimension, but also by the social imagination and through changing modes of cultural representation. It is thus evident that 'city branding' is nothing more than old wine in new bottles. It is merely an improved version of the first, primitive level of marketing (best expressed with the phrase 'selling what we have got'). It is therefore, a big step backwards for city marketing.

The Model

The most comprehensive view of the place marketing process is provided by Ashworth and Voogd [1], who have adapted a large number of commercial marketing techniques to the urban context. According to them, the process of urban marketing contains four stages. These stages can help explain the interaction of the three main elements involved in any marketing process, namely consumers, market, producers. In other words, the way in which the market brings together 'populations and resources…so that the needs of the former are satisfied by the products derived from the latter' is affected, influenced, and manipulated by the operation of place marketing processes whose stages include the following:

Market Analysis

Market analysis in the context of cities, concerns the analysis of the existing urban facilities/organizational structures (supply side) and the examination of the characteristics, market behavior and needs of consumers (demand side) with the purpose of determining which marketing strategy is appropriate. For market analysis to be performed, certain tools from traditional marketing are employed, the most influential of whom are presented in the following paragraphs.

Product Positioning-Strategic Positioning

The commodification of the functions of the city and their positioning with reference to the existing competition, constitute a phase within the stage of market analysis called product positioning. However, a process of product repositioning is possible when an analysis of the characteristics, market

behavior, needs of users as customers takes place, because then the appropriateness of the urban product to these groups and the need for adaptation on the supply side will become evident.

Auditing the Market

The analysis of the demand and the supply side is part of auditing the market. Ashworth and Voogd [1] mention that it 'implies a systematic analysis of the market position of a city in relation to both the external environment and the internal environment', an opinion shared by Page [22] as well. Smyth [28] defines the term *'market position'* as determining where a city is broadly going to compete in the market.

External Audit

Jensen [16] observes that the external audit refers to the supply side and deals with issues that cannot be influenced by urban authorities as well as other factors that affect urban policies but are not affected by it. As Ashworth and Voogd [1] note, 'through external audit, insights into the opportunities, problems or threats will be gained in relation to actual or potential competitors' so that possible directions for marketing strategies and goals can be derived.

Internal Audit

It refers to the demand side and provides an overview of strengths and weaknesses of the urban product by examining/analyzing issues that can be influenced by urban policy. This guides policies for shaping urban facilities so as to accord with the requirements of potential users. They also suggest that full internal audit requires knowledge about various submarkets which necessitates a process of market segmentation.

Forms of Market Segmentation

It involves the segmentation of the market into various subgroups, which have different demands for the same urban product. Ashworth and Voogd [1] argue that there are three ways of doing market segmentation, that is undifferentiated marketing (no segmentation), differentiated marketing by having several segments and developing tailored marketing plans for each, and concentrated marketing, targeting only one segment of the population. As Page [22] argues, market segmentation serves the purpose of identifying the target market. This also requires knowledge of the market behavior of users and of the consumer decision-making process.

The ways in which market segmentation can be performed, are always dependent on the employment of certain characteristics deemed crucial for the categorization of the demand side into various subgroups. As Ashworth and Voogd [1] stress, what is important in this process of market segmentation is to determine what are the characteristics which can best describe and express the consumption behavior of the user of the urban product.

The Consumer Decision-Making Process

Once the behavioral pattern of selected targeted audiences is identified, an attempt to influence it must take place. This attempt has to be based on a detailed knowledge of the criteria by which the consumer decision-making process is shaped. These criteria are monetary, time specific, place specific, sensory, psychic.

Competition-Potency Analysis

Again, Ashworth and Voogd [1] argue that, as part of market analysis, a competition and potency analysis is required to establish how the city's product compares to that of other cities. They note that potency analysis measures the potency or attractiveness of a certain place for a certain target group by establishing a set of criteria (e.g. qualities of site, land costs, transport infrastructure) and examining how this place responds to them. This will provide an objective view of the quality of the urban product through the analysis of certain attributes that are considered to be important in this evaluation. After this objective view of the attractiveness of the urban product is established, a subjective view on the same issue based on the opinion of one or more of the target groups (competition analysis) is

pursued. Potency analysis will provide evidence of the actual quality of the urban product and competition analysis will indicate its perceived quality by various target groups. These two aspects of the urban product do not always correspond; therefore sometimes product development has to take place so as to improve the actual quality of the urban product when its image (perceived quality) is optimistic. On the other hand, when the image of the place is neither optimistic, nor reflecting the actual situation, then promotion has to be called for. The third possible situation, which is the most convenient, is when the actual and the perceived quality of the urban are both positive.

Formulation of Goals and Planning Strategies
According to Krantz and Schatzl [20], Ashworth and Voogd [1], Page [22] they comprise: expansion or diversification strategy, consolidation or defensive strategy, quality strategy, reduction strategy.

The Expansion or Diversification Strategy
The expansion strategy is aimed to identify new markets for existing urban services and is also accompanied by simultaneous expansion of the entire range of services provided by the local authority. As for diversification, new targeted markets for a new set of services will be sought for. This implies the reshaping of the urban product so as to accord with the needs of the new users to be targeted through the marketing campaign.

The Consolidation-Defensive Strategy
It concerns the maintenance of the existing range of services for current customers and the analysis of developments that endanger stability.

The Reduction Strategy
This form of strategy entails the reduction of the range of services provided by local authorities and it is used with the purpose of avoiding negative effects deriving from over urbanization phenomena such as environmental pollution and traffic congestion.

The Quality Strategy
In this case, effort is placed upon improving the quality of services/facilities for the same customers/consumers without expanding or diversifying them.

The Strategic Objectives
Each of the aforementioned strategies aims to achieve a combination of the three following objectives, namely: developmental, expressed by the establishment of new activities, organizational, comprising the integration of different urban policies, and promotional by involving the supply of selected information about a city's products to potential users.

The Place Marketing Mix
It is a combination of measures needed to achieve the objectives pursued by the marketing strategy. Ashworth [1] stresses that in the context of cities these include a combination of the following instruments "promotional measures, spatial-functional measures, organizational measures and financial measures". Kotler's [19] different opinion on the same issue includes the manipulation of the four key variables used extensively in commercial marketing namely, product formulation, price, promotion and place (the so-called four P's). Kotler's approach however, seems to be dismissed by Krantz and Schatzl [20] who suggest that "decisions regarding these traditional areas tend to be disjointed." Therefore, the following analysis of the place marketing mix will be based on the perspective provided by Ashworth and Voogd.

Promotion
First of all, what needs to be stressed is that promotion is merely a part of a comprehensive marketing process. The most accurate definition of promotion is provided by Schmoll [25] as 'all the communication measures designed to create awareness of, interest in, and a favorable image for, existing or new facilities or services with the aim of attracting customers to them.' As far as the subject of promotion is concerned, Ashworth and Voogd [2] note that it 'maybe the selling of a

selected package of facilities or the selling of a place as a whole through images composed of various attributes associated with it.' (pp. 39-52).
The successful application of promotional strategies requires the adoption of tools such as advertising and public relations.

Advertising the City
It is the instrument used to promote the outward directed interests of the city's policy. Ward [29], Griffiths [13] and Page [22] suggest that the tools used in advertising include print and other media advertising, direct mail, selective publicity, special events, slogans and diagrams, brochures, videos, websites, newspapers, magazines, television, themes, image positioning and visual symbols. Kim and Short [18] as well as Hall [14] note that advertising can be conducted through distribution of information via tourist offices, libraries, commercial information services, responses to postal enquiries, poster advertising, press advertisement, the employment of recognizable logos. Griffiths [13] stresses that behind those common themes in promotional materials, the renaming of places can also be considered as an indirect form of advertising for the reason that it is an effort to remove negative images of a locality and replace them by more positive ones. Nevertheless, some of the most important advertising tools are triggered by event-based promotional strategies. Ward [29] acknowledges the role of sports events as being generating the interest of the media to change more general perceptions of the city.
Regarding the actors involved in place advertising, this is done by advertising and public relations agencies hired/funded by most of the actors engaged in place marketing in general namely, local economic development and tourism officers.

Public Relations
Meffert's [21] definition of public relations refers to the "planned and systematic attempt to build up mutual understanding and trust between an institution and the public through a process of information exchange, consultation provision and democratic participation" (p. 493). All in all, public relations can help get local authority projects accepted at an early stage by means of measures able to build trust and achieve consensus.
Kotler, Haider and Rein [19] reveal the outward focus of PR. They define it as "the effort to build good relations with the organizations publics". The content of PR in this case is aimed outwards in order to assist in the launch of new products, in influencing specific target groups, in defending places that have encountered public problems and in reconstructing the image of a place.
As for the tools of PR, they include press relations, event publicity and lobbying all of which are explicitly outward oriented. The advantages of PR in relation to advertising as mentioned by Kotler, Haider and Rein are that PR are highly credible and more authentic because they communicate the message in the form of news instead of being just a sales directed activity. This also makes them indirect and therefore more capable of reaching target groups who might avoid advertisements. PR are also much less costly than advertisements because there are no payments made for space or time obtained in the media but for a staff to develop and circulate stories and manage certain events. Should these stories and events be interesting enough for the media (e.g. Olympic Games, International EXPOs, Trade Fairs etc) they stimulate publicity worth of millions of dollars in equivalent advertising. Finally, they have a much higher capability of market penetration than advertisements because of their indirect and more credible character.
Overall, there is a clear distinction between the Dutch-German interpretation of the role of PR and the US-British equivalent in city marketing. The former assumes an inward directed focus targeting on consensus-building and reconciling conflicting interests within the locality, whereas the latter is outward directed aiming at influencing target groups outside the locality with the purpose of reinventing it and consequently "selling it"[1]. The Dutch - German approach of the role of PR has clear implications for overall urban management while the US - British one concerns itself in purely economic development terms. However, there is no reason why these two approaches cannot be combined together. PR can very well serve this dual role by employing the relevant tools mentioned

[1] It should be noted, however, that this in no way implies mere selling as what is to be sold in this case is firstly shaped according to the needs of selected target groups.

earlier in each approach. The result will be a more encompassing use of PR, able to produce more and better outcomes.

