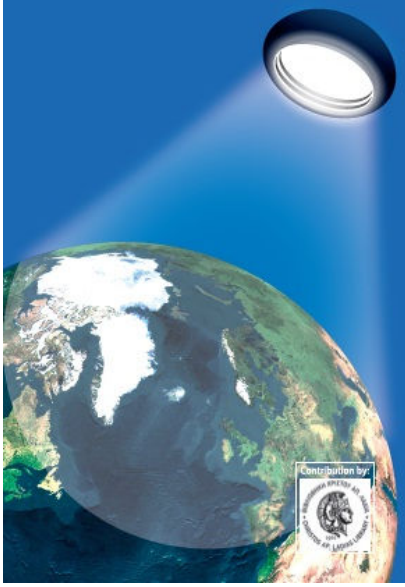
Regional Science Inquiry



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Contents

RSI Journal, Volume IV, Issue 2 – Editorial

Regional convergence and regional policy in the EU

At the beginning of the twenty-first century, the convergence debate has become one of the foremost topics in economic research. While much of the research has initially centred on cross-country patterns and trends, the issue of regional income convergence has received increasing attention in recent years. Over the most recent decades, for instance, income inequality among European regions has remained rather constant from an aggregated point of view. Some economists are now taking this as a natural, or at least as the global-capitalist order of things: the rich get richer and so do the poor, but without even catching up (Hurst et al, 2000, p.9). This interest has been enhanced by both the deepening and widening of the integration process in Europe, in particular, the expectations of catch-up of the new EU-member states in the eastern periphery of Europe. The expectations largely rest – explicitly or implicitly – one the acceptance of unconditional convergence hypothesis which suggests that per capita incomes of regional economies converge to one another in the long-run independently of initial conditions. Although national monetary are obviously important, equally so are substantial – that is regional and local – aspects of the European monetary integration process (Martin, 2001). While the regional dimensions of EMU have certainly not been ignored in EU policy statements (European Commission, 1996, 1997, and 1999), some commentators have argued that the regional issue has received insufficient attention. For Thirlwall (2000a), the outcome appears quite clear.

In the debate on the euro, little attention is paid to differences in the level of income and unemployment across the regions of Europe, and whether a single currency is likely to narrow or exacerbate these differences. This is an important issue because existing regional inequalities already pose a threat to the cohesion of the European Union. There is very real possibility that the single currency, without an effective regional policy, will worsen these disparities (Thirlwall, 2000a, p.23). Monetary union in Europe will cause economic divergence amongst the regions, and this in turn could well threaten to undermine the whole single currency programme (Thirlwall, 2000b). The EU's regional policy aims to strengthen economic, social and territorial cohesion by reducing differences in the level of development among regions and Member States. For the period 2007-2013 a budget of 347.41 billion euros is foreseen, equivalent to more than one third of the whole EU budget. The main concerns of the policy for 2007 to 2013 are (Eurostat, 2009): convergence – 81.5% of the funds available; (regional) competitiveness and employment – 16% of the funds available; territorial cooperation – 2.5% of the funds available. 'Past experience shows that, to be effective in regional development terms such assistance should not be speared too thinly over areas which are too large or fragmented. We need to increase the concentration of Community part-financing if we are to reach a critical mass and have a significant impact …' (European Commission, 1998, section 1). The major argument for the creation of European Community regional policy was the threat of economic restructuring problems in the weaker, peripheral parts of the Community, liked to the 1992 project. To speed up the reconstructing process, and to improve the conditions of economic development, Community financial assistance was deemed necessary. With the instutionalisation of regional policy and the Delors I package, the peripheral economies received substantial financial support for development projects. Public spending, investment subsidies may be counterproductive when poorly designed. Especially when firms know that they are entitled to repeated regional support, resources may be shifted to rent-seeking activities such as (political) lobbying, rather than to investing in productivity improvements or exploring new markets. The incentive for these rent-seeking activities increases in general with the size of the sunk-costs of the industry. This may partially explain why subsidies did not work very well in those regions with a bias towards capital-intensive heavy industries (Hurst et al. 2000, pp. 18-19). Local public administrations have a share of responsibility for project delays due to lack of

management skills and organisational failures. This characteristic is found in lagging regions as well as in some advanced regions. Moreover, increasing returns are present in almost every activity, especially those related to knowledge and technology (adoption and creation). This should be taken into account by policy makers when they design regional policies and development projects.

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

This issue includes twelve 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 asymmetry in land use pattern and endogenous formation of transportation networks in a two dimensional continuous space is examined in a model developed by Miyata. Cechella et al assess the position of the Brazilian economy with respect the Investment Development Path. Using the region of Aragón as a case study, Lanaspa et al, establish the pattern of fragile and structurally weak rural areas and provide guidelines for regional and supra-regional policies. Tibério and Diniz examine the sector of traditional agri-food production in Portugal using a set of three main variables: production, prices and commercialization. Vescoukis and Stratigea attempt to answer the potential of network integration to support the development of ICTs applications in education in peripheral regions. The effectiveness of initiatives and policies using the Environmental Kuznets Curve, with reference to the city of Toyohashi, Hossain and Miyata address the effectiveness of waste management and technology. The agroforestry systems and activities in the areas of the Northern Portugal, Marta-Costa et al overview the main features that characterize the sustainability and un(sustainability) of these activities. The role of the railways in the Trans-European Network together with the extension of the railway network is the main research focus of the paper by Dionelis et al. Using the principles of geopolitical analysis, Mazis and Sgouros, describe the Greek EEZ in the light of the current political developments in the area. An empirical analysis of the Information and Communication Technologies in Bangladesh, Malaysia and Japan is conducted by Muzahidul Islam et al. Their analysis indicates certain recommendations for technology adoption in developing countries. An econometric analysis by Prodromidis isolates average income, income-filer population size, and annual effects allows for an alternative aspect of the sub-regional and cross-regional patterns of income evolution in

Greece. In a similar vein, Xanthos, Ladias and Genitsaropoulos use a composite weighted indicator of growth to examine regional inequalities in Greece.
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.

Dr. Alexiadis Stilianos
Dr. Kokkinou Aikaterini
RSI Journal

Papers

AN URBAN ECONOMIC MODEL OVER A CONTINUOUS PLANE WITH SPATIAL CHARACTERISTIC VECTOR FIELD
- ASYMMETRIC LAND USE PATTERN AND INTERNALIZING TRANSPORTATION NETWORKS -

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Abstract
Among others Beckmann (1952) firstly introduced the concept of a two dimensional continuous space into economics. This great step had unfortunately not shown further expansion in economics. Through several papers related to Beckmann's initiation, Beckmann and Puu (1985) at last reached a systematic treatment of the continuous spatial economics. Although their achievement is fascinated by employing a partial differential equations approach, Beckmann's original philosophy, that is, the gradient law has still been inherited. Beckmann and Puu's book (1985) aims to study formation of urban configuration in a two dimensional continuous space, focusing on flows of commodities. However, consideration of households and firms location is not necessarily sufficient, resulting in reconsideration from a new urban economics point of view. Differing from Beckmann and Puu's studies, Miyata (2010) introduces bid rent functions (Fujita (1989)), which are familiar in the new urban economics, for land of households and firms, and then he studies how the results of Beckmann and Puu are rigorously modified by using the theory of partial differential equations. However Miyata (2010) deals with a symmetric equilibrium which seems to be a little unrealistic. This article extends the author's previous study introducing spatial characteristic vector field in the model which stands for heterogeneity in geographical conditions in a city, and try to show asymmetry in land use pattern and endogenous formation of transportation networks in a two dimensional continuous space.

Keywords continuous plane city · Beckmann · Puu · asymmetric land use · heterogeneity ·

JEL, **classification** R10, R40, R30

1. INTRODUCTION

Among others Beckmann (1952) firstly introduced the concept of a two dimensional continuous space into economics. This great step had unfortunately not shown further expansion in economics. Through several papers related to Beckmann's initiation, Beckmann and Puu (1985) at last reached a systematic treatment of the continuous spatial economics. Although their achievement is fascinated by employing a partial differential equations approach, Beckmann's original philosophy, that is, the gradient law has still been inherited. Following their achievement, Puu (2003) alone developed their theory by using many computer simulations to visually show the significance of their theory.

Beckmann and Puu's book (1985) aims to study formation of urban configuration in a two dimensional continuous space, focusing on flows of commodities. However, consideration of households and firms location is not necessarily sufficient, resulting in reconsideration from a new urban economics point of view. As another exceptional urban economic study of a plane city, Lucus and Rossi-Hansberg (2002) is pointed out. They were inspired by Fujita and Ogawa (1982), and indicate endogenous land use pattern over a plane city. However they neglect commodity market to simplify the analysis. Well discussion about formation of urban configuration is summarized in Anas, Arnott, and Small (1998).

* corresponding author

Differing from Beckmann and Puu's studies, Miyata (2010) introduces bid rent functions (Fujita (1989)), which are familiar in the new urban economics, for land of households and firms, and then it studies how the results of Beckmann and Puu are rigorously modified by using the theory of partial differential equations (Courant and Hilbert (1953, 1962).

However Miyata (2010) deals with a symmetric equilibrium which seems to be a little unrealistic. This article extends the author's previous study introducing spatial characteristic vector field in the model which stands for heterogeneity in geographical conditions in a city, and try to show asymmetry in land use pattern and endogenous formation of transport networks in a two dimensional continuous space.

2. ASSUMPTIONS OF THE MODEL

(1)There is a city in a two dimensional continuous space (a plane). The land characteristics are heterogeneous. The characteristics of each point are denoted by $(lc_1(x_1, x_2),\cdots,lc_n(x_1, x_2))$ named spatial characteristic vector field (SCVF). For example, one can consider uneven land and/or a gradient. SCVF gives impact only on transport cost.
(2)Transports of commodities and labor are considered in this study. The transportation cost is expressed as von Thünen type. The transport cost of unit volume of commodity at point (x_1, x_2) is specified as a scalar function over SCVF denoting it by $\varepsilon(x_1, x_2)$. Regarding workers commuting, transport cost per head and per distance is denoted by $\zeta(x_1,x_2)$.
(3)There are N households and M firms in the city. N and M denote the numbers of households and firms, respectively, and they are sufficiently large. Households and firms are homogeneous, respectively.
(4)Land in the city is owned by absentee landowners, who reside outside the city. There is a unique local government in the city, and it rents all land in the city from the absentee landowners. The local government rents the land to households and firms at market rent, and then redistributed it equally to households.
(5)The service of capital stock is assumed to be the numerare, since the capital stock is assumed to move in free of cost in the city leading to unique equilibrium capital return rate being irrespective firms' locations.
(6)As mentioned later, the parameters in the locational potential function for each firm is sufficiently large. In this case a simple von Thünen ring becomes an equilibrium urban configuration.

3. FIRMS BEHAVIOR

The production function of a firm at location $\boldsymbol{x} = (x_1, x_2)$ is specified as a Cobb-Douglas type of homogeneous degree of unity, and agglomeration economy is taken into account. The agglomeration economy is represented by locational potential function, $\Omega(\boldsymbol{x})$, which was introduced by Fujita and Ogawa (1982). The locational potential function is defined as follows:

$$\Omega(\boldsymbol{x}) \equiv \int\int_A \mu b(\boldsymbol{y}) \exp(-\omega \| \boldsymbol{x} - \boldsymbol{y} \|) dy_1 dy_2 \tag{1}$$

where
A : city area
$b(\boldsymbol{y})$: density of firms at location $\boldsymbol{y}$
μ : monetary conversion parameter in locational potential
ω : parameter expressing the effects of distance between different points
$\| \boldsymbol{x} - \boldsymbol{y} \|$: distance between location $\boldsymbol{x}$ and $\boldsymbol{y}$

Then the production by a firm at location $\boldsymbol{x}$ may be written as follows:

$$q(\boldsymbol{x}) = \Omega(\boldsymbol{x}) q_A k_d(\boldsymbol{x})^{\alpha_k} l_d(\boldsymbol{x})^{\alpha_l} m_B(\boldsymbol{x})^{\alpha_m} \tag{2}$$

where
$q(\boldsymbol{x})$: output of a firm at location $\boldsymbol{x}$,
$k_d(\boldsymbol{x})$: input of capital stock at location $\boldsymbol{x}$
$l_d(\boldsymbol{x})$: input of labor at location $\boldsymbol{x}$
$m_B(\boldsymbol{x})$: input of land at location $\boldsymbol{x}$

q_A : efficient parameter in the production function
α_k, α_l, α_m : elasticity parameters in the production function ($\alpha_k + \alpha_l + \alpha_m = 1$)

We assume that each firm is a price taker for commodities and production factors. The firms' locational equilibrium condition is that the profit in each firm is equalized at every point. Due to the linear homogeneity of degree one in each firm's technology, the equilibrium profit in each firm becomes zero. Then the bid rent function in each firm is defined as follows:

$$g_B(\boldsymbol{x}) \equiv max\left[\frac{p(\boldsymbol{x})q(\boldsymbol{x}) - r(\boldsymbol{x})k_d(\boldsymbol{x}) - w(\boldsymbol{x})l_d(\boldsymbol{x})}{m_B(\boldsymbol{x})}\right] \tag{3}$$

with respect to $k_d(\boldsymbol{x}), l_d(\boldsymbol{x})$ *and* $m_B(\boldsymbol{x})$

subject to

$$q(\boldsymbol{x}) = \Omega(\boldsymbol{x}) q_A k_d(\boldsymbol{x})^{\alpha_k} l_d(\boldsymbol{x})^{\alpha_l} m_B(\boldsymbol{x})^{\alpha_m}$$

$$\pi_B(\boldsymbol{x}) = 0$$

where
$p(\boldsymbol{x})$: price of commodity at location $\boldsymbol{x}$
$r(\boldsymbol{x})$: capital return rate at location $\boldsymbol{x}$,
$w(\boldsymbol{x})$: wage rate at location $\boldsymbol{x}$
$g_B(\boldsymbol{x})$: bid rent by a firm at location $\boldsymbol{x}$
$\pi_B(\boldsymbol{x})$: profit in a firm at location $\boldsymbol{x}$