Spatial-Functional-Landscape Measures

Griffiths [13] makes a categorization between event-based strategies and landscape strategies. Within the category of event-based strategies special reference must be made to spectacles because of the massive impact they have on the commercialization of places, in image creation, and in increased competitiveness. As Ward [29] notes they aim to attract external investment especially through tourism. He also suggests that special events generate the interest of the media to change more general perceptions of the city (image reconstruction). The promotion of culture and leisure activities assumes a central role in this effort of image improvement. Sports events especially can have the additional effect of strengthening social cohesion and civic pride because of their popular dimension. Therefore, they are more easily acceptable by locals. This in turn implies consensus building and higher speeds of design and implementation. Some of the effects of sports events are the attraction of large masses of sports tourism in hosting cities and the extensive TV coverage which ensure large publicity.

Olympic Games especially serve as magnets for mobile investment and tourism. Image enhancement and international business awareness of the hosting city are achieved through publicity stimulated by this type of event. The advantages of such strategies are that they can act indirectly as advertising agents themselves for the city, being at the same time able to reconstruct the city, mobilize endogenous potential, improve the city's image, identify the inhabitants with their city, attract public-private investment, improve environmental care, rationalize production and consumption, as Krantz and Schatzl [20] and Cuadrado and Rubalcaba [10] argue.

In more practical terms, benefits will first accrue to the building sector and induced by multiplier effects to commerce and private services that profit from building investment. Investments in equipment are also distributed over machinery construction, electrical industry and commerce. All these benefits are supposed to take place in the preparatory phase of a large-scale event. During the implementation phase, another series of benefits are expected. They mainly refer to benefits deriving from tourist investment in very well known sectors such as restaurants, hotel trade, foodstuffs, commerce, leisure, and cultural services. As far as the long-term economic development effects are concerned, three main areas have been identified namely: establishing an area as a location specializing in a particular type of event, positive employment effects and attraction of future investment as a result of the improved traffic/ electronic infrastructure and environmental quality.

There are however, some negative effects regarding the hosting of Olympic Games. Expenditure risks deriving from incorrect estimates of costs and mistakes in the implementation phase coupled with organizational difficulties stemming from the peculiarity of the political/administrative system are some risk factors. Moreover, lack of appropriate use of the established infrastructure after the end of the Games will jeopardize long-term economic development benefits.

Landscape strategies, as Griffiths [13] argues, involve largely urban design statements such as high-profile flagship buildings designed by famous architects. He argues that these buildings are used with the purpose of hosting high culture uses as for example, opera houses, galleries, and museums. These uses are able to fulfill some of the demands for high culture stemming from higher income people. In more general terms, these uses are also able to cater for a new lifestyle reflecting the renewed image of the city. Image building has also been pursued through the construction of various elements of physical design such as airports, bridges, communication towers, skyscraper office towers.

Lower scale interventions (in terms of investment) in the built environment also aim to the same kind of effects (image building) but on a smaller scale. They concern the labeling and repackaging of neighborhoods and districts with the assistance of special programs such as inner city revitalization schemes.

Inner city revitalization schemes, albeit less impressive than flagship development projects, can have a very substantial effect on the improvement of actual living conditions in the respective area. While image improvement is a common characteristic of both flagship projects and small-scale neighborhood initiatives, the latter have an additional (and more) tangible effect which is far more important than the previous one. The changes in land uses brought about can terminally reconstruct the actual area, not just its image. This is how real improvement can take place. Flamboyant architectural statements will be appreciated only in the context of more substantial interventions; otherwise their effect will be just

like putting lipstick on a gorilla. The example of the arts and cultural districts can combine both the aforementioned elements in an integrated way. They contain according to Griffiths, 'a number of new or refurbished high art venues such as theatres, opera houses, art galleries, museums together with a selection of bars and high price restaurants. They are situated in locations with a history of social marginality which local authorities need to get rid of'. Their target group is high rank professionals and managers rather than middle-income families. Moving on to a different type of landscape strategies, Griffiths acknowledges the role of festival market places. He stresses that they are located in historic (usually waterfront) areas and include small mid-to-upscale retail shops, street entertainment and proximity to other popular attractions.
The common characteristic of landscape strategies is that they all serve the purpose of establishing and maintaining the notion of the '24-hour city'.

Organizational-Financial Measures
Ward [29] suggests that success lies on a spirit of deep co-operation between the public and private sectors in the whole process of reconstructing cities. Partnerships have a direct and an indirect role. The first rests on bringing about new investments through tax abatements, subsidies and the second is to provide a sign of the degree of local friendliness to external business investors. He further distinguishes between two forms of partnerships: business-led partnerships and centrally legitimated initiatives such as UDCs and Enterprise Zones. The latter aims to make the derelict areas of inner cities more attractive to private investors, usually with the provision of subsidies or tax incentives. The role of public sector in partnerships is focused on promotional planning regimes, site preparation, and negotiation with developers. Private sector's role is to provide the revenue. This comes from a mixture of membership subscriptions, corporate sponsorship, advertising income and sales and assistance in kind.

Elaboration-Evaluation
This refers to the implementation of the place marketing mix. The above heading would otherwise be named implementation-evaluation; however this final stage of the place marketing process is actually an iterative process hence, after each iteration, the various steps become more detailed and more operational, as Ashworth and Voogd [1] suggest. The first step called 'search for direction' could initially be just the launching of an idea, while in following rounds it could involve the tasks of "auditing" in order to reveal the strengths and weaknesses, opportunities and threats for the authority conducting city marketing. This step results in a "plan" which is the immediate step. This could be at the beginning just a statement of the intention to write a report or project plan on a designated issue in following rounds. Next, communication and information activities constitute the third step which aims to ensure support for the plan formulated in the previous step. Two options can be found in this stage. First, there may not be enough support for the proposed plan, therefore alternative directions need to be considered. This implies that the whole process must return to the very first step. Second, the required support has been gained (through promotion) therefore the next step can follow. This refers to the financial feasibility of the proposals. In the first iteration, this step will not be of considerable importance, however the more iterations there have been, the more important it will become. It also includes the investigation of organizational structures (such as public-private partnerships with other agencies). The last step in this process called "actions" may initially include organizational and budgetary measures taken to support plan making and research in the next iteration. Following rounds may include the start of planning implementation or the start of actual building activities.

An overview of the entire city marketing process is presented in the following flow chart.

Figure 1: The city marketing process model

As derived from the chart shown above, the spatial/landscape measures are but one of the elements of the place marketing mix which in turn is just a part of the entire place marketing process. A subset of

such measures is easily identified in any given case of hosting Olympic Games (mainly in the form of sports and transport infrastructure) and hence in the Hellinikon old airport case. This however, does not necessarily mean that such measures are part of a wider city marketing process. To determine this, will require to identify what other elements of the process have been applied (if any) either in the context of the entire city or within the context of the specific area, given that place marketing can be used in various spatial scales such as the city as a whole, for a specific attribute of the city or for a particular area within the city. This will be the scope of the following analysis which will focus on the planning process for the former airport area.

Planning for the Hellinikon area

Athens Hellinikon airport was constructed in 1939 and has been the city's only airport for more than sixty years. Its relocation from Hellinikon to Spata took place in March 2001. Consequently, a 580Ha coastal area eight kilometers far from the city center and within city limits was freed.

Its availability and proper management will determine to a large extent its effect on creating the open spaces and green areas which are so much lacking in Athens. A research program for the future utilization of the former Hellinikon airport site was assigned in 1995 to the Laboratory of Spatial Planning and Urban Development of the National Technical University of Athens by the then Ministry of the Environment, Planning and Public Works via its relegated authority, the Organization for the Regulatory Planning and the Environmental Protection of Athens. The program's aim was to come up with specific guidelines for the airport's future use as a large scale metropolitan park. The recreation aspect was planned to be implemented through the design of a multifunctional recreation park for all Athenians. Research requirements included the formulation of proposals for attaining the following objectives: the creation of sports, of recreational and cultural facilities, the improvement of the wider area's social equipment, fund raising for project implementation through entrepreneurship, the creation of a project management and implementation scheme in collaboration with local governments, the integration of all necessary actions into a comprehensive plan that will not allow for piecemeal development.

Central to this was the requirement for the design of a business center that could make possible the self-financing of the project. The research, supervised by Wassenhoven [30], [31], was initially divided in three phases, however only two were ever implemented, in 1996 and 1999 respectively.

The first phase included an analysis of the airport area and its wider area of influence, an assessment of past urban regeneration practices from abroad, as well as older proposals regarding the area in question.

The aim of phase two was to come up with alternative developmental scenarios. Its outcome was four preliminary scenarios of development whose feasibility was assessed. These were:

Theme parks: Thematic recreation at the city - sea interface comprising theme parks, museums, exhibition halls, leisure facilities.

Arts and letters: Creation of cultural pole comprising an opera house and concert hall, a conservatoire, a dance school, art laboratories, a library, a book centre, facilities for national and egional art organizations.

Conference and exhibition centre and temporary facilities for an international

EXPO comprising a convention hall, international exhibition facilities, the Attica museum, a virtual reality centre, an aquarium, a cinema centre, a business centre, a telecom centre.

Aeronautics and telecommunication and space technology comprising an aeronautics centre, an air transport museum, an image centre, an informatics centre, an exhibition hall, and leisure facilities

The following figures display their most important aspects.