Solving this optimization problem, we obtain the conditional demands for labor and capital associated with firm's output $q(\boldsymbol{x})$, the bid max lot size and the bid rent function.

$$k_d(\boldsymbol{x}) = \frac{\alpha_k p(\boldsymbol{x})}{r(\boldsymbol{x})} q(\boldsymbol{x}) \tag{4}$$

$$l_d(\boldsymbol{x}) = \frac{\alpha_l p(\boldsymbol{x})}{w(\boldsymbol{x})} q(\boldsymbol{x}) \tag{5}$$

$$m_B(\boldsymbol{x}) = (\Omega(\boldsymbol{x})q_A)^{-\frac{1}{\alpha_m}} p(\boldsymbol{x})^{\frac{\alpha_m - 1}{\alpha_m}} \left[\frac{r(\boldsymbol{x})}{\alpha_k}\right]^{\frac{\alpha_k}{\alpha_m}} \left[\frac{w(\boldsymbol{x})}{\alpha_l}\right]^{\frac{\alpha_l}{\alpha_m}} q(\boldsymbol{x}) \tag{6}$$

$$g_B(\boldsymbol{x}) = \alpha_m (p(\boldsymbol{x})\Omega(\boldsymbol{x})q_A)^{\frac{1}{\alpha_m}} \left[\frac{\alpha_k}{r(\boldsymbol{x})}\right]^{\frac{\alpha_k}{\alpha_m}} \left[\frac{\alpha_l}{w(\boldsymbol{x})}\right]^{\frac{\alpha_l}{\alpha_m}} \tag{7}$$

4. HOUSEHOLDS

The household utility function at location $\boldsymbol{x}$ is assumed to be expressed as follows:

$$u(c(\boldsymbol{x}), m_H(\boldsymbol{x})) \equiv c(\boldsymbol{x})^{\beta_c} m_H(\boldsymbol{x})^{\beta_m} \quad (\beta_c + \beta_m = 1) \tag{8}$$

where
$u(c(\boldsymbol{x}), m_H(\boldsymbol{x}))$: household utility function at location $\boldsymbol{x}$
$c(\boldsymbol{x})$: household consumption at location $\boldsymbol{x}$
$m_H(\boldsymbol{x})$: household land input at location $\boldsymbol{x}$
β_c and β_m : elasticity parameters in the utility function

Each household endows available working time l_s, and capital stock k_s, and is assumed to inelastically supply them to firms obtaining income of $w(\boldsymbol{x})\, l_s + r(\boldsymbol{x})\, k_s$ plus redistributed income from the local government π_H. In household locational equilibrium, the household utility level takes the same value u^*, being irrespective of household residential places. Therefore the household bid rent function for land is specified as follows:

$$g_H(\boldsymbol{x}) \equiv max \frac{w(\boldsymbol{x})l_s + r(\boldsymbol{x})k_s + \pi_H - p(\boldsymbol{x})c(\boldsymbol{x})}{m_H(\boldsymbol{x})} \tag{9}$$

with respect to $c(\boldsymbol{x})$ *and* $m_H(\boldsymbol{x})$

subject to $u(\boldsymbol{x}) = u^*$

where $g_H(\boldsymbol{x})$ is a household bid rent function at location $\boldsymbol{x}$, and π_H is defined as follows:

$$\pi_H \equiv \frac{1}{N}\int\int_A [g_B(\boldsymbol{x})b(\boldsymbol{x})m_B(\boldsymbol{x}) + g_H(\boldsymbol{x})h(\boldsymbol{x})m_H(\boldsymbol{x})]dx_1dx_2 \tag{10}$$

where

$h(\boldsymbol{x})$: density of households at location $\boldsymbol{x}$

Solving the optimization problem (9), one obtains per capita consumption, the bid max lot size and the bid rent function.

$$c(\boldsymbol{x}) = \frac{\beta_c}{p(\boldsymbol{x})}(w(\boldsymbol{x})l_s + r(\boldsymbol{x})k_s + \pi_H) \tag{11}$$

$$m_H(\boldsymbol{x}) = \left[\frac{p(\boldsymbol{x})}{\beta_c(w(\boldsymbol{x})l_s + r(\boldsymbol{x})k_s + \pi_H)}\right]^{\frac{\beta_c}{\beta_m}} u^{*\frac{1}{\beta_m}} \tag{12}$$

$$g_H(\boldsymbol{x}) = \beta_m\left[\frac{\beta_c}{p(\boldsymbol{x})}\right]^{\frac{\beta_c}{\beta_m}}\left[\frac{w(\boldsymbol{x})l_s + r(\boldsymbol{x})k_s + \pi_H}{u^*}\right]^{\frac{1}{\beta_m}} \tag{13}$$

5. LAND MARKET EQUILIBRIUM CONDITION

We consider a monocentric land use patter, since it has been demonstrated by Miyata (2010) that a monocentric land use patter becomes an equilibrium one if parameters in the locational function are appropriately chosen. The market rent function is denoted by;

$$g(\boldsymbol{x}) \equiv max\{g_B(\boldsymbol{x}), g_H(\boldsymbol{x}), g_A\} \tag{14}$$

where g_A stands for agricultural land rent exogenously given.

If the business district is located surrounding the city center, and the residential area exists surrounding the business district, the equilibrium land rent is denoted as follows:

$g(\boldsymbol{x}) = g_B(\boldsymbol{x}) \geq g_H(\boldsymbol{x}) : \boldsymbol{x} \in$ business district (15)

$g(\boldsymbol{x}) = g_B(\boldsymbol{x}) = g_H(\boldsymbol{x}) : \boldsymbol{x} \in$ boundary between the business district and the residential area (16)

$g(\boldsymbol{x}) = g_H(\boldsymbol{x}) \geq g_B(\boldsymbol{x}) : \boldsymbol{x} \in$ the residential area (17)

$g(\boldsymbol{x}) = g_H(\boldsymbol{x}) = g_A(\boldsymbol{x}) : \boldsymbol{x} \in$ on the city boundary (18)

The constraints on the numbers of firms and the households are as follows:

$$M = \int\int_{A_B} \frac{1}{m_B(\boldsymbol{x})}dx_1dx_2 \quad \text{where } A_B \text{ is business district.} \tag{19}$$

$$N = \int\int_{A_H} \frac{1}{m_H(\boldsymbol{x})}dx_1dx_2 \quad \text{where } A_H \text{ is residential area.} \tag{20}$$

6. LOCAL BALANCE EQUATIONS FOR COMMODITY, LABOR, AND CAPITAL STOCK

Let us assume the transport technology for commodities as von Thünen technology with a variable ratio $\varepsilon(\boldsymbol{x}) \equiv \varepsilon(x_1, x_2)$ which depends on location. That is, the transport cost is incurred in the shipped commodities being expressed as $\varepsilon(\boldsymbol{x})\cdot q$ in shipping q unit of commodities in the unit distance. Let $\varphi(\boldsymbol{x})$ be a two dimensional vector of commodities transported to location $\boldsymbol{x}$ in unit time and in unit area size. Then the following local balance equation for commodities is realized (Beckmann and Puu (1985)).

$$div\,\varphi(\boldsymbol{x}) = q(\boldsymbol{x})b(\boldsymbol{x}) - c(\boldsymbol{x})h(\boldsymbol{x}) - \varepsilon(\boldsymbol{x})\|\varphi(\boldsymbol{x})\| \tag{21}$$

where

$b(\boldsymbol{x})$: firms' density at location $\boldsymbol{x}$ ($= 1 / m_B(\boldsymbol{x})$)

$h(\boldsymbol{x})$: households' density at location $\boldsymbol{x}$ ($= 1 / m_H(\boldsymbol{x})$)

$\|\cdot\|$: norm of a two dimensional vector

Similarly, let $\zeta(\boldsymbol{x}) \equiv \zeta(x_1, x_2)$ denote the transport cost in conveying unit labor in unit distance. This cost is incurred in labor itself as well. Let $\psi(\boldsymbol{x})$ express a two dimensional vector of labor in unit time and in unit area size shipped to location $\boldsymbol{x}$. Then the local balance equation for labor held at location $\boldsymbol{x}$ is expressed as follows (Beckmann and Puu (1985)):

$$div\,\psi(\boldsymbol{x}) = l_s h(\boldsymbol{x}) - l_d(\boldsymbol{x})b(\boldsymbol{x}) - \xi(x)\,\|\psi(\boldsymbol{x})\| \tag{22}$$

As for capital stock, we assume that capital stock can move to arbitrary places in free of cost. This assumption reflects the fact that if once the capital stock is installed in firms, spatial movement of capital stock after the installation can be considered to be less than commodities and labor. Thus the equilibrium in capital stock holds at the location of each firm. This is described as follows:

$$k_d(\boldsymbol{x})b(\boldsymbol{x}) = ks(\boldsymbol{x}) \tag{23}$$

where $\iint_A ks(\boldsymbol{x})dx_1dx_2 = \iint_A k_s h(\boldsymbol{x})dx_1dx_2$ and A stands for the city area.

Due to the free of cost assumption in capital stock location, the following formula holds.

$$\iint_A ks(\boldsymbol{x})dx_1dx_2 = k_s N \tag{24}$$

where N : the number of households residing in the city

7. THE LOCAL GOVERNMENT AND ABSENTEE LANDOWNERS

The city area is assumed to be occupied by absentee landowners. Absentee landowners reside outside of the city. The local government rents all land in the city from absentee landowners. It rents the land to firms and households in the city at market rents. The revenue of the local government from the land rent is equally redistributed to households. The redistributed household income, π_H, is indicated as formula (10) mentioned earlier.

8. GLOBAL EQUILIBRIUM CONDITION IN COMMODITY AND LABOR MARKETS

Integrating the commodity local balance equation (21), and applying Gauss divergence theorem, one can obtain the global equilibrium condition on commodities as presented in equation (26), since all commodities produced in the city are consumed by households in the city, and we assume that there is no import and export of commodities. So the right hand side in equation (26) becomes zero.

$$\iint_A div\,\varphi(\boldsymbol{x})dx_1dx_2 = \iint_A [q(\boldsymbol{x})b(\boldsymbol{x}) - c(\boldsymbol{x})h(\boldsymbol{x}) - \varepsilon(\boldsymbol{x})\,\|\varphi(\boldsymbol{x})\|]dx_1dx_2 = \int_{\partial A} c_n(\boldsymbol{x}(s))ds = 0 \tag{25}$$

$$\therefore \iint_A [q(\boldsymbol{x})b(\boldsymbol{x}) - c(\boldsymbol{x})h(\boldsymbol{x}) - \varepsilon(\boldsymbol{x})\,\|\varphi(\boldsymbol{x})\|]dx_1dx_2 = 0 \tag{26}$$

where
∂A: city boundary
$c_n(\boldsymbol{x}(s))$: net export whose direction is normal to the city boundary

Next integrating the labor local balance equation (22) with Gauss divergence theorem, one can obtain the global equilibrium equation for labor. Since we assume that there is no in- and out-migration at the city boundary, the line integral of labor migration along the city boundary becomes zero as well.

$$\iint_A div\,\psi(\boldsymbol{x})dx_1dx_2 = \iint_A [l_s h(\boldsymbol{x}) - l_d(\boldsymbol{x})b(\boldsymbol{x}) - \xi(\boldsymbol{x})\,\|\psi(\boldsymbol{x})\|]dx_1dx_2 = \int_{\partial A} l_n(\boldsymbol{x}(s))ds = 0 \tag{27}$$

$$\therefore \iint_A [l_s h(\boldsymbol{x}) - l_d(\boldsymbol{x})b(\boldsymbol{x}) - \xi(\boldsymbol{x})\,\|\psi(\boldsymbol{x})\|]dx_1dx_2 = 0 \tag{28}$$

9. COMMODITY TRANSPORT AGENT (*C.T.A.*)

Transporting commodities is assumed to be done by the commodity transport agent (*C.T.A.*) (Beckmann and Puu (1985)). The *C.T.A.* buys $p(\boldsymbol{x})q(\boldsymbol{x})b(\boldsymbol{x})$ of commodities at point $\boldsymbol{x}$, and sells $p(\boldsymbol{x})c(\boldsymbol{x})h(\boldsymbol{x})$ of commodities to households. Thus the profit of *C.T.A.* at $\boldsymbol{x}$ is expressed as follows:

$$\pi_{Tq}(\boldsymbol{x}) = p(\boldsymbol{x})c(\boldsymbol{x})h(\boldsymbol{x}) - p(\boldsymbol{x})q(\boldsymbol{x})b(\boldsymbol{x}) = -p(\boldsymbol{x})div\,\varphi(\boldsymbol{x}) - p(\boldsymbol{x})\varepsilon(\boldsymbol{x})\,\|\varphi(\boldsymbol{x})\| \tag{29}$$

The *C.T.A.* aims to find the optimal route which maximizes the profit earned over the entire city area. The profit of the *C.T.A.* over the entire city area is written as follows:

$$\iint_A \pi_{Tq}(\boldsymbol{x})dx_1dx_2 = \iint_A [p(\boldsymbol{x})c(\boldsymbol{x})h(\boldsymbol{x}) - p(\boldsymbol{x})q(\boldsymbol{x})b(\boldsymbol{x})]dx_1dx_2$$
$$= -\iint_A [p(\boldsymbol{x})div\,\varphi(\boldsymbol{x}) + p(\boldsymbol{x})\varepsilon(\boldsymbol{x}) \| \varphi(\boldsymbol{x}) \|]dx_1dx_2 \quad (30)$$

The necessary and sufficient condition for the profit maximization in the *C.T.A.* is derived from the calculus variation (Gelfand and Fomin (1963)). The Euler-Lagrange equation in the calculus variation is as follows:

$$\frac{d}{dx_1}\frac{\partial \pi_{Tq}}{\partial(\partial\varphi_i/\partial x_1)} + \frac{d}{dx_2}\frac{\partial \pi_{Tq}}{\partial(\partial\varphi_i/\partial x_2)} - \frac{\partial \pi_{Tq}}{\partial \varphi_i} = 0 \quad (31)$$

where $\boldsymbol{x} = (x_1, x_2)$ and $\varphi(\boldsymbol{x}) = (\varphi_1(x_1, x_2), \varphi_2(x_1, x_2))$.

Transforming the profit in the *C.T.A.* in the x_1-x_2 coordinate, we have;

$$\pi_{Tq}(\boldsymbol{x}) = -p(\boldsymbol{x})(div\,\varphi(\boldsymbol{x}) - p(\boldsymbol{x})\varepsilon(\boldsymbol{x}) \| \varphi(\boldsymbol{x}) \|) = -p(x_1, x_2)\left\{\frac{\partial \varphi_1}{\partial x_1} + \frac{\partial \varphi_2}{\partial x_2} + \varepsilon(\boldsymbol{x})(\varphi_1^2 + \varphi_2^2)^{1/2}\right\} \quad (32)$$

Therefore the Euler-Lagrange equation is concretely expressed as follows:

$$\frac{\partial \pi_{Tq}}{\partial(\partial\varphi_i/\partial x_i)} = -p(\boldsymbol{x}) \quad (33)$$

$$\frac{d}{dx_i}\frac{\partial \pi_{Tq}}{\partial(\partial\varphi_i/\partial x_i)} = -\frac{\partial p(\boldsymbol{x})}{\partial x_i} \quad (34)$$

$$\frac{\partial \pi_{Tq}}{\partial \varphi_i} = -p(\boldsymbol{x})\varepsilon(\boldsymbol{x})\frac{\varphi_i(\boldsymbol{x})}{\| \varphi(\boldsymbol{x}) \|} \quad (35)$$

Thus the optimal condition is finally reduced to equation (36).

$$\therefore p(\boldsymbol{x})\varepsilon(\boldsymbol{x})\frac{\varphi(\boldsymbol{x})}{\| \varphi(\boldsymbol{x}) \|} = grad\ p(\boldsymbol{x}) \quad (36)$$

In equation (36), $\varphi(\boldsymbol{x}) / \| \varphi(\boldsymbol{x}) \|$ stands for the direction along which commodities are transported, and that direction coincides the gradient of commodity price. This condition is the optimal one for commodity transport. In other words, the direction along which commodities are transported is the direction where commodity price gets highest. This is famous a finding as the so-called gradient law by Beckmann (1952).

$p(\boldsymbol{x})\varepsilon(\boldsymbol{x})\varphi(\boldsymbol{x}) / \| \varphi(\boldsymbol{x}) \|$ depicts the cost of shipping a unit commodity in a unit distance. Let us calculate the transport cost in carrying a unit commodity from the point $\boldsymbol{x}_A$ to $\boldsymbol{x}_B$ on the optimal route. We denote the route by $D(s) = (x_1(s), x_2(s))$ $(0 \le s \le 1, \boldsymbol{x}_A = (x_1(0), x_2(0)), \boldsymbol{x}_B = (x_1(1), x_2(1)))$. Thus the transport cost is expressed as follows:

$$\int_0^1 p(\boldsymbol{x}(s))a\frac{\varphi(\boldsymbol{x}(s))}{\| \varphi(\boldsymbol{x}(s)) \|}\frac{d\boldsymbol{x}(s)}{ds}ds = \int_0^1 grad\ p(\boldsymbol{x}(s))\frac{d\boldsymbol{x}(s)}{ds}ds = p(\boldsymbol{x}_B) - p(\boldsymbol{x}_A) \quad (37)$$

This equation implies that the transport cost in carrying the unit commodity along the optimal route is the difference between commodity prices at different points. This also asserts that the transport cost is incurred in commodity price. Then let us calculate the profit in the *C.T.A.* earned in the entire city area. Multiplying the both hand sides in equation (36) by $\varphi(\boldsymbol{x})$ in the sense of scalar product, we have;

$$p(\boldsymbol{x})\varepsilon(\boldsymbol{x}) \| \varphi(\boldsymbol{x}) \| = \varphi(\boldsymbol{x})grad\ p(\boldsymbol{x}) \quad (38)$$

$$\therefore \iint_A \pi_{Tq}(\boldsymbol{x})dx_1dx_2 = -\iint_A [p(\boldsymbol{x})div\,\varphi(\boldsymbol{x}) + p(\boldsymbol{x})\varepsilon(\boldsymbol{x}) \| \varphi(\boldsymbol{x}) \|]dx_1dx_2$$
$$= -\iint_A [p(\boldsymbol{x})div\,\varphi(\boldsymbol{x}) + \varphi(\boldsymbol{x})grad\ p(\boldsymbol{x})]dx_1dx_2 \quad (39)$$

By the way, $div\ p(\boldsymbol{x})\varphi(\boldsymbol{x}) = p(\boldsymbol{x})div\,\varphi(\boldsymbol{x}) + \varphi(\boldsymbol{x})grad\ p(\boldsymbol{x})$ holds. Thus equation (39) can further be transformed as;

$$\iint_A \pi_{Tq}(\boldsymbol{x})dx_1dx_2 = -\iint_A div\ p(\boldsymbol{x})\varphi(\boldsymbol{x})dx_1dx_2 = -\int_{\partial A} p_n(\boldsymbol{x}(s))c_n(\boldsymbol{x}(s))ds = 0 \quad (40)$$

Equation (40) asserts that the total profit in the *C.T.A.* in the city area becomes zero.

10. LABOR TRANSPORT AGENT (*L.T.A.*)

In turn, we formulate the behavior of the labor transport agent (*L.T.A.*) (Beckmann and Puu (1985)). The *L.T.A.* receives wages of $w(\boldsymbol{x})l_d(\boldsymbol{x})b(\boldsymbol{x})$ from firms at location $\boldsymbol{x}$, and pays wages of $w(\boldsymbol{x})l_s h(\boldsymbol{x})$ to households. As mentioned earlier, it is assumed that there is no migration from and to the outside of the city. Therefore the profit in the *L.T.A.* at $\boldsymbol{x}$ is denoted as follows:

$$\pi_{Tl}(\boldsymbol{x}) = w(\boldsymbol{x})l_d(\boldsymbol{x})b(\boldsymbol{x}) - w(\boldsymbol{x})l_s h(\boldsymbol{x}) = -w(\boldsymbol{x})div\,\psi(\boldsymbol{x}) - w(\boldsymbol{x})\varsigma(\boldsymbol{x})\,||\psi(\boldsymbol{x})|| \tag{41}$$

The *L.T.A.* determines labor transport routes so as to maximize the profit which will be gained over the entire city area. This problem is specified as follows:

$$\begin{aligned} &max \iint_A \pi_{Tl}(\boldsymbol{x})dx_1dx_2 = max \iint_A [w(\boldsymbol{x})l_d(\boldsymbol{x})b(\boldsymbol{x}) - w(\boldsymbol{x})l_s h(\boldsymbol{x})]dx_1dx_2 \\ &= max -\iint_A [w(\boldsymbol{x})div\,\psi(\boldsymbol{x}) + w(\boldsymbol{x})\varsigma(\boldsymbol{x})\,||\psi(\boldsymbol{x})||]dx_1dx_2 \end{aligned} \tag{42}$$

Similar to the case of commodity transport, the following profit maximization condition is obtained by applying the calculus of variation again.

$$w(\boldsymbol{x})\varsigma(\boldsymbol{x})\frac{\psi(\boldsymbol{x})}{||\psi(\boldsymbol{x})||} = grad\ w(\boldsymbol{x}) \tag{43}$$

This equation shows that labor is transported along the direction where the wage rate gets highest as well. Taking two points, $\boldsymbol{x}_A$ and $\boldsymbol{x}_B$, on the optimal route, the transport cost in moving the unit labor from $\boldsymbol{x}_A$ to $\boldsymbol{x}_B$ along the optimal route is calculated as follows:

$$\int_0^1 w(\boldsymbol{x}(s))\varsigma(\boldsymbol{x}(s))\frac{\psi(\boldsymbol{x}(s))}{||\psi(\boldsymbol{x}(s))||}\frac{d\boldsymbol{x}(s)}{ds}ds = \int_0^1 grad\ w(\boldsymbol{x}(s))\frac{d\boldsymbol{x}(s)}{ds}ds = w(\boldsymbol{x}_B) - w(\boldsymbol{x}_A) \tag{44}$$

One can know from equation (44) that the wage rate includes transport cost. The total profit of *L.T.A.* in the city is expressed as follows by using Gauss divergence theorem.

$$\iint_A \pi_{Tl}(\boldsymbol{x})dx_1dx_2 = -\iint_A [w(\boldsymbol{x})div\,\psi(\boldsymbol{x}) + w(\boldsymbol{x})\varsigma(\boldsymbol{x})\,||\psi(\boldsymbol{x})||]dx_1dx_2 = -\int_{\partial A} w_n(\boldsymbol{x}(s))\psi_n(\boldsymbol{x}(s))ds \tag{45}$$

where

$w_n(\boldsymbol{x}(s))$: wage rate prevailing on the city boundary

$\psi_n(\boldsymbol{x}(s))$: volume of labor flow from or to outside of the city

Since we assume that there is no labor flow from and to the outside of the city in this study, $\int_{\partial A} w_n(\boldsymbol{x}(s))\psi_n(\boldsymbol{x}(s))ds = 0$ holds. That is, the zero profit condition holds in the *L.T.A.* as well.

11. WALRAS LAW

Now let us write the budget conditions on all economic agents.

firms : $$\iint_A [p(\boldsymbol{x})q(\boldsymbol{x}) - r(\boldsymbol{x})k_d(\boldsymbol{x}) - w(\boldsymbol{x})l_d(\boldsymbol{x}) - g_B(\boldsymbol{x})m_B(\boldsymbol{x})]b(\boldsymbol{x})dx_1dx_2 = 0 \tag{46}$$

households : $$\iint_A [w(\boldsymbol{x})l_s + r(\boldsymbol{x})k_s + \pi_H - p(\boldsymbol{x})c(\boldsymbol{x}) - g_H(\boldsymbol{x})m_H(\boldsymbol{x})]h(\boldsymbol{x})dx_1dx_2 = 0 \tag{47}$$

local government : $$\iint_A [g_B(\boldsymbol{x})m_B(\boldsymbol{x})b(\boldsymbol{x}) + g_H(\boldsymbol{x})m_H(\boldsymbol{x})h(\boldsymbol{x})]dx_1dx_2 - N\pi_H = 0 \tag{48}$$

Summing up equations (46) to (48), we obtain the following equation.

$$\begin{aligned} &\iint_A p(\boldsymbol{x})[q(\boldsymbol{x})b(\boldsymbol{x}) - c(\boldsymbol{x})h(\boldsymbol{x})]dx_1dx_2 \\ &+ \iint_A w(\boldsymbol{x})[l_s h(\boldsymbol{x}) - l_d(\boldsymbol{x})b(\boldsymbol{x})]dx_1dx_2 \\ &+ \iint_A r(\boldsymbol{x})[k_s h(\boldsymbol{x}) - k_d(\boldsymbol{x})b(\boldsymbol{x})]dx_1dx_2 = 0 \end{aligned} \tag{49}$$

Equation (49) is interpreted as a kind of Walras law, however, the true Walras law must be more restricted. This point will be referred again in a later part. Any way, taking into account the free mobility of capital stock, that is, the capital rental price is independent of location, we set the capital stock service as numeraire in the model, i.e. $r(\boldsymbol{x}) = 1$ for all $\boldsymbol{x} \in A$.

12. COMMODITY PRICE

The commodity price equation (36) can be transformed into the following non-linear first order partial differential equation.

$$\left(\frac{\partial ln\ p(\boldsymbol{x})}{\partial x_1}\right)^2+\left(\frac{\partial ln\ p(\boldsymbol{x})}{\partial x_2}\right)^2=\varepsilon(\boldsymbol{x})^2 \tag{50}$$

Equation (50) can mathematically be solved, and its solution is formula (51) when the initial manifold is degenerated to a single point.

$$p(x_1,x_2)=p_0\exp\varepsilon(x_1,x_2)\sqrt{x_1^2+x_2^2} \tag{51}$$

The initial price p_0 is obtained by the price on the city boundary determined by general equilibrium in the entire city. The formula (51) is called integral conoid showing a cone shaped surface in the three dimensional space as presented Miyata (2010), if $\varepsilon(x_1, x_2)$ is a constant (see Figure 1). Regarding variable $\varepsilon(x_1, x_2)$, its graphical illustration will be shown later.

13. WAGE RATE

Regarding the wage rate, the same discussion is possible. The solution surface for the wage rate is expressed by;

$$w(x_1,x_2)=w_0\exp(-\varsigma(x_1,x_2)\sqrt{x_1^2+x_2^2}) \tag{52}$$

When we assume that the business district encircles the origin, and the residential area is located outside the business area, that is, a simple von Thünen ring, the wage rate prevailing at the city center w_0 is given by the wage rate on the city boundary which is determined to satisfy the equilibrium conditions mentioned later. Conversely to the commodity price surface, the wage profile shows a decrease with exponential order from the city center to the city boundary if $\zeta(x_1, x_2)$ is a constant (see Figure 2).