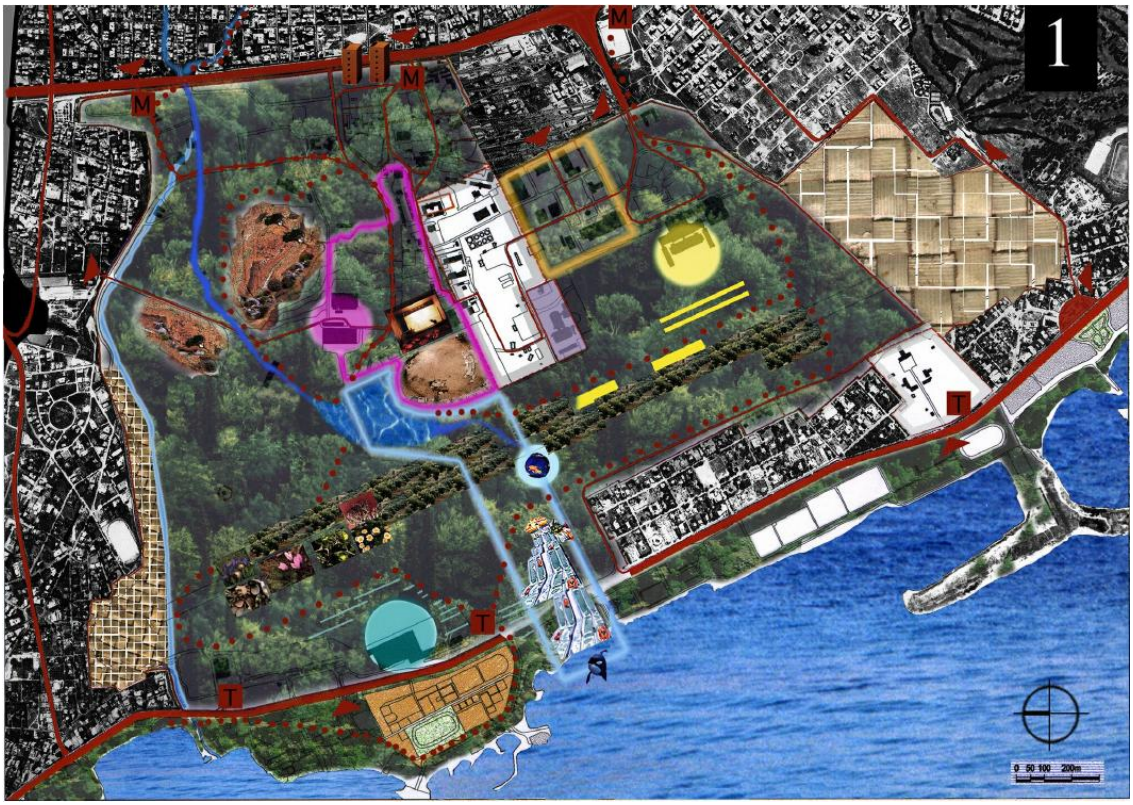

Figure 2: Theme parks scenario.
Source: Wassenhoven, 2007a.

In this scenario, the "virtual reality theme park" with a belvedere demarcated with fuchsia color as well as the "water-recreation park" demarcated with blue color within which a lake and an aquarium are included, have a dominant position. An exhibition center is placed in the old east terminal (yellow circle) and right next to it a business center demarcated with beige color is also placed. The national book center is located in the turquoise circle shown at the bottom of the picture. Finally, office buildings in the easternmost part of the picture, next to Vouliagmenis Avenue, are depicted in brown color.

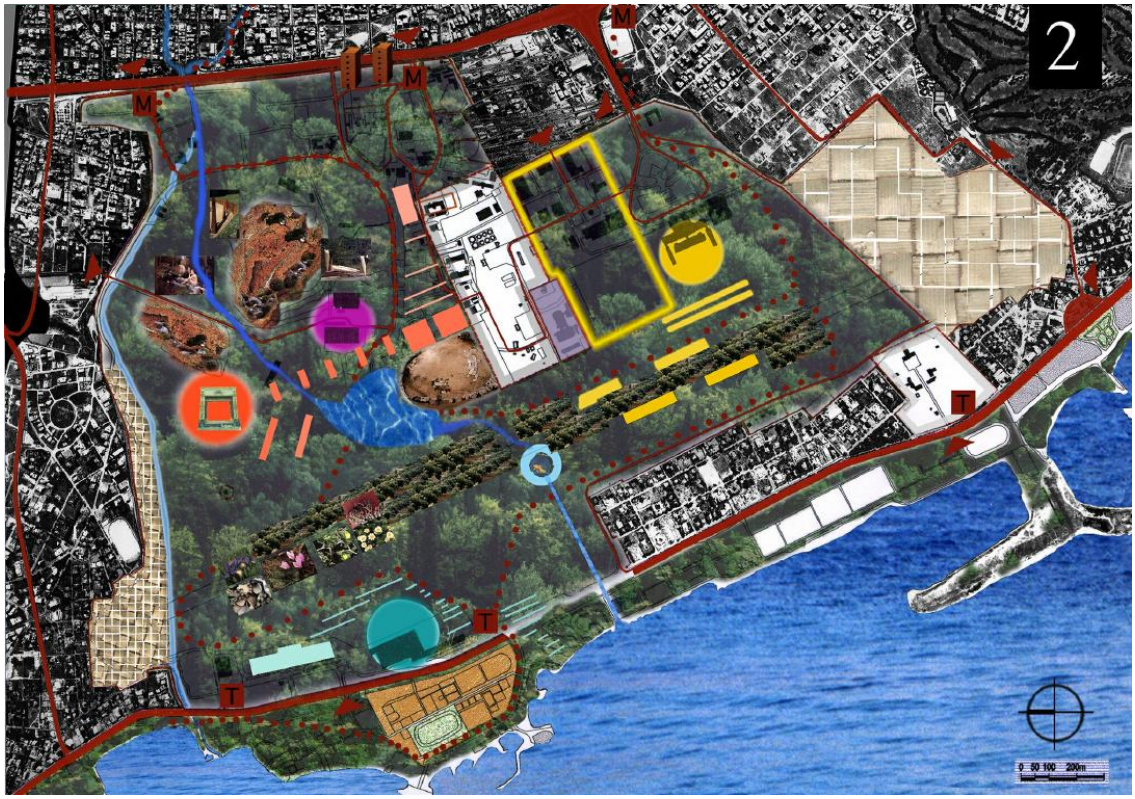

Figure 3: Arts and letters scenario - cultural pole
Source: Wassenhoven, 2007a.

The arts complex (light red circle) and the image center (fuchsia circle) are the dominant entities in this scenario. The lake is connected to the aquarium (little blue ring) through a stream of water abutting in the sea. Next to the lake a belvedere is planned. An exhibition center is placed in the old east terminal (yellow circle) and right next to it a business center (rectangular area depicted with yellow color) is also placed. The Letter complex depicted with turquoise color is located at the bottom of the picture. As in the previous scenario, office buildings in the easternmost part of the area, next to Vouliagmenis Avenue, are depicted in brown color.

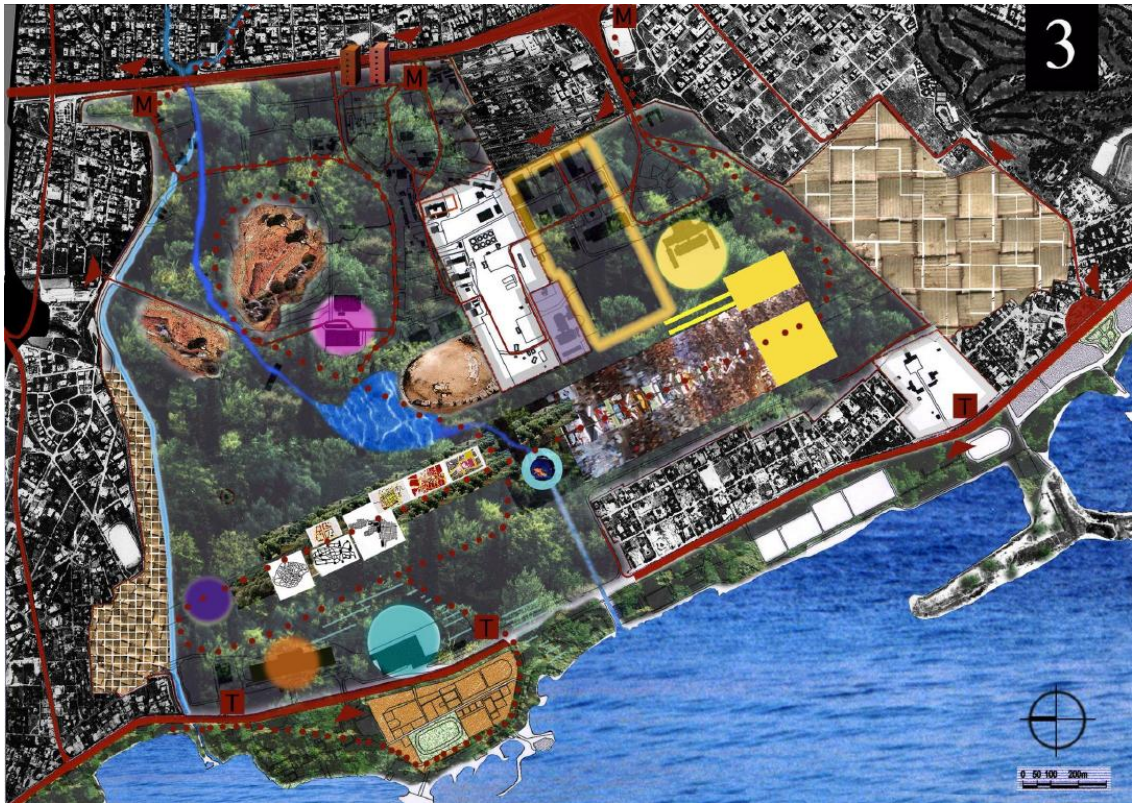

Figure 4: Conference and exhibition centre and temporary facilities for an international EXPO scenario
Source: Wassenhoven, 2007a**.**

The exhibition center shown by the yellow circle serves as the core for the proposed international EXPO and constitutes the centerpiece of this scenario. Next to it the yellow rectangular areas are locations of temporary supplementary exhibition facilities. Right next to them, along the former runway, outdoor exhibition spaces are located reaching as far as the aquarium (little blue ring). From that point on, thematic and geometric gardens develop ending up to the new Athens Museum (purple color). The virtual reality Center (fuchsia color) is located in the eastern side of the lake connected through the aquarium to the sea. A belvedere is planned right next to the lake. The business center is located next to the exhibition center (yellow rectangular) and the national book center is depicted in dark orange color in the north. The turquoise circle delimits the area where the convention center is planned.
As in previous scenarios, office buildings in the easternmost part of the area, next to Vouliagmenis Avenue, are depicted in brown color.