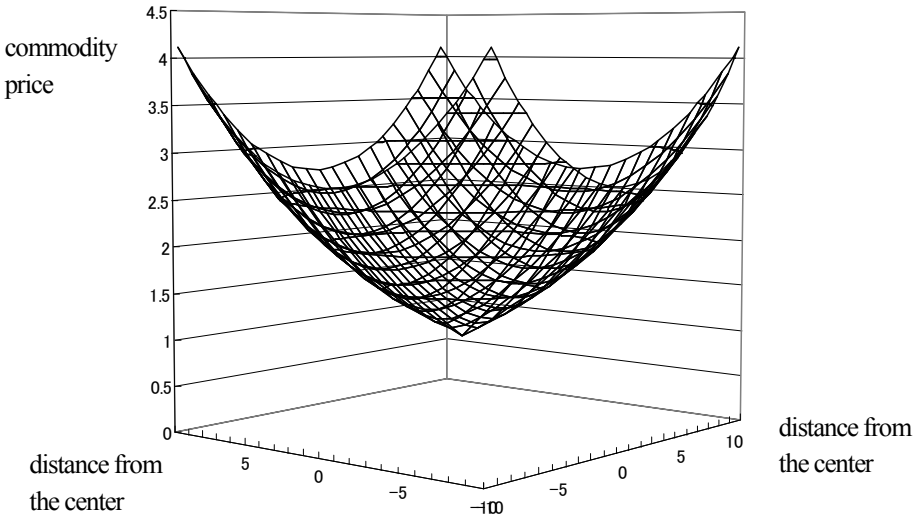

Figure 1 Shape of the Commodity Price Surface

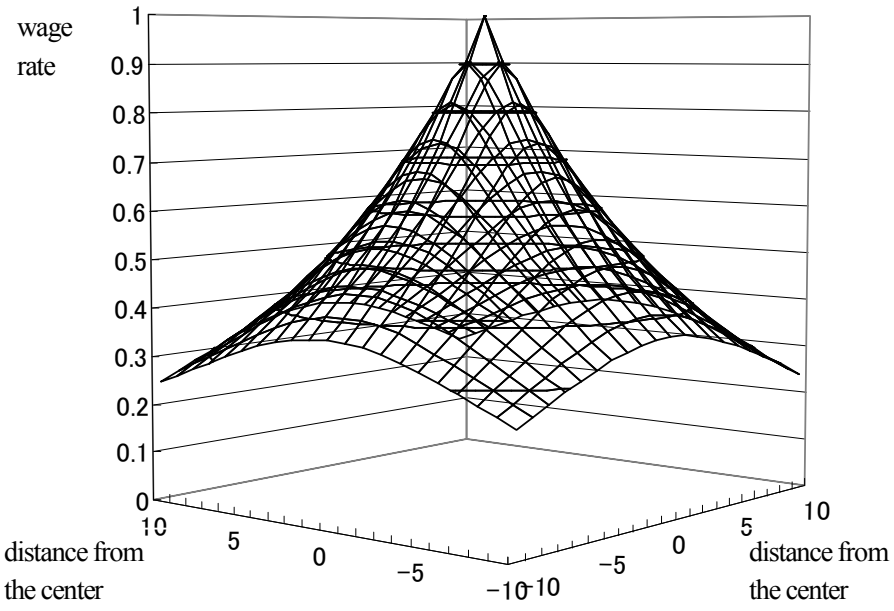

Figure 2 Shape of the Wage Rate Surface

14. THE OPTIMAL TRANSPORT OF COMMODITIES

In this section, we try to solve the optimal volume of shipment of commodities. To this end, we start with transforming equation (43) yielding;

$$\frac{\varphi(\boldsymbol{x})}{\|\varphi(\boldsymbol{x})\|}=\frac{1}{\varepsilon(\boldsymbol{x})}\frac{grad\ p(\boldsymbol{x})}{p(\boldsymbol{x})}=\frac{1}{\varepsilon(\boldsymbol{x})}grad\ ln\ p(\boldsymbol{x}) \tag{53}$$

Therefore $\varepsilon(\boldsymbol{x})^2=\|grad\ ln\ p(\boldsymbol{x})\|^2$ holds, leading to $\varepsilon(\boldsymbol{x})=\|grad\ ln\ p(\boldsymbol{x})\|$.

$$\therefore \frac{\varphi(\boldsymbol{x})}{\|\varphi(\boldsymbol{x})\|}=\frac{grad\ ln\ p(\boldsymbol{x})}{\|grad\ ln\ p(\boldsymbol{x})\|} \tag{54}$$

$$\therefore \varphi(\boldsymbol{x})=\|\varphi(\boldsymbol{x})\|\frac{\varphi(\boldsymbol{x})}{\|\varphi(\boldsymbol{x})\|}=\|\varphi(\boldsymbol{x})\|\frac{grad\ ln\ p(\boldsymbol{x})}{\|grad\ ln\ p(\boldsymbol{x})\|}=\|\varphi(\boldsymbol{x})\|(\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|,\tilde{x}_2/\|\tilde{\boldsymbol{x}}\|) \tag{55}$$

where $\tilde{x}_1\equiv(\partial\varepsilon(\boldsymbol{x})/\partial x_1)\|\boldsymbol{x}\|+\varepsilon(\boldsymbol{x})x_1/\|\boldsymbol{x}\|$, $\tilde{x}_2\equiv(\partial\varepsilon(\boldsymbol{x})/\partial x_2)\|\boldsymbol{x}\|+\varepsilon(\boldsymbol{x})x_2/\|\boldsymbol{x}\|$ and $\tilde{\boldsymbol{x}}\equiv(\tilde{x}_1,\tilde{x}_2)$

Taking divergence of the both hand sides in equation (55) yields;

$$\begin{aligned} &div\ \varphi(\boldsymbol{x})=grad\|\varphi(\boldsymbol{x})\|(\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|,\tilde{x}_2/\|\tilde{\boldsymbol{x}}\|)+\|\varphi(\boldsymbol{x})\|div\,(\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|,\tilde{x}_2/\|\tilde{\boldsymbol{x}}\|)\\ &=q(\boldsymbol{x})b(\boldsymbol{x})-c(\boldsymbol{x})h(\boldsymbol{x})-\varepsilon(\boldsymbol{x})\|\varphi(\boldsymbol{x})\| \end{aligned} \tag{56}$$

Hence the following equation is obtained.

$$grad\|\varphi(\boldsymbol{x})\|(\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|,\tilde{x}_2/\|\tilde{\boldsymbol{x}}\|)=q(\boldsymbol{x})b(\boldsymbol{x})-c(\boldsymbol{x})h(\boldsymbol{x})-\|\varphi(\boldsymbol{x})\|div\tilde{\boldsymbol{x}}/\|\tilde{\boldsymbol{x}}\| \tag{57}$$

$$\therefore \frac{\tilde{x}_1}{\|\tilde{\boldsymbol{x}}\|}\frac{\partial\|\varphi(\boldsymbol{x})\|}{\partial x_1}+\frac{\tilde{x}_2}{\|\tilde{\boldsymbol{x}}\|}\frac{\partial\|\varphi(\boldsymbol{x})\|}{\partial x_2}=q(\boldsymbol{x})b(\boldsymbol{x})-c(\boldsymbol{x})h(\boldsymbol{x})-\|\varphi(\boldsymbol{x})\|(\varepsilon(\boldsymbol{x})+div\,\tilde{\boldsymbol{x}}/\|\tilde{\boldsymbol{x}}\|) \tag{58}$$

The left hand side in equation (58) stands for a directional derivative with respect to the volume of commodity transportation. Its direction is obtained by normalizing $(\tilde{x}_1,\tilde{x}_2)$, and a change in commodity flow volume in the direction where the transport cost gets higher is larger than in other directions.

The first term in the right hand side expresses the supply of commodities at location $\boldsymbol{x}$, the second term depicts household consumption and finally the third term implies the depreciation in goods in transporting and *generalized diffusion effect*. Here generalized diffusion effect means that a change in

shipment of commodities gets smaller as the location of commodities transported gets further from the city center. This fact never appears unless SCVF and land density are taken into account.

Although $div\,\tilde{\boldsymbol{x}}/\|\tilde{\boldsymbol{x}}\|$ can be expanded, it becomes a very complex formula and it is not easy to see its economic implication. However when a change in $\varepsilon(\boldsymbol{x})$ is small as compared with the distance between $\boldsymbol{x}$ and the city center, $div\,\tilde{\boldsymbol{x}}/\|\tilde{\boldsymbol{x}}\|$ becomes a decreasing function of distance showing a property of diffusion effect.

The right hand side in equation (58) is a scalar. Therefore if $\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|$ in the left hand side is large (i.e. the transport cost is high in the direction of x_1), it is natural that $\partial\|\varphi(\boldsymbol{x})\|/\partial x_1$ gets smaller. That is, the volume of commodities transported becomes smaller in the direction where the transport cost gets higher. This matches our sense in observing usual transportation phenomena.

Then the system of characteristic differential equations for equation (58) is as follows: (note that parameter s appears in this and next sections, but its meaning is different from one in the previous section.)

$$\frac{dx_1(s)}{ds}=\tilde{x}_1(s)/\|\tilde{\boldsymbol{x}}(s)\| \tag{59}$$

$$\frac{dx_2(s)}{ds}=\tilde{x}_2(s)/\|\tilde{\boldsymbol{x}}(s)\| \tag{60}$$

$$\frac{d\,\|(\varphi_1(x_1(s),x_2(s)),\varphi_2(x_1(s),x_2(s))\|}{ds}=q(\boldsymbol{x})b(\boldsymbol{x})-c(\boldsymbol{x})h(\boldsymbol{x})-\|\varphi(\boldsymbol{x})\|(\varepsilon(\boldsymbol{x})+div\,\tilde{\boldsymbol{x}}/\|\tilde{\boldsymbol{x}}\|) \tag{61}$$

Taking into account that the direction of $\varphi(\boldsymbol{x})$ is the same as that of *grad ln* $p(\boldsymbol{x})$, we set initial conditions for equations (59) to (61) as $x_1(0)=0, x_2(0)=0,$ and $\|(\varphi_1(x_1(0),x_2(0),\varphi_2(x_1(0),x_2(0))\|)=\|\varphi_0\|$, since we assume a simple von Thünen ring. From equations (59) and (60), the following differential equation is obtained.

$$\left(\frac{dx_1(s)}{ds}\right)^2+\left(\frac{dx_2(s)}{ds}\right)^2=1 \tag{62}$$

Now solving equation (58) introducing a distance parameter s with the initial value of zero at the city center, we obtain equation (63).

$$\begin{aligned}\|\varphi(\boldsymbol{x}(s))\|=&\int_0^s[q(\boldsymbol{x}(\tau))b(\boldsymbol{x}(\tau))-c(\boldsymbol{x}(\tau))h(\boldsymbol{x}(\tau))]\\&\cdot exp\left(-\int_\tau^s div\,\tilde{\boldsymbol{x}}(\eta)/\|\tilde{\boldsymbol{x}}(\eta)\|\,d\eta\right)exp\left(-\int_\tau^s\varepsilon(\boldsymbol{x}(\eta))\,d\eta\right)d\tau\end{aligned} \tag{63}$$

Moreover the vector of commodity flow is denoted by;

$$\varphi(\boldsymbol{x})=(\|\varphi(\boldsymbol{x})\|\tilde{x}_1/\|\tilde{\boldsymbol{x}}\|,\ \|\varphi(\boldsymbol{x})\|\tilde{x}_2/\|\tilde{\boldsymbol{x}}\|) \tag{64}$$

If SCVF is even, the direction of commodity shipment shows a line. But when SCVF is uneven, the direction will illustrate a curve.

Now let us explain the economic implication of equation (63). [·] in the integral is commodities produced minus household consumption. The second term describes the generalized diffusion effect in which the volume of commodities transported to the point $\boldsymbol{x}$ more decreases as $\boldsymbol{x}$ gets further from the city center. This is the first theoretical finding among literature, and it never appears without variable land density and SCVF.