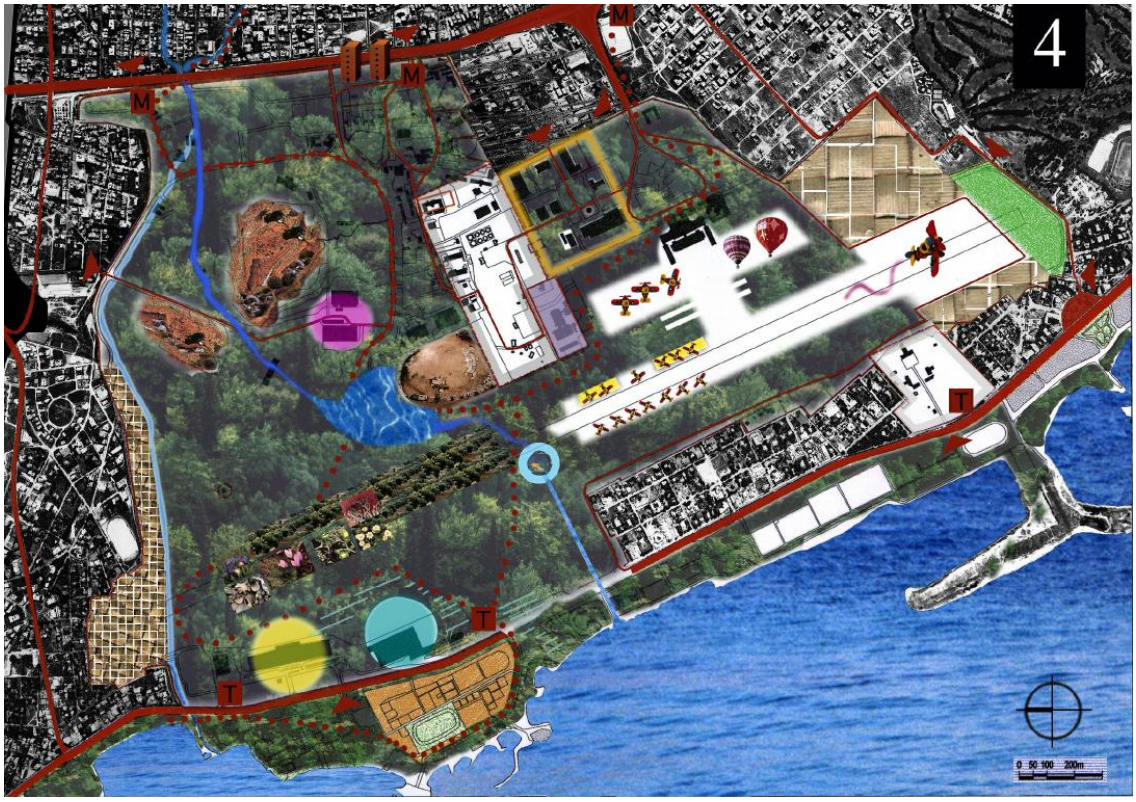

Figure 5: Aeronautics, telecommunication and space technology scenario
Source: Wassenhoven, 2007a**.**

The dominant element of this scenario is the preservation and use of a certain part of the runway for activities related to aviation such as hot air balloons, model aircrafts and aero clubs providing flight training lessons. A virtual reality center depicted in fuchsia color is also planned on the east side of the lake. The business center is located next to the east terminal (yellow rectangular). A national book center (turquoise circle) and a convention center (yellow circle) are located at the northwest.

Within the planning framework for the Athens 2004 Olympic Games, and due to the delays occurred during the Olympic preparation period that could jeopardize the hosting of the event, it was decided in 2000, that an Olympic complex would be created in the old airport area. This idea was incorporated in Wassenhoven's [32] complementary program of 2001 that included proposals for the area and its connection with Agios Kosmas beach and Floisvos waterfront. This led to the formulation of a master plan for the area as shown below.

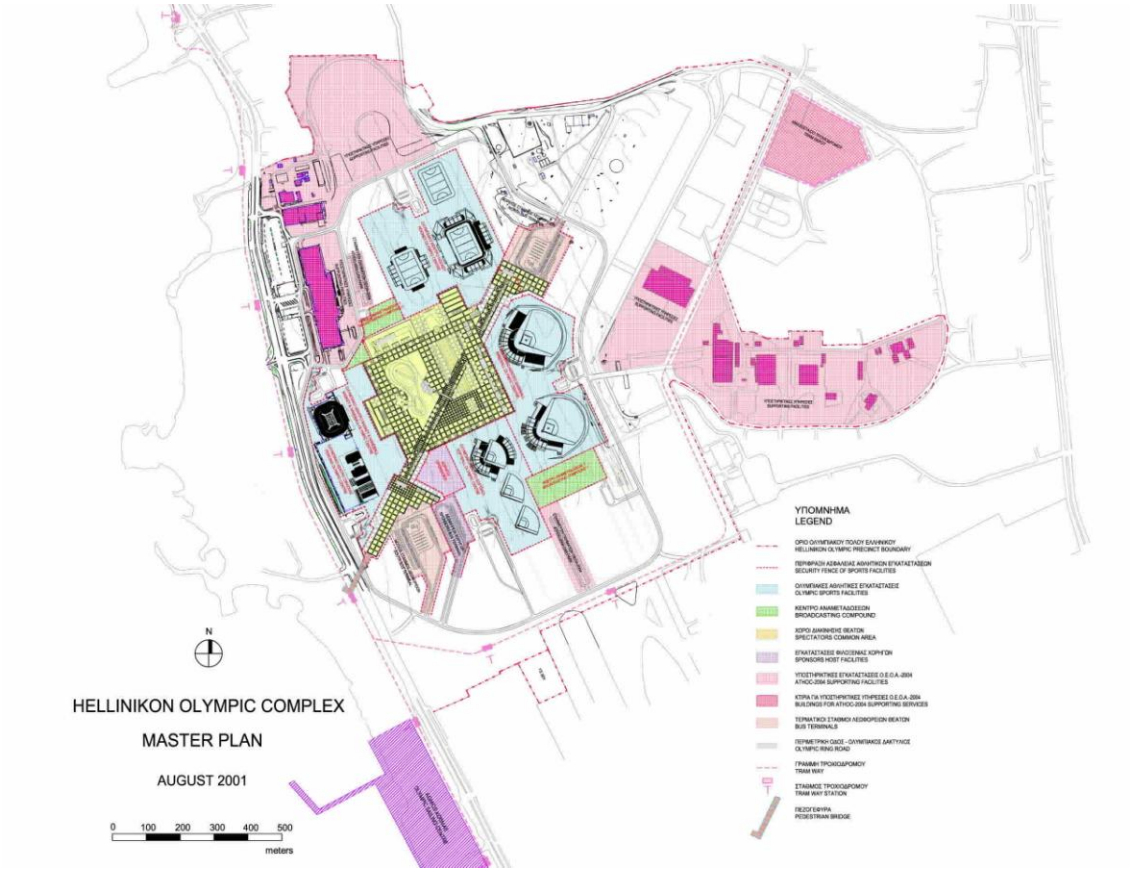

Figure 6: Detailed account of all Olympic facilities installed in Hellinikon
Source: ATHOCOG 2004 [3]

The location of Olympic venues and other infrastructure projects in the Hellinikon former airport site (light railway depot, power distribution station, anti-flood projects), were legislated via joint ministerial decisions issued in 2001. Moreover, a garbage transfer station was located in the area via law legislated in 2004. Furthermore, seventeen hectares were allotted to the Hellenic Tourism Development Corporation so that a convention center would be built in the area. There are several other constructions with different use each established in the area, such as a meteorological station, two churches, a health center, a center for the disabled, the civil aviation authority's offices, water and fuel tanks, the Olympic catering building, a bus depot, a fire station, the Athens area control center of the civil aviation authority, former hangars.

A press release issued on April 2003 by the then prime minister's press office dictated specific guidelines for the post - Olympic use of the area, according to which, the metropolitan park would cover an area of 400Ha within which recreation, cultural, sports facilities would be installed along with a multipurpose convention-exhibition center. The remaining 100Ha would be dedicated for commercial development so as to finance the park as well as some of the city's most derelict areas.

The outcome of the two-phase research program and the 2001 complementary program were used as the basis for an international architectural competition for the post Olympic development of the former airport area that took place in 2003. One hundred and fifty nine competitors participated and the winner was (2004) the Serero and Fernandez Architects in conjunction with the Philippe Coignet Office of Landscape morphology [26].

Figure 7: The Serero-Fernandez award winning proposal
Source: Serero 2005

Finally, the Hellinikon Olympic complex was built in the northern section of the former airport of Athens (Figure 8). The basketball and fencing center covers an area of 10.9Ha and the facilities were staged in the old hangars which were remodeled for that purpose. The baseball, softball and hokey center cover an area of 2.3 Ha consisting of open air facilities. Only one of them was to remain after the Games ended, however, all three courts are still (2010) in place. In addition, the Olympic canoe-kayak-slalom center (5,000 seats) was built in the Hellinikon site covering an area of 28.7 Ha. It is leased for thirty years and is destined to become a water park.

Figure 8: Location of the Hellinikon Olympic complex (white area) within the entire former airport site.
Source:http://www.in.gr/news/reviews/image.asp?lngReviewID=534200&lngImageGalleryID=535764&lngPage=2

A special legal framework for the future use of all Olympic facilities was formulated and enacted via Law as soon as the Games were over [15]. Especially as regards the Hellinikon airport site, apart from the uses allowed for hosting the Games the following functions and uses are allowed per category of venue:
Within basketball and fencing venues, cultural events, exhibitions, commercial shops and food courts are allowed. Within baseball, softball and hokey venues, athletic uses, cultural events and assemblage public domains are allowed. Within the existing installations of the canoe-kayak-slalom venue, shops selling or renting sports gear and assemblage public domains are permitted, while in the surrounding area a theme (sports) park and a hydro park are also permitted. Hellenic Olympic Properties S.A., a management authority established exactly for the purpose of securing the post Olympic use of most of the Olympic properties (including that of the former airport site) was also legislated via the same legal framework.

In 2006, the Serero-Hernandez office was assigned by the Ministry of Planning, Environment and Public Works, to formulate an updated version of their initial award-winning proposal. This was submitted one year later, in August 2007. In the meantime, and specifically in January 2007 a research program named 'Completion and updating of the research project 'Development of the Hellinikon Airport site' was assigned by the Athens Organization to the Laboratory of Spatial Planning and Urban Development of the National Technical University of Athens. It was an updated version of the older two phase program conducted in 1996 and 1999 respectively, and it was also divided into two phases [33], [34]. The first dealt with the updating of the old research program while the second aimed to examine issues related to the founding of the site's management agency (such as necessary institutional arrangements) as well as further studies and actions deemed necessary for the completion of the project. The four scenarios mentioned in the initial research program remained, albeit in an updated manner. The program ran in parallel to the Serero-Hernandez updated proposal that had been requested by the Ministry.

In November of the same year, an altered version of the Serero-Hernandez updated proposal was released by the Ministry and was given to the Hellenic Public Real Estate Corporation for

consultation. This new version was in turn assessed by Pollalis [23], [24] (on behalf of the Corporation who commissioned him for that task) both in planning and financial feasibility terms. Major flaws were identified, such as the lack of a business plan for the area in question, of an estimation of construction and maintenance costs for public buildings, of a market research for land values in the vicinity, of research for self-financing models and corresponding development phases, of traffic loads before and after the proposed development, of an accessibility study for both public and private premises, of an environmental impact assessment before and after the proposed development, of specific information regarding the availability of water for irrigation, of a study and of a cost estimate for organizing and founding the "Green Fund" and finally of the project's impact in the entire Attica basin. The ministry's proposal was quite different than the original award winning proposal of the Serero & Fernandez Architects. Furthermore, it confined itself to purely planning and construction building issues for the area concerned while environmental aspects were considered in an abstract and general way. As Pollalis put it, the basic idea was missing. Overall planning for the area consisted of delinked, fragmentary projects with no cohesiveness. Another shortcoming was the lack of a feasibility study that could determine the sustainability of the Ministry's proposals put forward. In this respect, Pollalis stressed that it is not financially feasible to transform the entire area into a metropolitan park, despite the widespread rhetoric developed about such a necessity. He argued that maintenance costs and issues of security are bound to render such an effort impossible. However, this is not the only argument he employed to justify his thesis. More specifically, he noted that the area is located outside the city center, and in spite of a metro station in the vicinity, accessibility is rather low. He suggests that Athens needs green spaces distributed in various underprivileged parts of the city rather than a disproportionately large regional park. Moreover, he proposes that mount Hymettus (being bare of any type of vegetation) be developed as a green space instead of Hellinikon. The adjacent municipal authorities although insisting on specific uses for the area, yet have not adjusted their own urban fabric to the needs deriving from such uses. Finally, he notes that the possibility of creating a large park in the area may facilitate the establishment of undesirable land uses such as night clubs in the area.

The Local Union of Municipalities and Town Councils of Attica (T.E.D.K.N.A.) on behalf of Alimos, Argiroupolis, Glyfada and Hellinikon municipalities, commissioned to the Urban Environment Laboratory of the National Technical University of Athens a research programme named 'Basic Principles for the Planning of a Metropolitan Park in the Former Hellinikon Airport Site'. The first phase of this programme, supervised by Bellavillas [6], was released in June 2010 while the second phase is still (January 2011) pending. The outcome of the first phase can be briefly summarized in the following proposals:

- Fence extirpation and immediate removal of all prefabricated squatter exhibition facilities located in the courtyard of the airport site.
- Cancellation of the land selling programme regarding specific plots for sale
- Abandonment of the highly costly scheme for the building up of new areas
- Cancellation of transport infrastructure plans in the vicinity
- Gradual implementation of low cost 'green' projects
- Gradual re-use of existing constructions through concessions. The income accrued is to be dedicated solely for the purpose of creating, operating and maintaining the park.
- Formulation of a business plan and a feasibility study.

Results and discussion

Several proposals have been put forward officially throughout the entire plan making period as illustrated in previous paragraphs, not to mention individual interventions from various agents[2] expressed in public meetings, symposia or other occasions.

[2] These includ the Civil Aviation Authority, planning professionals, the Technical Chambers of Greece, the four adjacent municipalities, the UIA, the Greek Association of Urban and Regional Planners, organized local pressure groups, T.E.D.K.N.A. and academics.

However, as regards the application of marketing approaches in the Hellinikon case, it is only the EXPO (third) scenario mentioned in the research program conducted by the Laboratory of Spatial Planning and Urban Development that stands out. According to that research, the hosting of an international exhibition would be the best starting point for the Hellinikon metropolitan park operation. To undertake the task of organizing such an event would also provide the impetus for the implementation of the entire metropolitan park project. Moreover, it pinpoints that staging an EXPO will not only be compatible to the park's overall use as a place of culture and recreation, but more importantly, it can serve to establish its status on a national and international scale. It was argued that it would literally put Hellinikon on the map of national and international interest, hence boost its development. Furthermore, it was suggested that organizing an EXPO could become the cornerstone of a promotional effort for the entire city to a world wide scale. After all, an international exhibition's primary aim is to promote the host country. Wassenhoven [33] specifically highlights the fact that major international events such as the Olympics or the EXPO's are marketing tools for a place, a city or an entire country.

Therefore, the promotional element is evident in this planning approach as a basic element of a marketing approach in public sector urban planning. It concerns not only the area in question, but also the city and the entire country. Apart from the promotional objectives mentioned in city marketing literature which are also identified in this planning proposal, organizational efficiency objectives are also included. The aforementioned proposal specifically mentions that the staging of an EXPO will facilitate the creation of the park due to the fact that its creation will be directly linked to the hosting of the proposed EXPO. Thus, deadlines will have to be set and met, organizing committees will have to be established and funding will have to be secured. Hence, overall organizing capacity will improve. Therefore, within the framework of hosting a major international event, such as an EXPO, all four elements of the place marketing mix can be found; promotion (due to the nature of the event itself), spatial measures (metropolitan park creation and landscaping), organizational measures (EXPO organizing committee) and financial measures (funding for the EXPO).

As far as the strategy adopted, out of the four strategies mentioned in the literature, the diversification strategy seems to gain prevalence in this case. The Hellinikon airport site is an area where a business center along with a museum, a theme park, a virtual reality center and possibly a Music Center were proposed. This proposal aims to bridge social and cultural activities with entrepreneurial activities especially within the field of high class business services. All activities mentioned above, can be regarded in marketing terms as a new set of services designed for new targeted markets (entrepreneurs – business center, visitors – museum, park, virtual reality center, new residents – apartments). The identification of the strategy adopted in this case also reveals the market analysis element described in the city marketing process. The fact that, in this case, specific market segments have been targeted means that a primary form of market segmentation has also been performed. Whether differentiated marketing or concentrated marketing has been applied, this is an issue that can be looked at from two different perspectives. If the primary aim of market segmentation has been the identification of the target group which would ensure the financial feasibility of the entire project, then concentrated segmentation has been performed. In the Hellinikon airport site case, this target group would undoubtedly be the entrepreneurs. On the other hand, if all market segments are treated equally regardless of their economic impact, then differentiated marketing is applied. Despite the fact that it is not quite clear which one of the two approaches has been followed in this case, nevertheless the fact that a basic prerequisite was for the project to be self sustained, leads us to believe that concentrated marketing is implicitly the most probable form of market segmentation for Hellinikon. After all, the development of a business center is displayed in all four alternative developmental scenarios.

As far as product positioning is concerned, within the EXPO scenario Wassenhoven [33] mentions that "the creation of an exhibition center in Hellinikon airport site is expected to have exceptionally favorable conditions for its operation given that exhibition centers are increasingly developing throughout the world". In marketing terms, this can be regarded as an incomplete

form of product positioning, for although it refers to the commodification of the area in question as advocated in the literature, at the same time fails to relate to the existing competition which would allow for the positioning to take place.

At this point, it is necessary to highlight that despite the fact that all aforementioned remarks are not explicitly mentioned in the research supervised by Wassenhoven; nevertheless they are easily identified and derived when looked at from a marketing perspective.

Urban effects

It is quite clear that there is a huge gap between plan formulation and plan implementation regarding the Hellinikon former airport site redevelopment. The poor initial planning for the 2004 Games resulted in the cursory creation of an Olympic complex within the Hellinikon former airport site so as to meet pressing deadlines which otherwise, might not have been met. This was coupled with the construction of some permanent facilities that were unnecessary given the low popularity of the sports hosted in them (softball and baseball). Most of sports facilities in that area, permanent and temporary, were stockaded for security reasons, however fences remained after the Games were over, creating thus enclosed areas. These developments created a de facto situation completely unfavorable to any kind of comprehensive redevelopment, much less to the creation of a metropolitan park. In addition, most sports installations have been underutilized, if utilized at all. Moreover, according to Bellavillas [6], within the former east terminal area, major squatter exhibition facilities have appeared, whereas the terminal itself designed by famous architect Eero Saarinen has been abandoned by its management authority, that is, the Hellenic Tourism Development Co. Furthermore, the coastal zone, which is also included in the design of the metropolitan park, has been reportedly occupied by squatter night clubs.

Since the spring of 2007, Agios Kosmas' marina, located right next to Hellinikon, was allotted by Olympic Properties SA, the management authority of Olympic venues, to a private developer who plans to build a 60,000 m^2 mall and a cinema complex. Both of the aforementioned plans lay outside the area in question, but are close enough to affect it in terms of competition.

Moreover, in January 2007 Olympic properties SA allotted to a private developer the canoe-kayak-slalom facility for thirty years, so that a water park would be built along with the necessary parking space to support its operation. The facility is located within the Hellinikon area. However, the developer who undertook the task of transforming it into a theme park has ceased to pay the rent to the management authority (Olympic Properties S.A.) due to the state's failure to issue the building permits necessary for the transformation. Consequently, the dispute that has arisen between Olympic Properties S.A. and the developer in relation to this issue will have to be resolved through arbitration. In 2008, both the Athens Bar Association and Hellinikon Municipality have resorted to the Council of State asking for the cancellation of the joint ministerial decision by which the environmental terms for the above mentioned transformation were approved. They argue that there is no study for the creation of the water park in the area and that its implementation will degrade the overall design of the Hellinikon metropolitan park. The development process is for the time being (2010) monitored by the Athens Organization however a special governing body will take charge in the future.