The last term is an exponential integral of the variable transport cost showing that the commodities are depreciated by transport services. Incidentally if ε is a constant, then the last term becomes *exp* $(-\varepsilon\cdot(s-\tau))$ and one can intuitively see its economic implication. The equation (63) can be described in words as follows:

commodity volume transported to point $\boldsymbol{x}$ = (*total supply of commodities – total consumption of commodities*)×
generalized diffusion effect – depreciation in commodities by transport services

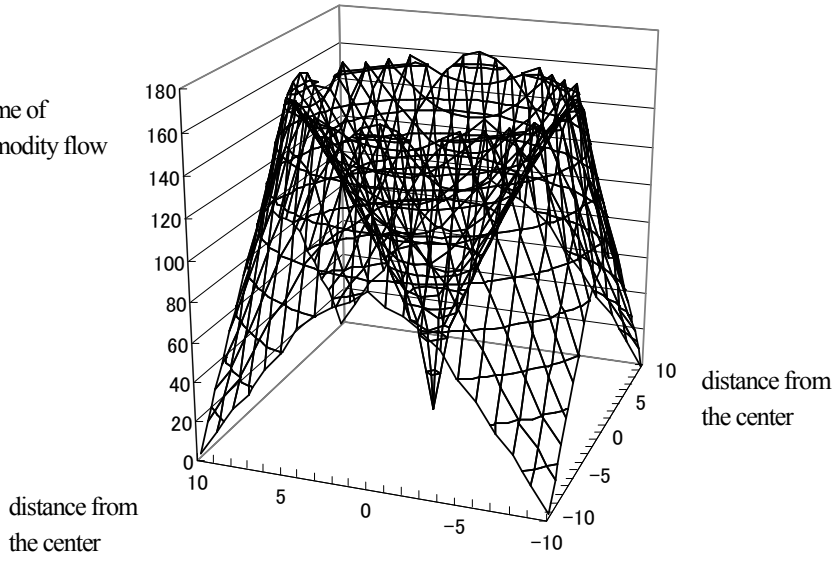

Figure 3 Shape of the Volume of Commodity Flow

15. THE OPTIMAL TRANSPORT OF LABOR

Regarding the optimal transport of labor, it can also be solved applying the same method in the case of commodity transport. Since $w(\boldsymbol{x})b\dfrac{\psi(\boldsymbol{x})}{\|\psi(\boldsymbol{x})\|}=grad\ w(\boldsymbol{x})$, we obtain $\dfrac{\psi(\boldsymbol{x})}{\|\psi(\boldsymbol{x})\|}=\dfrac{grad\ ln\ w(\boldsymbol{x})}{\|grad\ ln\ w(\boldsymbol{x})\|}=.$ $-(\hat{x}_1\|\hat{\boldsymbol{x}}\|,\hat{x}_2\|\hat{\boldsymbol{x}}\|)$.

where $\hat{x}_1\equiv(\partial\varsigma(\boldsymbol{x})/\partial x_1)\|\boldsymbol{x}\|+\varsigma(\boldsymbol{x})x_1/\|\boldsymbol{x}\|$, $\hat{x}_2\equiv(\partial\varsigma(\boldsymbol{x})/\partial x_2)\|\boldsymbol{x}\|+\varsigma(\boldsymbol{x})x_2/\|\boldsymbol{x}\|$ and $\hat{\boldsymbol{x}}\equiv(\hat{x}_1,\hat{x}_2)$

$$\therefore\psi(\boldsymbol{x})=\|\psi(\boldsymbol{x})\|\frac{\psi(\boldsymbol{x})}{\|\psi(\boldsymbol{x})\|}=-\|\psi(\boldsymbol{x})\|(\hat{x}_1/\|\hat{\boldsymbol{x}}\|,\hat{x}_2/\|\hat{\boldsymbol{x}}\|) \tag{65}$$

Taking divergence of the both hand sides in equation (65), we have;

$$div\,\psi(\boldsymbol{x})=grad\|\psi(\boldsymbol{x})\|(\hat{x}_1/\|\hat{\boldsymbol{x}}\|,\hat{x}_2/\|\hat{\boldsymbol{x}}\|)+\|\psi(\boldsymbol{x})\|div(\hat{x}_1/\|\hat{\boldsymbol{x}}\|,\hat{x}_2/\|\hat{\boldsymbol{x}}\|) \tag{66}$$

$$\begin{aligned}\therefore grad\|\psi(\boldsymbol{x})\|(\hat{x}_1/\|\hat{\boldsymbol{x}}\|,\hat{x}_2/\|\hat{\boldsymbol{x}}\|)&=div\,\psi(\boldsymbol{x})-\|\psi(\boldsymbol{x})\|div(\hat{x}_1/\|\hat{\boldsymbol{x}}\|,\hat{x}_2/\|\hat{\boldsymbol{x}}\|)\\&=l_s h(\boldsymbol{x})-l_d(\boldsymbol{x})b(\boldsymbol{x})-\varsigma(\boldsymbol{x})\|\psi(\boldsymbol{x})\|+\|\psi(\boldsymbol{x})\|div\hat{\boldsymbol{x}}/\|\hat{\boldsymbol{x}}\|\end{aligned} \tag{67}$$

$$\therefore\frac{\hat{x}_1}{\|\hat{\boldsymbol{x}}\|}\frac{\partial\|\psi(\boldsymbol{x})\|}{\partial x_1}+\frac{\hat{x}_2}{\|\hat{\boldsymbol{x}}\|}\frac{\partial\|\psi(\boldsymbol{x})\|}{\partial x_2}=l_s h(\boldsymbol{x})-l_d(\boldsymbol{x})b(\boldsymbol{x})-\|\psi(\boldsymbol{x})\|(\varsigma(\boldsymbol{x})-div\hat{\boldsymbol{x}}/\|\hat{\boldsymbol{x}}\|) \tag{68}$$

The interpretation of equation (68) is as follows: The left hand side is a directional derivative with respect to the volume of labor commuting. Its direction is the normalization of $(\hat{x}_1,\hat{x}_2)$, and a change in the volume of labor commuting flow in the direction where the transport cost gets higher is larger than in other directions. While the first term in the right hand side is a household labor supply at location $\boldsymbol{x}$, the second is firms' labor demand, $\zeta(\boldsymbol{x})\cdot\ \|\psi(\boldsymbol{x})\|$ is the transport cost in conveying labor, and finally $\|\psi(\boldsymbol{x})\|div\hat{\boldsymbol{x}}/\|\hat{\boldsymbol{x}}\|$ is *the generalized congestion effect*. That is, the change in labor flow becomes larger as the location of commuting gets closer to the center. This fact also never appears if SCVF and land density are not taken into account.

$div\,\hat{\boldsymbol{x}}/\|\hat{\boldsymbol{x}}\|$ can be expanded, however, it becomes a very complex formula and it is not easy to see its economic implication as well. When the distance between $\boldsymbol{x}$ and the city center is short, $div\,\hat{\boldsymbol{x}}/\|\hat{\boldsymbol{x}}\|$ takes a large value illustrating a characteristic of congestion effect.

The right hand side in equation (68) is a scalar. Therefore if $\hat{x}_1/\|\hat{x}\|$ in the left hand side is large (i.e. the transport cost is high in the direction of x_1), it is natural that $\partial\|\psi(\boldsymbol{x})\|/\partial x_1$ gets smaller. That is,

the volume of labor transported becomes smaller in the direction where the transport cost gets higher. This also matches our sense in usual transport phenomena.

Then the system of characteristic differential equations for equation (68) is as follows:

$$\frac{dx_1(s)}{ds} = \hat{x}_1(s) / \| \hat{\boldsymbol{x}}(s) \| \tag{69}$$

$$\frac{dx_2(s)}{ds} = \hat{x}_2(s) / \| \hat{\boldsymbol{x}}(s) \| \tag{70}$$

$$\frac{d \| \psi(x_1(s), x_2(s)) \|}{ds} = l_s h(\boldsymbol{x}) - l_d(\boldsymbol{x}) b(\boldsymbol{x}) - \| \psi(x_1(s), x_2(s)) \| (\varsigma(\boldsymbol{x}) - div \hat{\boldsymbol{x}} / \| \hat{\boldsymbol{x}} \|) \tag{71}$$

Taking into account that the direction of $\psi(\boldsymbol{x})$ is the same as that of *grad ln* $w(\boldsymbol{x})$, we set the initial value as, $x_1(0) = 0, x_2(0) = 0,$ and $\| (\psi_1(x_1(0), x_2(0)), \psi_2(x_1(0), x_2(0))) \| = \| \psi_0 \|$. From the equations (69) and (70), we obtain the following differential equation.

$$\left(\frac{dx_1(s)}{ds} \right)^2 + \left(\frac{dx_2(s)}{ds} \right)^2 = 1 \tag{72}$$

Equation (72) can be solved as $x_1(s) = \gamma_1(S\text{-}s)$ and $x_2(s) = \gamma_2(S\text{-}s)$ ($\gamma_1^2 + \gamma_2^2 = 1$ and S is the parameter value which sets $x_1(S)$ and $x_2(S)$ on the city boundary.) referring to the initial conditions. Similar to the case of commodities, we get the solution in equation (68) as follows:

$$\begin{aligned} \| \psi(\boldsymbol{x}(S-s)) \| = & \int_0^s [l_s h(\boldsymbol{x}(S-\tau)) - l_d(\boldsymbol{x}(S-\tau)) b(\boldsymbol{x}(S-\tau))] \\ & exp\left(\int_\tau^s div\, \hat{\boldsymbol{x}}(S-\eta) / \| \hat{\boldsymbol{x}}(S-\eta) \| \, d\eta \right) exp\left(- \int_\tau^s \varsigma(\boldsymbol{x}(S-\eta))\, d\eta \right) d\tau \end{aligned} \tag{73}$$

The vector of labor commuting flow is expressed as follows:

$$\psi(\boldsymbol{x}) = (- \| \psi(\boldsymbol{x}) \| \hat{x}_1 / \| \hat{\boldsymbol{x}} \|, \; - \| \psi(\boldsymbol{x}) \| \hat{x}_2 / \| \hat{\boldsymbol{x}} \|) \tag{74}$$

If SCVF is even, the direction of labor commuting shows a line. But when SCVF is uneven, the direction will depict a curve like in the commodity flow.

Let us explain the economic implication of equation (73). [·] in the integral is household labor supply minus labor demand by firms. The second term describes the generalized congestion effect where the volume of workers commuting to the point $\boldsymbol{x}$ more increases as $\boldsymbol{x}$ gets closer to the city center. This is also the first theoretical finding among literature, and it never appears without variable land density and SCVF.

The last term is an exponential integral of the variable transport cost showing that the labor forces are reduced by transport services. By the way if ζ is a constant, then the last term becomes *exp* $(-\zeta \cdot (s\text{-}\tau))$ and one can intuitively see the transportation cost. The equation (73) can also be written in words as follows:

the number of households commuting to point $\boldsymbol{x}$ = (*total supply of labor – total demand for labor*) × *generalized congestion effect – reduction in labor forces by transport services*

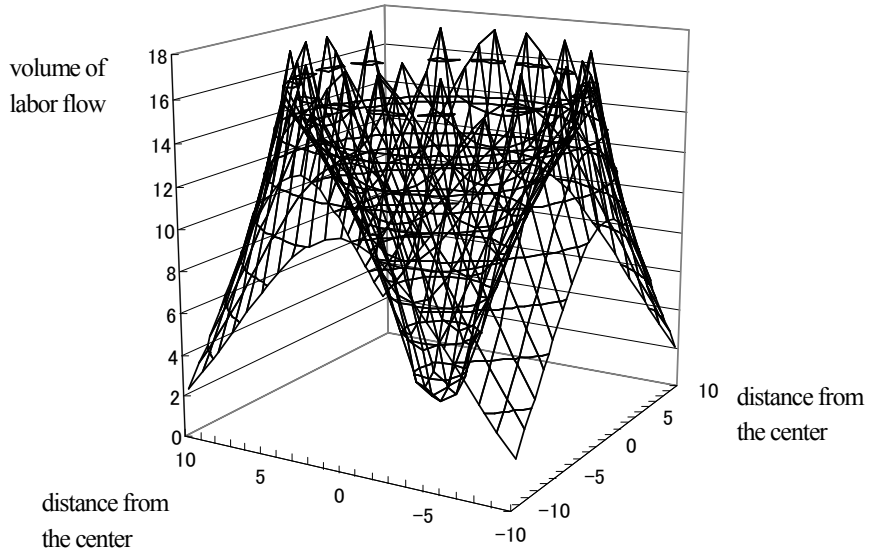

Figure 4 Shape of the Volume of Labor Flow

16. EQUILIBRIUM CONDITIONS

Equilibrium conditions in the model are summarized as follows:

Commodity market

$$\| \varphi(\boldsymbol{x}(S)) \| = 0 \tag{75}$$

Labor market

$$\| \psi(\boldsymbol{x}(0)) \| = 0 \quad \text{(the number of households commuting into the city center = 0)} \tag{76}$$

Capital market

$$ks(\boldsymbol{x}) = k_d(\boldsymbol{x}) b(\boldsymbol{x}) \text{ and } \iint_A ks(\boldsymbol{x}) dx_1 dx_2 = N \cdot k_s \tag{77}$$

Land market: equations (15) to (18)

Location conditions

$$\pi_B(\boldsymbol{x}) = 0 : \boldsymbol{x} \in \text{business district} \tag{78}$$

$$u(\boldsymbol{x}) = u^* : \boldsymbol{x} \in \text{residential area} \tag{79}$$

The numbers of firms and households:

$$M = \iint_{A_B} \frac{1}{m_B(\boldsymbol{x})} dx_1 dx_2 \quad (A_B : \text{business district}) \tag{80}$$

$$N = \iint_{A_H} \frac{1}{m_H(\boldsymbol{x})} dx_1 dx_2 \quad (A_H : \text{residential area}) \tag{81}$$

From these conditions, bid rents $g_B(\boldsymbol{x})$ and $g_H(\boldsymbol{x})$, bid max lot sizes $m_B(\boldsymbol{x})$ and $m_H(\boldsymbol{x})$ and the equilibrium utility level are obtained determining the equilibrium urban configuration.

17. INTRODUCING SPATIAL CHARACTERISTIC VECTOR FIELD AND EXPECTED RESULTS

As an example of SCVF, we consider a case where the transport costs increase at a certain place in the city. Figure 5 shows a change in heights from the city center to a point (7, 7). The land shape shows a slope from a circle passing a point (3. 3), and the height hits the peak of 4.5 at a point (7, 7). This change is expressed by a part of the normal distribution surface, and then the spatial configuration of commodity price shows a surface presented in Figure 6 hitting its peak at point (5,5).

In the slope area, the isoprice set is calculated as a circle of $(x_1\text{-}5)^2+(x_2\text{-}5)^2 = r^2$ differing from the

isoprice set from the city center $x_1^2 + x_2^2 = r^2$. Thus transport routes become a set of curves from points (3, x_2). Then commodity supply, household consumption, land use pattern etc. are determined under the general equilibrium framework.

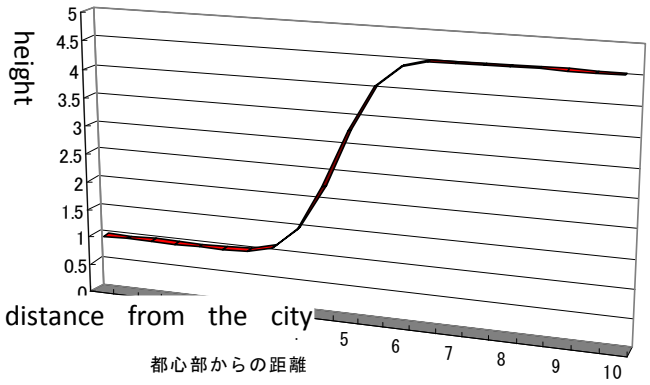

Figure 5. Hypothetical Geographical Condition

Moreover Figure 7 illustrates an expected result by our approach. Due to a heterogeneous geographical condition, unit transport cost varies depending on different points. So commodity prices do not change uniformly resulting in curved transport routes. This expectation suggests internalization of a transport network which more approximates the real transport networks than in the traditional urban economic models.