In addition, reality has surpassed plans that were formulated long ago, thus rendering them outdated. The National Book Center was finally decided to be built in the old horse race track instead of the Hellinikon site; the convention center will finally be located in the former Faliron Olympic complex, and all three open air sports courts remained even though only one of them was to remain according to the initial plans.

Concluding remarks

It is evident that there has been a long (in a fifteen year time span) series of studies concerning the future use of the former airport site, yet none of them was ever attempted to be implemented.

Pressures from various interest groups such as municipal authorities, central government politicians, local pressure groups, academics, established agencies (Olympic Properties S.A., Hellenic Tourism Development Corporation), private developers each one of them with a different agenda in mind, have hindered any serious effort for formulating a definite and comprehensive development plan. On the contrary, there is indication that piecemeal development is starting to take place, putting thus the area's developmental prospects at risk.

Furthermore, it is found that out of the various studies and research projects formulated throughout the entire period, only one has (implicitly) adopted marketing elements in plan formulation, namely the one formulated by the Laboratory of Spatial Planning and Urban Development of the National Technical University of Athens, within which the EXPO scenario was included. In this scenario, besides promotion, which can be identified even in primitive forms of marketing (such as pseudo marketing), all other three elements of the city marketing mix were identified; spatial/organizational/financial measures. As for planning strategies, the diversification strategy was adopted within the framework of the city marketing process. New sets of services were proposed for new targeted markets. There is also strong evidence that market segmentation was also performed in the form of concentrated marketing. Finally, an incomplete form of product positioning took place through an attempt to commodify the area by transforming it into an exhibition site; however no relations were established with regard to the existing competition.

All in all, the Hellinikon case provides an excellent opportunity for applying city marketing principles in practice, especially principles deriving from the Dutch-German approach that could match supply and demand not for the purpose of profit making but for achieving wider developmental objectives (including environmental protection and consensus building). It seems however, that the cacophony stemming from the involvement of various stakeholders who compete with each other to further their own personal agenda will pose a serious threat to ever implementing the long awaited redevelopment.

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Conferences, Announcements, News

International Symposium of Scientized Sports Law
Organized by:
Research Center of Sports Law of China
University of Political Science and Law
Law School of China University of Political Science and Law
China, November 2010
Conference Overview by Dr. Aikaterini Kokkinou, University of Glasgow

Dr. Dimitrios Panagiotopoulos, Assistant Professor, Faculty of Physical Education & Sports Science, University of Athens - Lawyer, has been invited to participate at the International Symposium of Scientized Sports Law, organized by the Research Center of Sports Law of China, the University of Political Science and Law and the Law School of China University of Political Science and Law.

Dr. Dimitrios Panagiotopoulos presented the original paper titled *'Professional Players and International Legislations Governing their Protection*' introducing new approaches in this research framework.

The symposium host, the Legal Research Center of Physical Culture of China University of Political Science and Law (CUPL) is the first research institute in China on sports law from a professional perspective and it boasts a constellation of prestigious scholars.

The major research orientation of the Center is as follows: the origin and evolution of sports law, the sports industry, sports organizations, sports agents, sports contracts, sports lotteries, sports intellectual property, the rights and corresponding obligations of athlete and referee, as well as their respective legal status, competition rules, anti-doping, sports consumption, and damage compensation for sports facilities.

During recent years, the Center has achieved impressive progress in terms of academic research, and the members of the Center are also involved in the formulation of a series of sports Acts. Apart from that, they provide consultation services on sports law in connection with the media and sports institutes.

In terms of foreign exchanges, the Center carried out active exchange programs and reached agreement on the cultivation of talents in the sports law field with other research institutes and organizations.

The development of the Center has attracted the attention and concern from international academic society in law and economics.

The Greek Geographical Information Community under operation

Conference Overview by Constantinos Ikonomou, University of Athens

Two main events on Geographical Information Systems were recently held in Greece. The 20th annual meeting of the ArcGIS users was organised in Athens by the business that releases ArcGIS in Greece, Marathon Data System, on the first three days of November 2010, the week were the classic Marathon was held, celebrating 2500 years since the original Marathon run.

The participation of many Greek universities, public enterprises and businesses was combined with the advent of the very active ArcGIS "corporate evangelist", the presence of highly competitive businesses from Europe and especially the USA and the presentation of few successful Greek-Cypriot examples of GIS applications.

The meeting highlighted the research, corporate and public interest for GIS applications in Greece, the active role undertaken by the Greek Universities and the interest to build public-private partnerships in the field, in various national or international schemes. It also emphasized the need to open more widely a market that is relatively limited in Greece or, at least, under development. The Greek research and university community was offered an opportunity to share various GIS applications and improvements. An interdisciplinary discussion was held among various scientific communities, such as those from geological, agricultural, geographical, forest or resource management, cartographic and civil engineering studies.

Though interesting, few of these applications or improvements were of international-level standards. Most GIS applications are developed because some programmes happened to be funded and not because a particular agenda is pursued. This problem reflects a general lack of long-term research agendas behind knowledge development in Greek Universities and possibly the absence of an authority organising and guiding research on the subject.

A month after, the 2nd and 3rd of December, the 6th Pan-Hellenic Conference Hellas GIS was held at the Polytechnic School of Athens. The conference was divided in various sessions: i) spatial data infrastructure, ii) GIS and cadastre iii) geospatial planning, iv) spatial applications for free software, v) GIS application at the Internet, vi) spatial analysis, vii) civil engineering applications and GIS at the local level, viii) GIS applications in Archaeology- History, ix) GIS and the environment.

Though this conference touched upon broader issues than the annual meeting, it did not simultaneously involved any non-native speakers (at least in separate sessions), failing in that respect to engage the interest of the international community in the Greek context and, what is more, to gain its valuable, critical feedback that was clearly missing. Furthermore, it seemed that significant mistakes and the lack of basic geographical knowledge impeded reaching proper scientific conclusions in the papers presented. For example the need to normalise geographical variables or take into account statistical bias was systematically neglected. Clearly, it seems that the Greek community of GIS users has not reached yet the level of scientific maturity that is necessary to attract research and academic interest from outside the national borders and it seems to prefer the road of national narcissism rather than international openness and criticism. One may argue that this is a more general problem found in national GIS communities, but this is certainly not an excuse in the case of conferences that are held for a software (ArcGIS) using an interface in English. A lot remains to be done.

16th Conference of the Hellenic Association of Regional Scientists: The Regional Dimension of the New Strategy 'Europe 2020'

The 16th Conference of the Hellenic Association of Regional Scientists took place in October 2010 and organised jointly by the Department of Postgraduate Studies of the Harokopeion University "Sustainable Development" and the Regional Science Inquiry Journal.

Though this Conference, 56 papers were presented while 77 scientists from various universities and scientific institutions were participating. These papers were included in five sessions, i.e. (a) Innovation and Development, (b) Regional Policy, (c) Economic Policy, (d) Culture and Environment and (e) Tourism and Development.

In the opening of the Conference the President of the Hellenic Association of Regional Scientists Dr Christos Ladias pointed out, amongst other things, that "The conclusions of the 16th Conference aspire to contribute in shaping views on the new strategy "Europe 2020", especially at the regional level; a distinctive dimension of this strategy. It is our essential aim, through this Conference, to enquire about the essential elements that will form this new strategy together with a new perspective, which is the new structure of local governance and decentralisation management."

In turn, Professor Konstantinos Apostolopoulos, Head of the Department of Postgraduate Studies "Sustainable Development" of the Harokopeion University emphasised that "The necessity of studying the new strategy is, more than ever, clear-cut, given that together with the current economic crisis there is a plethora of accompanying crisis, such as those stemming from the social values, the environmental problems, the migration of people for survival. An explicit and conscientiously 'shift of interest of the academic and scientific community is of critical importance in order to confront this 'gloomy picture.

Professor Nicolaos Konsolas put particular emphasis to the following: "There are 56 years since the foundation of the Regional Science Association and 51 years from the first award of a PhD in Regional Science in the University of Pennsylvania. Ever since the Regional Science follows a dynamic evolution and studies the multidimensional nexus of the parameters that comprise this 'living organism' called 'region'. The initiative by the Hellenic Association of Regional Scientists to organise this conference in period of economic crisis for the Greek economy constitutes a valuable contribution in a thorough examination of the regional problem of Greece."

Finally, during the opening of the Conference, speeches were delivered by Euagelia Georgitsogianni Associate Professor and Head of the Department of Home Economics and Ecology, and Professor Paulos Delladetsimas, Head of the Department of Geography of the Harokopeion University.

The Chairs in the ten sessions of the conference were held by Professor Nikolaos Konsolas, Professor Rosetos Fakiolas, Professor Spiridon Kiritsis, Professor Anastasios Papastaurou, Professor Iosif Stefanou and Professor Konstantinos Apostolopoulos.

The papers and proceedings of the Conference are available at the website of the Hellenic Association of Regional Scientists Association.

Job Requirement Assessment (JRA) Project

The Job Requirement Assessment (JRA) research project highlights the relevance of the JRA module for several key policy issues and puts forward a strategy for extensive pilot testing of this module with participation of several OECD and European member countries. The JRA is a method for measuring skills use at the workplace that has evolved from the methods of occupational psychology so as to apply to surveys of the employed population. Such methods have been deployed in a number of OECD countries in both academic and policy-related research. This research project has been prepared as part of the development work on a new international survey of adult skills carried out under the OECD's Programme for the International Assessment of Adult Competencies (PIAAC). It outlines the principal findings and recommendations that have emerged from the validation of the results of the Job Requirements Approach (JRA) pilot survey, with an emphasis on those JRA items that are scheduled for inclusion in the Background Questionnaire (BQ) of the PIAAC survey.

The OECD Committee endorsed the research programme that was put forward by the Greek Life Long Learning Secretariat in relation to the OECD's Programme for the International Assessment of Adult Competencies (PIAAC). This research programme was aiming to focus and carry out the following points:

1. Developing the Job Requirements Approach (JRA) module which measured a range of generic work skills; and
2. Developing the Background Questionnaire, notably as regards work-related training.

The first phase of Job Requirement Assessment (JRA) research program took place in the period 2007-2009. During this period, each participating country was requested to provide a technical report covering all aspects of the fieldwork and subsequent data preparation. The questionnaire for this project was prepared by Francis Green, Professor of Economics, University of Kent, under the direction of Mark Keese, Directorate for Employment, Labour and Social Affairs, OECD. Each participating country provided a full Technical Report on all aspects of the fieldwork and subsequent data preparation, including the response rate. This included an assessment of the quality of the data collected within a classification between the general target-sample of primary school teachers.

Greece has participated in the first phase of JRA project, along with Australia, France and Korea. The experts appointed as scientific coordinators for the Hellenic team of experts were Assoc. Professor Dr. George M. Korres (University of the Aegean) and Professor Dr. Panagiotis Liargkovas (University of Peloponnese), on behalf of the General Secretariat of Education, Ministry of Education.

The first meeting-conference of experts on the Program for the International Assessment of Dexterities of Adults" (JRA, Job Requirement Approach) took place in the OECD, Paris on 2nd and 3rd December 2008. The following – up conference was held on 12th and 13th February 2009 in Thessaloniki by CEDEFOP-EU/OECD. On behalf of Greek research team, the scientific directors of this project Assoc. Prof. Dr. George M. Korres and Prof. Dr. Panagiotis Liargkovas participated with the presentation of relative articles regarding the implementation of collected data and the assessment of policies with regard to Job Requirement Assessment and the life - long learning in Greece. During this project and at the conference presentations Associate Prof. Konstnantinos Tsamadias (Harokopion University) and Dr. Aikaterini Kokkinou (University of Glasgow) have also participated.

Furthermore, in the particular program, the following institutions participated, representing Greece: General Secretariat of Education of Adults of Life Long Learning, the National Centre of Public Administration and Decentralization, the National Centre of Social Research, the National Statistical Service and the Ministry of Employment.

Academic Profiles

Professor Richard Harris

Professor Richard Harris is the Cairncross Professor of Applied Economics, University of Glasgow, Director of the Centre for Public Policy for Regions, as well as the Associate Director of Spatial Economics Research Centre, LSE.

Professor Richard Harris joined the University of Glasgow in October 2004 to take up the positions of Cairncross Professor of Applied Economics in the Department of Economics and Director of the Centre for Public Policy for Regions. He previously held positions at the Universities of Newcastle upon Tyne, Durham and Portsmouth in the UK and Waikato in New Zealand. He holds degrees from the Universities of Belfast, Lancaster and Kent.

His research interests focus mainly on micro-analysis of firm/plant level productivity using panel data; differences in regional performance; evaluation of government industrial policy; and, relative performance of SMEs, evaluation methodology for impact of government assistance on TFP; and, relative performance of family-owned SMEs.

He is among the top 5% authors worldwide and his most recent publications include:

- Harris, R. and Li, Q.C. (forthcoming). 'Participation in export markets and the role of R&D: establishment-level evidence from the UK Community Innovation Survey 2005', *Applied Economics.*
- Harris, R. (forthcoming). 'Models of regional growth: past, present and future', *Journal of Economic Surveys.*
- Harris, R. and Li, Q.C. (2010). 'Export-market dynamics and the probability of firm closure: evidence for the UK', *Scottish Journal of Political Economy*, vol. 57(2), (March), pp. 145-168.
- Harris, R. and Li, Q.C. (2009). 'Exporting, R&D and absorptive capacity in UK establishments', *Oxford Economic Papers*, vol. 61(1), (January), pp. 74-103.

  Harris, R., Li, Q.C. and Trainor, M. (2009). 'Is a higher rate of R&D tax credit a panacea for low levels of R&D in disadvantaged regions?', *Research Policy*, vol. 38(1), (February), pp. 192-205.

Academic Profile by Aikaterini Kokkinou, University of Glasgow

Professor Andy Pike

Prof. Andy Pike is Professor of Local and Regional Development in the Centre for Urban and Regional Development Studies (CURDS), Newcastle University, UK.

His central research interest is the geographical political economy of local and regional development. First, his research is concerned with the concepts and theory of the meaning and governance of development regionally and locally in an international context. In particular, his research seeks to broaden our understandings of development beyond the economic to encompass the social and ecological in more sustainable and progressive ways and begin more meaningfully to connect development locally and regionally in the global North and South. Second, his research focuses upon the intersections between local and regional development and Economic Geography.

His research builds upon close policy engagement and has informed local and regional development policy for international (e.g. European Commission, OECD), national (e.g. Government Departments), regional (e.g. RDAs, trade unions) and local (e.g. Local Authorities, Development Agencies) bodies.

His most recent publications include:

- Pike AJ. Geographies of brands and branding. *Progress in Human Geography* 2009, **33**(3), 619-645.
- Pike A, Birch K, Cumbers A, MacKinnon D, McMaster R. A Geographical Political Economy of Evolution in Economic Geography. *Economic Geography* 2009,**85** 2 175-182.
- Pike AJ. Brand and branding geographies. *Geography Compass* 2009,**3** 1 190-213.

MacKinnon D, Cumbers A, Pike A, Birch K, McMaster R. Evolution in Economic Geography: Institutions, Political Economy, and Adaptation. *Economic Geography* 2009, **85**(2), 129-150

Academic Profile by Aikaterini Kokkinou, University of Glasgow

Professor Kiran Prasad

Professor Kiran Prasad is a Professor in Communication and Journalism at Sri Padmavati Mahila University, Tirupati, India and an Associate Professor in Communication Studies, College of Applied Science at Salalah, Ministry of Higher Education, Oman.

Professor Kiran Prasad is a Commonwealth Visiting Research Fellow at the Centre for International Communication Research, University of Leeds, UK and Canadian Studies Research Fellow at the School of Journalism and Communication, Carleton University, Ottawa, Canada. She is also the youngest ever recipient of the 'State Best Teacher Award' for university teachers from the Government of Andhra Pradesh, India and recipient of Shiksha Rattan Puraskar for academic excellence at the national level.

She has researched extensively in India, Bangladesh, Singapore, Malaysia, Canada, UK and the Middle East on the interrelations between communication and development studies. A prolific writer and well known communication philosopher, she is author/editor of over seventeen books and conceptualized many theories in communication studies.

Her recent books include:

- *Information and Communication Technology: Recasting Development* (2004);
- *Women, Globalization and Mass Media: International Facets of Emancipation* (2006);
- *Media Law and Ethics: Readings in Communication Regulations* (2008, in 2 Vols.);
- *HIV and AIDS: Vulnerability of Women in Asia and Africa* (2008);
- *Feminist Development Communication: Empowering Women in the Information Era* (2009); and
- *e-Journalism: New Media and News Media* (2009).

She is also series editor of *Empowering Women Worldwide*, a book series published by the Women Press, New Delhi.

Academic Profile by Aikaterini Kokkinou, University of Glasgow

Professor Elias G. Carayannis

Prof. Dr. Elias G. Carayannis is Full Professor of Science, Technology, Innovation and Entrepreneurship, as well as co-Founder and co-Director of the Global and Entrepreneurial Finance Research Institute (GEFRI) and Director of Research on Science, Technology, Innovation and Entrepreneurship, European Union Research Center, (EURC) at the School of Business of the George Washington University in Washington, DC.

Dr. Carayannis' teaching and research activities focus on the areas of strategic Government-University-Industry R&D partnerships, technology road-mapping, technology transfer and commercialization, international science and technology policy, technological entrepreneurship and regional economic development.

He has consulted for a wide variety technology-driven organizations in both government and the private sector, including the World Bank, the European Commission, the Inter-American Development Bank, the US Agency for International Development, IKED, the National Science Foundation Small Business Innovation Research Program, the National Institute of Standards and Technology Advanced Technology Program, the National Coalition for Advanced Manufacturing (NACFAM), the USN CNO Office, Sandia National Laboratories' New Technological Ventures Initiative, the General Electric Corporate Training & Development Center, Cowen & Co, First Albany International and others.

Dr. Carayannis has a wide range of publications in both academic and practitioner international journals. He has also published thirteen books to date on science, technology, innovation and entrepreneurship with CRC Press, Praeger/Greenwood, Palgrave/MacMillan and Edward Elgar, and has several more projects under contract. He has also published working papers with the World Bank and given invited lectures on a number of occasions at the World Bank, the IADB, the European Union, and several universities. Furthermore, Dr. Carayannis has multiple professional roles and affiliations, being Editor-in-Chief in established in international journals and book series, as well as Visiting Professor in different universities, worldwide.

Academic Profile by Prof. Dr. George M. Korres, CURDS, Newcastle University, UK.

Book Reviews

European Political Integration and Solidarity Policies

in Greek

by Olga Gioti – Papadaki

Kritiki, 2010

'European Political Integration and Solidarity Policies' is a book that shows that the path to European integration passes through the solidarity of nations.

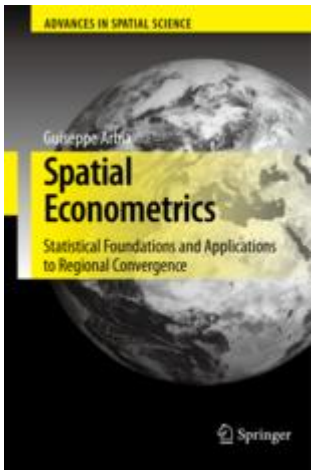
The European Union constitutes an evolving inter-country system of governing, in which the sovereignty is shared between state-members and international institutions. The relation between state-members and European institutions continues to be differentiated resulting from the altered will of nations of Europe for the promotion of integration process.

Despite the oppositions for the nature and the power of the Union, which exist since its foundation and remain undiminished until today; state-members have ceded important power in the international institutions, limiting their independence.

However, for the political integration to be promoted beyond economic level, its political background should be supported by the population of Union. The acceptance and the attendance of citizens in European Union are connected with the convergence of developmental level of national economies, with the sufficiency of the European institutional framework, with the aid of the economic and social cohesion, elements that progressively can inspire the feeling of an integrated European Union, in step with the national identity of each nation.

This revised publication includes additions and improvements as well as a extensive annex of the developments that resulted from the first publication of the book. The book is addressed to researchers and scholars of European issues, as well as to each informed citizen.