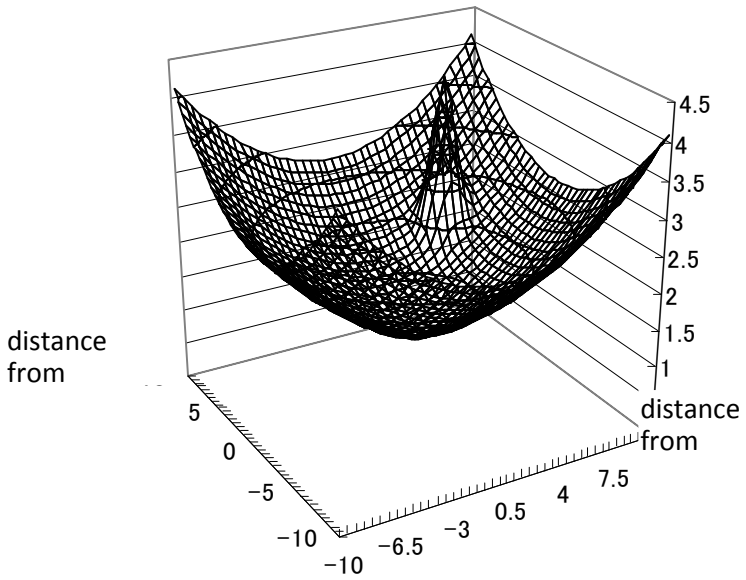

Figure 6. A Change in Spatial Configuration of Commodity Price

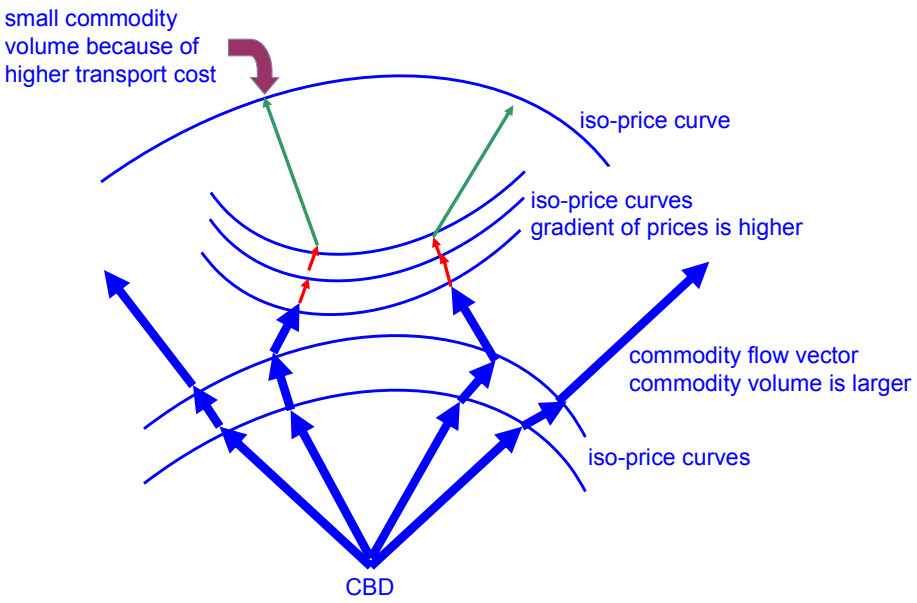

Figure 7. Expected Transport Routes and Commodity Volume

18. CONCLUDING REMARKS

This paper has examined the patterns of commodity and labor transportation in a monocentric city by solving the partial differential equations under the framework initiated by Beckmann (1952) and Beckmann and Puu (1985). This study extends my previous achievement into a case of variable von Thünen transport coefficient introducing SCVF. The new findings in this paper are summarized as follows:

(1)Transport networks can be internalized by applying the variational principle.
(2)Although only linear routes in a network appear over an even SCVF, curved routes in a network can be internalized over an uneven SCVF.
(3)By introducing uneven SCVF, generalized diffusion effect and generalized congestion effect can be obtained.
(4)Commodity and labor flows irregularly change over an uneven SCVF.
(5)A curved route relates the light changing in a continuously uneven medium studied in physics. Relationship our approach and the wave equation could be an interesting theme.

Areas worth examining in the near future include solving the full equilibrium model mentioned in this study with appropriate hypothetical parameter value. Empirical studies based on our theory are an interesting topic as well.

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THE BRAZILIAN ECONOMY POSITION ON THE INVESTMENT DEVELOPMENT PATH (IDP)

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Abstract
The hypothesis that inward and outward FDI positions of a country are related to the level and structure of economic development in relation to other economies, was first showed by Dunning (1979. The IDP suggests that countries tend to pass through five main development stages and that these phases can be classified according to the propensity of countries to host and/or invest abroad. This article attempts to measure the position of Brazil in the IDP. The investment by Brazilian firms abroad, in relation to emerging countries, was the first until 90s. However, Brazil's outward FDI increased substantially from 2000. In 2006 the Outward FDI exceeded inward FDI for the first time in the history of the country. Nowadays, the Brazilian economy seems to be in phase 2 and give signs of entry to stage 3, and some signs of evolution to phases 4 and 5. This paper intends to measure de Brazilian economy position on IDP especially between emerging countries context and the importance of a new stage of Brazilian economy: the systematic internationalization of domestic firms. This paper has the following structure: an evolution of FDI in recent years; after that we explain the phases of Investment Developmet Path Theory and measure de Brazilian economy position on IDP. Finally, the final considerations are related.

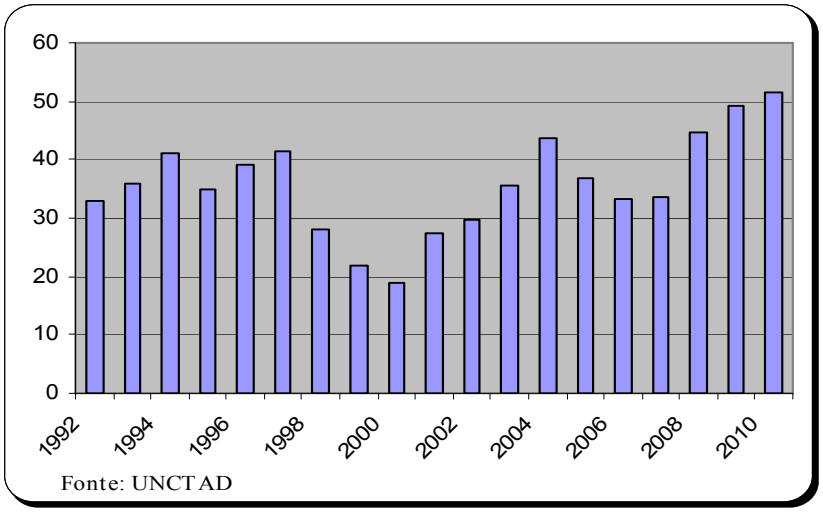
Keywords: Investment Development Path – Brazil – Emerging countries – FDI Inward – FDI Outward – Phases – Position – Flows - Stocks

JEL, **classification** R10, R40, R30

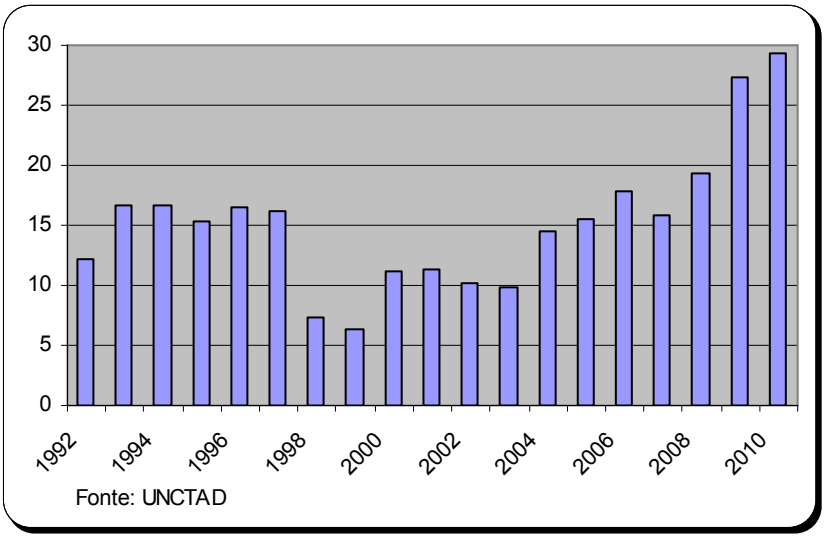
1. THE EVOLUTION OF FOREIGN DIRECT INVESTMENT (FDI) IN RECENT YEARS

According to the World Development Report 2011 [1], in the first time in history emerging markets have attracted more foreign investment, ie, 53% of the world total in 2010, as shown in Figure 1. At the same time, these economies have become major investors, increasing their share of the global volume of FDI inflows by 29% in 2010 compared to 15% in 2007, the year before the financial crisis (Figure 2) . Overall, investment in emerging markets abroad increased from 198 billion euros in 2009 to 243 billion euros in 2010, an increase of about 23%. Among developed economies, FDI outflows also increased but at a slower pace than emerging countriees - 10% - amounting to 744 billion euros. FDI inflows increased in all major groups of economies, but at different rates. The flow of emerging countries has rebounded, reflecting the strength of their economies, the growth of transnational companies and their increased propensity to compete in new markets. Cechella [2], for example, show the economic policies implemented in Brazil after the Real Plan had a positive effect, including for the react to the global financial crisis since 2008, and continue their path of internationalization. Thus, in 2010, emerging countries as a whole accounted for about 18% of the stock of FDI, versus 11% in the 2000s.

Graph 1 – Emerging countries FDI inflows, 1992-2010
Percentage of world total



Graph 2 – Emerging Countries FDI outflows
Percentage of world total



Globally, the flow of FDI accounted for countries reached 954 billion euros in 2010, representing an increase of 13% over the previous year. Brazil was the most notable of this group of investors, as they left a negative flow of FDI of 10.0 billion euros in 2009 to an inflow of U.S. $ 11.5 billion in 2010. The country also went from 15th in 2009 to 5th in the ranking of countries that received foreign direct investment. The United States tops the ranking of the UNCTAD, with inflows of 175 million euros, representing an increase of 49%. China and Hong Kong are respectively the second and third with FDI of 81.5 billion euros and 53 billion respectively. Fourth, was Belgium, with 48 billion euros in investments. In 2010, FDI grew by 5% over the previous year, although still 37% below the 2007 peak.

Latin America and the Caribbean was the region with the highest growth in FDI flows in 2010, driven primarily by increased merger and acquisition of the participation of transnational corporations. FDI inflows in Latin America amounted to 166 million euros, a sum far greater than that received by China (U.S.$95 billion). Besides Brazil, Chile, Colombia and Mexico have also increased outward investment flows and mergers and acquisitions activities involving transnational corporations last year. The significant increase is due to increased investment by multinationals in Brazil and Mexico, the

main investors in the region. In Brazil, the outflow was 11.5 billion euros due to investments in foreign companies such as CVRD, Braskem and Petrobras, Camargo Correa, Gerdau and Votorantim.
Another trend is to increase South-South relations (Aykut, [3]), responsible for the growth of FDI as shown in Figure 2. Among the areas where developing countries are the largest source of outward FDI were from the south, southeast and east Asia, which handled 175 billion euros, mainly on behalf of companies in Hong Kong, China mainland, Singapore and South Korea. According to UNCTAD, "An important feature of the growing role of developing economies and transition is that investors (70%) is directed to other developing countries and transition economies, while the ratio developed countries is only 50%." And the South-South foreign direct investment in particular from Asia and Latin America, was one of the main factors behind the recovery of FDI in 2010"said the report.
The BRICs (Brazil, Russia, India and China), according to UNCTAD (2011), the first three have recently shown a preference for acquiring assets in developed countries, particularly in the United States and Western Europe. The exception is China: most of the country's FDI has been directed to other developing countries, without losing sight of investments in developed countries. Brazil and Russia have shown a preference for the natural resources sector, China and India have acquired foreign assets mainly in the service sector, with indian companies to invest in business knowledge and technology-intensive, such as pharmaceuticals and automobiles. However, the total volume of FDI in terms of stocks and flows of the BRIC countries remains modest: the "market share" in the BRIC FDI stock was 3% in 2010, and 5 % FDI inflows.
Brazil was the largest emerging countries investor until 1990s, losing this position from the period of acceleration of world FDI. However, it has a stronger external position of Latin America, being the source of about 40% of the stock of outward FDI in the region. Brazilian FDI flows were directed mainly to offshore financial centers, two thirds of them for the Cayman Islands, Bahamas and the British Virgin Islands. There is also a considerable stock of brazilian FDI in other countries of Latin America such as Argentina and Uruguay, and in developed countries such as Denmark, Luxembourg, Spain, Portugal and the United States. In addition to offshore locations, the areas with higher brazilian investment are those of trade, mining and construction, which expanded at rates above the world average in most of the 2000s.

2. THE INVESTMENT DEVELOPMENT PATH THEORY

The IDP suggests that countries tend to pass through five main development stages and that these phases can be classified according to the propensity of countries to host and/or invest abroad.
The investment development path framework (IDP), first put forward by John Dunning [4]. Since then, the concept of the Investment Development Path (IDP) has been revised and expanded (Dunning [5, 6, 7 and 8]; Narula [9 and 10]; Dunning and Narula, [11]. The IDP suggests that emerging countries multinationals (MNEs) tend to initially invest in resource- and market-seeking activities in neighbouring or other developing countries, and then expand their presence worldwide (Aykut & Ratha [12]). The received literature suggests that there have been two phases of outward FDI from developing countries (Dunning et al. [13 and 14]; UNCTAD [15 and 16]): from the 1960s until early 1980s, and thereafter. The first-wave firms were driven mainly by market- and efficiency-seeking factors and investments were mainly directed towards other developing countries, most often neighbouring countries. In the second phase, driven by a combination of pull and push factors, strategic-asset seeking also became a motive and investments into developed countries and developing countries outside the investor's own region became more important. The first phase of FDI originated predominantly from Latin America where new MNEs emerged from Argentina, Mexico and Chile, followed by Brazilian, Colombian and Venezuelan competitors (Andreff, [17]). During a period which otherwise emphasized industrialization strategies based on import substitution, Latin American MNEs internationalised on the basis of products that had met the needs of their growing domestic markets and outward FDI went primarily to neighbouring developing countries with similar demand structures. The second phase, from the 1980s, was dominated by Asian MNEs, spreading from Republic of Korea, Taiwan, Hong Kong, Singapore and thereafter Malaysia, Thailand, China, India and the Philippines, and accompanied Asian countries' export oriented industrialization strategies. Outward FDI from Latin America was less prominent during this period. Asian TNCs expanded

mostly in the fast growing foreign markets but they also outward invested to access cheap labour in developing countries that were less developed than their home countries. The IDP phases are:

Phase 1

During the first stage of the IDP path, the Location specific advantages of a country are presumed to be insufficient to attract inward direct investment, with the exception of those arising from its possession of natural assets. Its deficiency in location-bound created assets may reflect limited domestic markets - demand levels are minimal because of the low per capita income - inappropriate economic systems or government policies; inadequate infrastructure such as transportation and communication facilities; and perhaps most important of all, a poorly educated, trained or motivated labour force. At this stage of the IDP, there is likely to be very little outward direct investment. Ceteris paribus, foreign firms will prefer to export to and import from this market, or conclude co-operative non-equity arrangements with indigenous firms. This is because the Ownership specific advantages of domestic firms are few and far between, as there is little or no indigenous technology accumulation and hence few created assets. Those that exist will be in labour-intensive manufacturing and the primary product sector (such as mining and agriculture), and may be government influenced through infant industry protection such as import controls.
Government intervention during Phase 1 will normally take two forms. First it may be the main means of providing basic infrastructure, and the upgrading of human capital via education and training. Governments will attempt to reduce some of the endemic market failure holding back development. Second, they engage in a variety of economic and social policies, which, for good or bad, will affect the structure of markets. Import protection, domestic content policies and export subsidies are examples of such intervention at this stage of development. At this stage, however, there is likely to be only limited government involvement in the upgrading of the country's created assets, for example innovatory capacity.

Phase *2*

In Phase 2, inward direct investment starts to rise, while outward investment remains low or negligible. Domestic markets may have grown either in size or in purchasing power, making some local production by foreign firms a viable proposition. Initially this is likely to take the form of import-substituting manufacturing investment—based upon their possession of intangible assets, for example technology, trademarks, managerial skills, etc.
Frequently such inbound FDI is stimulated by host governments imposing tariff and non-tariff barriers. In the case of export-oriented industries (at this stage of development, such inward direct investment will still largely be in natural resource intensive sectors with some forward vertical integration into labour-intensive low technology and light manufactures) the extent to which the host country is able to offer the necessary infrastructure (transportation, communications facilities and supplies of skilled and unskilled labour) will be a decisive factor. In short, a country must possess some desirable location characteristics to attract inward direct investment, although the extent to which these can be effectively exploited will depend on that country's development strategy and the extent to which it prefers to develop the technological capabilities of its domestic firms.
The ownership advantages of domestic firms will have increased from the previous phase, wherever national government policies have generated a virtuous circle of created asset accumulation. These ownership advantages will exist owing to the development of support industries clustered around primary industries, and production will move towards semi-skilled and moderately knowledge-intensive consumer goods. Outward direct investment emerges at this stage.
This may be either of a market-seeking or trade-related type in adjacent territories, or of a strategic asset-seeking type in developed countries. The former will be characteristically undertaken in countries that are either further back in their IDP than the home country, or, when the acquisition of created assets is the prime motive, these are likely to be directed towards countries further along the path.

The extent to which outward direct investment is undertaken will be influenced by the home country government-induced 'push' factors such as subsidies for exports, and technology development or acquisition (which influence the internalization advantages of domestic firms), as well as the changing (non- government-induced) the location advantages such as relative production costs.
However, the rate of outward direct investment growth is likely to be insufficient to offset the rising rate of growth of inward direct investment. As a consequence, during the second stage of development, countries will increase their net inward investment (their NOI position will worsen), although towards the latter part of the second stage, the growth rates of outward direct investment and inward direct investment will begin to converge.

Phase 3

Countries in Phase 3 are marked by a gradual decrease in the rate of growth of inward direct investment, and an increase in the rate of growth of outward direct investment that results in increasing of NOI. The technological capabilities of the country are increasingly geared towards the production of standardized goods. With rising incomes, consumers begin to demand higher-quality goods, fuelled in part by the growing competitiveness among the supplying firms. The comparative advantage of labour-intensive activities will deteriorate, domestic wages will rise, and outward direct investment will be directed more to countries at lower phases in their IDP.
The original ownership advantages of foreign firms also begin to be eroded, as domestic firms acquire their own competitive advantages and compete with them in the same sectors. The initial ownership advantages of foreign firms will also begin to change, as the domestic firms compete directly with them in these sectors. This is supported by the growing stock of created assets of the host country due to increased expenditure on education, vocational training and innovatory activities.
These will be replaced by new technological, managerial or marketing innovations in order to compete with domestic firms. These ownership advantages are likely to be based on the possession of intangible knowledge, and the public good nature of such assets will mean that foreign firms will increasingly prefer to exploit them through cross-border hierarchies. Growing of location advantages such as an enlarged market and improved domestic innovatory capacity will make for economies of scale, and, with rising wage costs, will encourage more technology-intensive manufacturing as well as higher value added locally. The motives of inward direct investment will shift towards efficiency-seeking production and away from import-substituting production.
In industries where domestic firms have a competitive advantage, there may be some inward direct investment directed towards strategic asset-acquiring activities.
Domestic firms ownership advantages will have changed too, and will be based less on government-induced action. Partly owing to the increase in their multinationality, the character of the ownership advantages of foreign firms will increasingly reflect their ability to manage and co-ordinate geographically dispersed assets. At this stage of development, their ownership advantages based on possession of proprietary assets will be similar to those of firms from developed countries in all except the most technology-intensive sectors. There will be increased outward direct investment directed to Phase 1 and 2 countries, both as market-seeking investment and as export platforms, as prior domestic location advantages in resource-intensive production are eroded.
Outward direct investment will also occur in Phase 3 and 4 countries, partly as a market-seeking strategy, but also to acquire strategic assets to protect or upgrade the O advantages of the investing firms (Dunning, van Hoesel and Narula [13 and 14]).
The role of government-induced ownership advantages is likely to be less significant in Phase 3, as those of FDI-induced ownership advantages take on more importance. Although the significance of location-bound created assets will rise relative to those of natural assets, government policies will continue to be directed to reducing structural market imperfections in resource-intensive industries. Thus governments may attempt to attract inward direct investment in those sectors in which the comparative ownership advantages of enterprises are the weakest, but the comparative advantages of location are the strongest. At the same time, they might seek to encourage their country's own enterprises to invest abroad in those sectors in which the ownership advantages are the strongest, and the comparative location advantages are the weakest. Structural adjustment will be required if the

country is to move to the next stage of development, with declining industries (such as labour-intensive ones) undertaking direct investment

Phase 4

Step 4 is reached when the stock of outward FDI of the country exceeds or equals the inward FDI, the growth rate of the first is still higher than the second. At this stage, most domestic companies are entitled to compete with foreign companies abroad as well as in its own market. The production processes and the goods are manufactured in the state of the art, with the cost of capital less than the cost of labor. Translated, the location advantages will be based almost entirely on the creation of assets. The inward FDI in Phase 4 is increasingly directed to sequential and the rationalization of investment in assets in companies of other countries that are in this phase. The competitive advantages of companies tend to be more related to the operationalization, obtained from its multinationality. Countries that are in earlier stages of the IDP also invest, with objectives such as market-seeking or asset seeking. Outward FDI is substantial, since the companies, to seek maintain competitive advantage, moving some of their operations to countries that are in earlier stages of the IDP, as well as in response to trade barriers. As the ownership advantages of the countries in this stage are very similar, producing intra-industry become the most important, and usually result in the growth of intra-industry. Both FDI and intra-industry tends to be increasingly conducted within the MNEs. The role of government is also likely to change in Phase 4. While continuing its role as regulator and supervision, to decrease market imperfections and maintain competition, it will give more attention to the structural adjustment of the economy and reduce the transaction costs of economic activity. The intervention is replaced by measures designed to help with the modernization of internal resources and capabilities, and to inhibit the market distortions and behavior of private economic agents.

Stage 5

In stage 5, the position of a country NOI first decreases and then oscillates around zero, reflecting relatively similar stock of FDI internal and external. At the same time, both inward FDI as the outward bound to increase. This is the stage in which the industrialized nations are catching up, and has two main features. First, as initiated in the previous phase, the growing propensity for cross-border transactions are not market driven, but internalized within the MNEs. Second, as countries converge in the structure of their locations, their investment positions are likely to become more balanced (Dunning and Lundan, [8]). These phenomena represent a natural progression and prospects for the internationalization of enterprises and economies. Thus, the nature and scope of economic activity gradually changes from countries that do business through products and services very different for cooperative trade between countries that produce similar products.

The phase 5 of the IDP represents a situation in which no country has an absolute hegemony of the assets created. In addition, the interest of multinational companies will be less dependent on their country of origin, but on its ability to buy goods and the ability of companies to organize their competitive advantages to exploit the profits of multinational joint governance. Another characteristic of Stage 5 is that, as the company has become globalized, nationality blurs it. While MNEs are strongly inclined to pursue a national policy of integration, no longer operate under the perspective of their country of origin, and trade and invest where it is more profitable. Increasingly, MNEs, through their arbitration functions, behave like mini-markets. In summary, the stage 5 is manifest by a gradual convergence of the structures of industrial activity between countries and a change in the character of international transactions. The activities of MNEs in particular will be targeted for FDI with an emphasis on cross-border cooperation, alliances, mergers and acquisitions, as well as the management control of multinational companies become will increasingly pluralistic. The success of countries in the accumulation of technology, as well as to induce a continued economic growth will increasingly depend on the ability of their companies (local and foreign) to coordinate their resources and capabilities in a regional and global level and form a institutional framework that fosters entrepreneurship, together with measures to protect competition.

3. IDP RESULTS FOR BRAZILIAN ECONOMY ON EMERGING COUNTRIES CONTEXT

UNCTAD [18] tested the IDP to correlate the net investment abroad (NOI) per-capita and GDP per capita for various countries, reaching important results about the theory of IDP. However, some contradictory results were obtained and need to new explanations for the IDP. Singapore, for example, has a very negative NOI per capita for their level of development. Secondly, many countries as Brazil (for its size and potential market), China, India, Mexico, South Africa and Turkey, which are investing significant amounts of FDI overseas, would be in stages 1 and 2 of the IDP, and have started the IDE outward IDE sooner than might be expected on the basis of the IDP (the net position of foreign investment disturbs a little because these countries also receive large amounts of internal IDE). Thus, the per-capita GDP may be a limited source to measure the IDP, and other indicators can be used to understand why countries with relatively low amounts invested abroad. However, it is an indication that many companies are conducting IDE sooner than had been able to wait in line with this theory. According to UNCTAD [18], there is evidence to suggest that MNEs from emerging economies are investing increasingly in an earlier stage in relation to the development of their country. One likely reason is the impact of globalization on countries and companies, especially by increased competition and opportunities. India, for example, is a poor country, but has a significant number of companies with a strong industrial base, indicating that Indian MNEs have some relevant ownership assets.

3.1 The case of Brazilian Economy

Despite its relative novelty, the internationalization of Brazilian companies has achieved a wide geographic spread. Brazilian FDI can today be found in 78 countries. Putting aside investment in tax havens, which accounts for 65% of the total, by 2010, half the stock of of FDI from Brazil had gone to Denmark, the United States and Spain, with developed economies together accounting for 75%. Among emerging markets, Argentina leads, followed by Uruguay. When it comes to sectoral distribution (and including tax havens), Brazilian central bank data indicate that 54% of FDI stock from Brazil had gone into financial services by 2010. Given the distortion introduced by the inclusion of flows to tax havens, however, it is difficult to mensurate a realistic picture of the final destination of these flows.

The internationalization of Brazilian companies is dominated by the private sector, although state-owned enterprises also play a role. Petrobras, for example, has expanded its overseas activities to 15 countries in three continents. In Latin America, for example, the company has pursued a strategy of regional integration in natural gas.