Book Review by Aikaterini Kokkinou, University of Glasgow



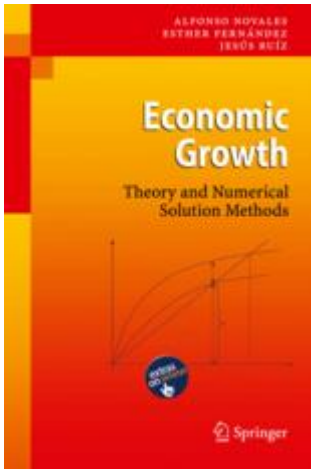
Spatial Econometrics: Statistical Foundations and Applications to Regional Convergence by Giuseppe Arbia

Springer, 2006

This pathbreaking book provides an extensive and thorough analysis of spatial econometrics. In particular, several topics and notions are explained in a precise and coherent manner. For example, the Markov random fields, the Ising's Law, the spatial error component random filed, are examined together with bivariate and multivariate auto-normal filed; in short essential apparatus for the understanding of spatial econometrics. Issues related to the likelihood function for spatial samples, followed by an in depth analysis of the linear regression model with spatial data, complete the theoretical framework.

An application of spatial econometrics is undertaken in chapter 5. This is conducted in the context of regional convergence using extensive data sets, namely for the Italian Provinces and the NUTS-2 regions of the European Union. Chapters 1 to 5 provide to the reader an integrated approach to the question of regional convergence. The book finishes with a short review of advanced topics in spatial econometrics, such as panel data and space-time models while some software programs are presented (e.g. GeoDa, SpaceStat, etc) in the appendix.

Book Review by Stilianos Alexiadis, University of Piraeus



Economic Growth: Theory and Numerical Solutions
by Novales, A., Fernandez, E. and Ruiz, J.

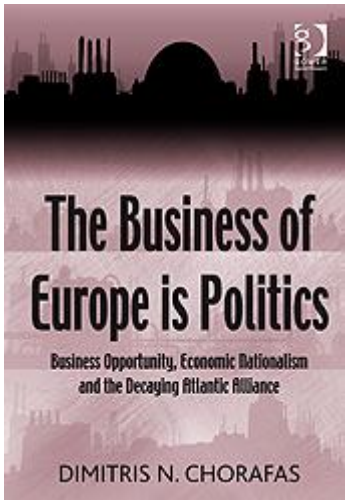
Springer, 2010

Students, both at undergraduate and postgraduate level, are often find themselves in difficulty to grasp the mathematics in the various models of economic growth. As a result, quite often, students, academics in this area, and professional economists with no profound theoretical background, while able to understand the basic theories about model construction fail to get a grasp of how these can be used in practice. The book by Novales, Fernandez and Ruiz provides a detailed analysis and description of all the computational methods that are necessary to produce solutions to models of economic growth.

In this book a wide variety of models are examined. These include Endogenous Growth models, Macroeconomic models of the Keynesian tradition together with models of theory of Business Cycle Theory. The structure and solutions of General Equilibrium models are also presented. The book is well written and provides valuable a significant addition to the literature on ways to portray the process of economic growth.

Book Review by Stilianos Alexiadis, University of Piraeus

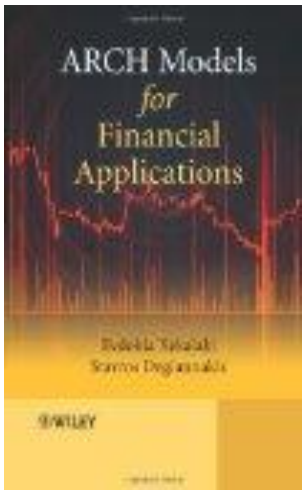
Business Opportunity, Economic Nationalism and the Decaying Atlantic Alliance by Prof. Dr. Dimitris N. Chorafas



This book offers insight into the particular nature of the European cocktail of business and politics, explaining how that bears on trade and relations between, for example, continental Europe and the UK, across the Atlantic with the US, with Russia and with Asia. The book explains and critiques Europe's conflicting aims and describes its wanting business plan. Case studies to illustrate the consequences for business of the deficiencies identified are included. With its mix of rigorously researched background and forthright argument, this timely book will satisfy those academics with an interest in the issues addressed and will also serve as a planning tool for business leaders and government executives trying to determine what they can do at enterprise level. The challenge is to survive and prosper in an environment where 'business is politics'. The book contemplates the present and future of the European Union and by extension of the North Atlantic Treaty Organization, looking at the Union's cocktail of business and politics, its conflicting aims and inadequate business practices, and its economic nationalism. The final section considers the decline of the Atlantic alliance.

Among specific topics are France as a case study of *Declinismé* in the Union, perils of the Union's enlargement, case studies on economic nationalism, and energy supplies and new alliances. He discusses the 2010 Greek financial drama in an epilogue. The first part of the book starts with the description of the EU's Cocktail of Business and Politics, focusing both on current situation and developing trends, then it describes the relationships among Britain, America, Russia and the EU, and it concludes with the description of *Declinismé* in the EU, focusing on a case study on France. The second part of the book portrays the EU's Conflicting Aims and Inadequate Business Practices, from the point of view of politicians, managers and Parliamentarians of the EU. The second part also illustrates the EU's constitution and constitutional referendums, as well as the perils of the EU's enlargement. The third part of the book depicts the EU's Economic Nationalism as a business opportunity, such as the European aeronautics defence and space industrial giant. The fourth part describes the Decline of the Atlantic Alliance, the case of Energy supplies and new alliances and puts an epilogue focusing on the 2010 Greek financial crisis.

Book Review by Dr Christos Ladias, University of Central Greece



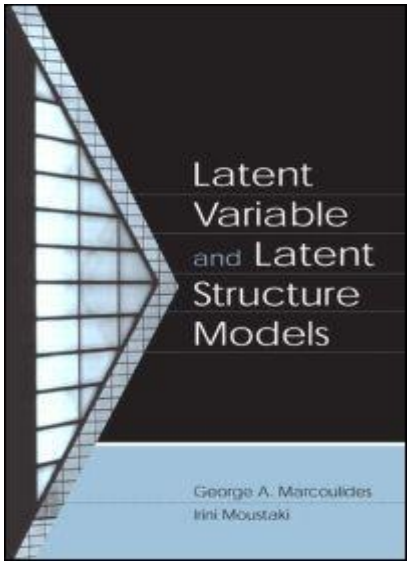
ARCH Models for Financial Applications
by Xekalaki, E. and Degiannakis, S.
Wiley

This book tackles with approaches hinging on financial and statistical theory. It is a book of practical orientation and applied nature intended for readers with basic knowledge of time series analysis wishing to gain an aptitude in the applications of financial econometric modelling. Balancing statistical methodology and structural descriptive modelling, it aims at introducing the readers to the area of discrete time applied stochastic volatility models and at helping them acquire the ability to deal with applied economic problems. It provides background on the theory of ARCH models, but with a focus on practical implementation via applications to real data with step-by-step explanations of their use. The readers are familiarized with theoretical issues of Autoregressive Conditionally Heteroskedastic (ARCH) models from model construction, fitting and forecasting through to model evaluation and selection, and gain facility in employing these models in the context of financial applications: volatility forecasting, value-at-risk forecasting, expected shortfall estimation, volatility forecasts for pricing options.
The book introduces the concept of ARCH process together with specific topics, such as models with innovations with Student-t, beta, Paretian or Gram Charlier type distributions, as well as generalised error distributions, applications of volatility forecasting in risk management and options pricing, etc.

The book is primarily intended as a text for postgraduate and final year undergraduate students of economic, financial, business and statistics programs. It is also intended as a reference book for academics and researchers in applied statistics and econometrics, doctoral students dealing with volatility forecasting, risk evaluation, option pricing, model selection methods and predictability. It can also serve as a handbook for consultants as well as to traders, financial market practitioners and professional economists wishing to pursue up-to-date expertise in practical issues of financial econometric modelling.

Book Review by Prof. Dr. George M. Korres, CURDS, Newcastle University and Esaias Papaionaou, Queen Mary College, University of London

Latent Variable and Latent Structure Models
Edited by
Marcoulides, G. California State University, and Moustaki, I. London School of Economics and Political Science



This edited volume features cutting-edge topics from the leading researchers in the areas of latent variable modelling. Content highlights include coverage of approaches dealing with missing values, semi-parametric estimation, robust analysis, hierarchical data, factor scores, multi-group analysis, and model testing. New methodological topics are illustrated with real applications. The material presented brings together two traditions: psychometrics and structural equation modelling. Latent Variable and Latent Structure Models' thought-provoking chapters from the leading researchers in the area will help to stimulate ideas for further research for many years to come.

The volume is based on material presented at the 22nd biennial conference of the Society for Multivariate Analysis in the Behavioural Sciences held by the Department of Statistics at the London School of Economics and Political Science.

This volume will be of interest to researchers and practitioners from a wide variety of disciplines, including biology, business, economics, education, medicine, psychology, sociology, and other social and behavioural sciences. It can also serve as a companion for consultants who wish to conduct their own research on practical issues.

Book Review by Dr. Christos Ladias, University of Central Greece

THE REGIONAL SCIENCE INQUIRY JOURNAL (RSIJ)
Instructions to Authors

Review Process

Each suitable article is blind-reviewed by two members of the editorial review board. A recommendation is then made by the Editor-in-Chief. The final decision is made by the Editor-in-Chief. If a revision is recommended, the revised paper is sent for a final approval to one of the Editors.

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Style and Format of the Paper

In order for a paper to be submitted to the Regional Science Inquiry Journal (RSIJ) for publication, the following should be taken into consideration:

1. All submitted articles should report original work, previously unpublished and not under consideration for publication elsewhere and they are subject to both review and editing.
2. Articles should be in good technical English with a length normally between 6,500-8,000 words, while all other texts should not exceed 2,500 words, apart from the references, tables and illustrations.
3. The first page of the manuscripts should contain the article title, the name and the affiliation of the authors with sufficient contact details (the corresponding author should be properly identified here).
4. Articles should have a set of Keywords (up to 7) and an Abstract (under 250 words, without references), followed by the Introduction, Methodology and Data, Results, Discussion, Conclusions and References.
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registered electronic address of the editors. It is also possible, for review purposes only, to
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6. Manuscripts should be typewritten with margins 2.5 cm x 2.5cm on A4 size paper. Margins should be consistent on all pages.
7. All pages should be numbered consecutively.
8. Titles and subtitles should be short.
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