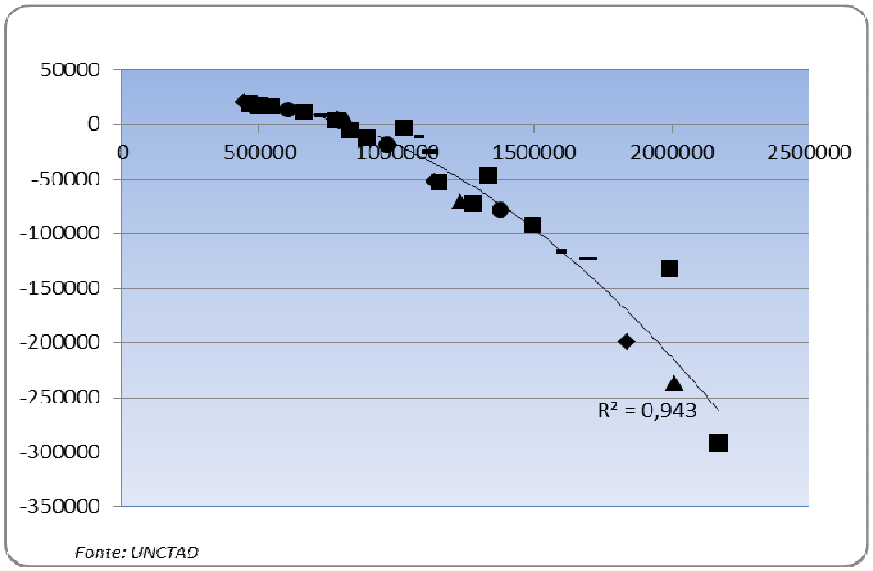
Why are more and more Brazilian companies going abroad? The most frequently cited reason is that they are following clients into international markets. But there are many other reasons as well, such as defending their competitive position, monitoring the competition in international markets, meeting international demand and reducing their dependence on a single (domestic) market. Many Brazilian companies are also interested in natural resources. Yet others are looking for lower costs, better infrastructure and more attractive fiscal incentives. Broadly speaking, Brazilian outward investors are in search of three things: markets, natural resources and investment climates superior to the one they find at home.

In keeping with the usual pattern of early internationalization, one of the main ways in which FDI from Brazil begins is by setting up offices for overseas sales. This is especially common in the consumer goods industry and the services sector. However, the overseas manufacture of goods and provision of services account for a substantial share of FDI as well. Brazilian overseas units also tend to expand into new functions, such as manufacturing goods and providing services, even if not initially set up to do so. It is interesting too to note how other, more sophisticated, functions such as logistics and R&D, already figure among their overseas activities.

The investment by Brazilian companies abroad, in relation to the emerging countries, are pioneers until the 90th, and they started to invest abroad more substantially from the 2000s, in terms of volume, reaching a peak in 2006, during which exceeded inflows of FDI in the country, a sign that may indicate that the country has some characteristics of phase 3. For purposes of calculating the IDP, in

accordance with the methodology of UNCTAD [18], the variables for calculating the IDP are the stocks of inward and outward FDI, and GDP per capita. The graph 1 show, by the traditional measure defined by Dunning, the trajectory of the IDP to Brazil.

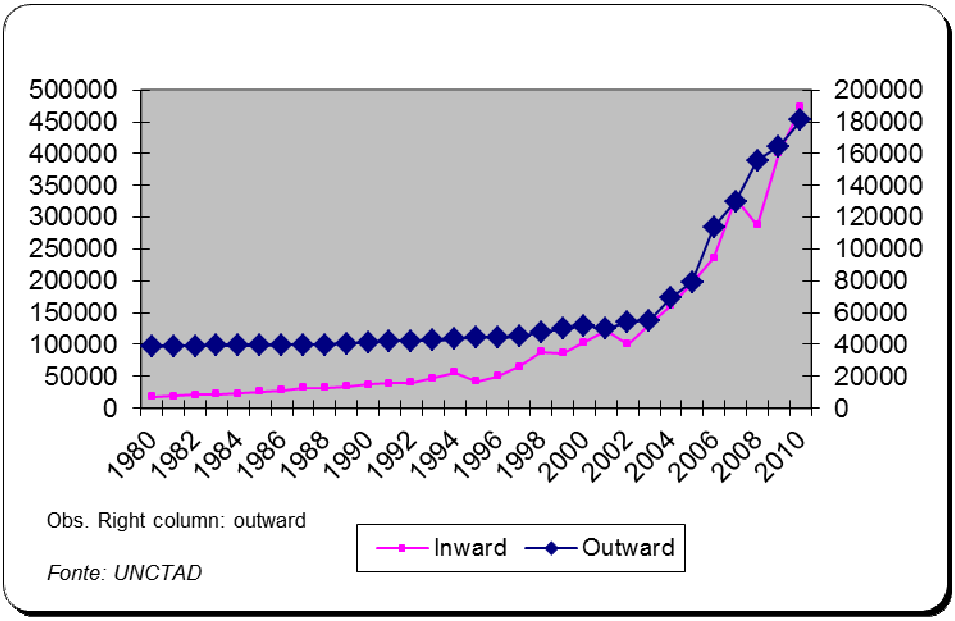
Graph 3 – Brazilian economy position on IDP, 1980-2010



3.2 Results

Our Brazil analysis seeks to explain why we think this country is more advanced than the results showed by UNCTAD[18]. We assume that the stages of the IDP are reference points, and one country can have elements of other phases. It is possible that the input variables in the model and the statistics be limited to detect the real stage where is the country (Dunning and Lundan, 2008). Therefore, it must be extrapolated through other methods, such as analysis of the country's economic development and other indicators statistics. In Brazil, for its own economic potential and attractiveness of FDI, it is difficult to say that at some point inward FDI could decrease by a competitiveness improve of domestic firms. The trend of recent years is the increase in outward FDI, without neglecting the potential of the internal market. According to the theory proposed by Dunning, the statistics provided by UNCTAD suggest that brazilian FDI stock outward was bigger than the stock of inward FDI from 1980 to 1991. This fact goes against the traditional theory exposed, though we believe values were too low to show a trend. Thus, we chose to relativize this point. Brazilian FDI abroad, since that time, can demonstrate the potential of Brazilian companies to expand abroad. At present, we believe that Brazil is fully in phase 2 of the IDP, with clear signs of phase 3 and some evidences of evolution to phases 4 and 5. The country used the policy of import substitution, from 1929 to the late '80s, with the objective of attracting FDI to develop the manufacturing sector and address problems such dependence on foreign capital. The reforms of the 1990s attracted substantial FDI to the country. Apart from the privatization program, the economic stability provided greater confidence, in the long term, for the international investor. Regarding to outward FDI, since the 70 was carried out by publicly traded companies such as Petrobras, and also private companies, such as Odebrecht. Especially since the 2000s, the Brazilian economy is showing signs of entry into phase 3, and some signs of phases 4 and 5, even with the stock of NOI FDI does not helping in this perception. The graph 2 shows that both the stock of inward FDI, as the stock of outward FDI continues to rise, which shows inconsistency with the features outlined in Phase 3, which FDI inward back down. However, this can be explained by the high potential of the domestic market attraction, as well as Brazil be a complex and dynamic economy, where certain sectors are more advanced than others.

Graph 4 – Brazil: stocks inward and ourward, 1980-2010
Million of dollars



As signs that the country is moving toward stage 3 is the improve of technological capabilities and competition from national companies in various sectors of the economy, as reflected, for example, in the exponential growth of exports in 2000, the establishment overseas of one thousand of them, and the strategy of some Brazilian MNES that focus on international management of its assets. Began to increase the demand from consumers for quality products and services. The outward FDI of MNEs in Brazil takes place in countries that are less than or equal phases of IDP (and other), as in Latin America but also in developed countries like the United States, Portugal, England, among others. Since the 1990s, still, the economic stabilization arising since the Real Plan, which covered a new set of rules of conduct for the public and private sector, enabled economy Brazil to focus on structural problems, restructuring key sectors (telecommunications, energy, etc.), upgrade the education system, encourage programs for promoting entrepreneurship (SEBRAE) and improve the quality and competitiveness of the companies (ISO 9000). In other words, the govern focus is to make structural adjustments and correct the imperfections of the market. The Brazilian govern, for example, encourage outward FDI through institutions such as the BNDES (Banco Nacional de Desenvolvimento Econômico e Social).
It turned out, even through the Census of Foreign Capitals Central Bank of Brazil in 1995, 2000 and 2005 some evidence of phase 4 of the IDP, through the intra-industry trade.

4. FINAL REMARKS

The IDP theory argues that as countries become more industrialized or developed – with a parallel advance in their industrial and service sectors – their firms are likely to build up firm-specific advantages, and so are able to compete more effectively at the international level.
According to the IDP theory, the outward and inward FDI position of a country is systematically related to a country's level and structure of economic development. Along the IDP, outward FDI is expected to be undertaken only when a country has reached a certain minimum level of development, at which time ownership advantages may have evolved among firms in that country. The outward FDI pattern will therefore reflect the evolving nature of ownership advantages of domestic firms as well as changes in the advantages of the home economy vis-à-vis potential host economies.
Essentially, countries may use both inward and outward FDI to upgrade the competitiveness of their indigenous resources and capabilities to facilitate structural change, thereby promoting dynamic

comparative advantage. In both cases, foreign assets (resources, capabilities, access to markets, patents, trade marks, entrepreneurial skills and institutions) are bought, whether it be via market, resource, efficiency or strategic asset seeking FDI.

The IDP suggests that at low levels of economic development, both imports and inward FDI are likely to be the most favoured means of securing "created" assets. Exceptions may be capital-rich countries (e.g. the oil-rich States) that might have the liquid assets to acquire foreign firms. This is obviously one of the quickest ways to gain access to the "competitive advantage" of foreign firms; but unless it is to be a portfolio investment, the purchaser must have some other capabilities to manage the purchased firm effectively. In such cases, outward FDI is being used as a means of augmenting existing advantages.

Normally, however, in the early stages of the IDP, countries are likely to obtain created assets through inward FDI. First, these are directed to low/medium knowledge-intensive industries and/or resource-based sectors in which the host countries have or are developing a comparative advantage; later as countries move upwards along their IDPs, FDI is directed to higher technology-intensive sectors, and/or more efficiency-seeking FDI takes place. Over time, through a variety of spillover effects, inward FDI acts as a competitive spur to domestic firms. Eventually, the most efficient of these will start to penetrate foreign markets (through exports, FDI or contractual agreements).

Because of recent technological and communication advances and the pressures of globalization, this process is accelerating. Sometimes it is aided by governments, as in the Republic of Korea in the 1980s and 1990s, and Malaysia and China today.

The principle of comparative dynamic advantage suggests a continuing restructuring of economic activity as countries move upwards along their IDP. Both inward and outward FDI policies have a critical role to play in guiding or facilitating this process, as do other macroeconomic and micro-management policies. Many firms today engage in a combination of the two types of FDI (asset-exploiting and asset- augmenting). In their development policies, countries may also opt for both inward and outward FDI. Finally, the geography of inward and outward FDI may differ just as much as that of trade. Certain companies might be in a favourable position to exploit or gain new assets via outward FDI, while others might best advance their competitive/comparative advantage by encouraging inward FDI from a different group of countries.

The brazilian position in the IDP, in accordance with the methodology of Dunning, have the outward stock bigger than inward stock . We consider that by the low values on early years, as well as other ways of perceiving the stage of the IDP in which the country is, the phenomenon can be relativized. Another incongruity is that the Brazilian inward stock continues to rise, along with the outward stock by the year 2007. In contrast, for phase 2 the inward stock rise and outward stock remains negligible, and phase three there is a gradual reduction in the stock inward and outward stock increased. However, the factors that underlie our perception that Brazil is fully in phase 2 (in the latter part of the second phase, the rates of inward and outward FDI will begin to converge) and has signals of phase 3 and some signs of phases 4 and 5, are as follows: Brazil already has a attractive market to MNEs for decades and the policy replacing imports have been used a long time ago, as imposition of tariffs or nontariff barriers, among others. Already for some time that the inward FDI in Brazil is well targeted sectors intensive in natural resources. For example from the 2000s, the vast majority of Brazilian MNEs have a your own strategy, independently of government action. Therefore, there is a government FDI, as Petrobrás, but private companies are the basis of brazilian outward FDI. The govern aim to reduce market imperfections.

The technological capabilities of the country are increasingly oriented towards the production of innovative and standardized goods. Some Brazilian multinationals do business through products and services though cooperative trade between countries. The economic stability made consumers with better purchasing power and begin to demand products of higher quality. The wages of workers have begun not be a relevant comparative advantage in some sectors, and there is evidence that outward FDI are also oriented to countries that are in earlier stages of the IDP, especially in Latin America and Africa. Domestic companies are increasingly competing on equal terms with foreign MNEs, which are forced to improve their technology, management and marketing, and the domestic firms competitive advantages are increasingly on their ability to manage and coordinate geographically dispersed assets. The market size of the country was an important locational factor, but the liberalization policies of the 1990s make innovation and the ability to do economies of scale important factors to the attractiveness

of the country. MNEs also have a wide variety of reasons to invest in Brazil, beyond the replacement of imports or obtain supplies of natural resources. The brazilian companies, rewards of ownership advantages, need less government action, and these are addressed, if necessary, to reduction of structural market imperfections or encourage local enterprises to invest abroad. Despite the speed and scale of the Brazilian internationalization process since 2004, there are some lacks when it comes to the sources of funding. Most Brazilian companies investing abroad indicate their own capital as the main source of funding. However, many of those that do not mention their own capital also do not mention other Brazilian sources. This suggests that access to funds from BNDES (the Brazilian Development Bank) or from domestic banks is still limited. But the lack of brazilian financing is not the only internal barrier to the internationalization of Brazilian companies. Many Brazilian companies also mention the lack of personnel with the necessary skills and the knowledge of potential markets.

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FRAGILE AND STRUCTURALLY WEAK RURAL AREAS. THE CASE OF ARAGÓN (SPAIN), 1900-2001[+]

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Abstract:
The fragile and structurally weak rural areas, in European Union terminology, are areas with important difficulties in maintaining their population and highly peripheral in nature. Generally, they have an aged population, a low density of population, a weight of the primary sector higher than the European average and communication difficulties. In this paper, the autonomous community of Aragón, which shows all the above-mentioned characteristics, is taken as an example of this type of region. The analyses carried out, both descriptive and with the adequate statistical and econometric techniques, during the period 1900-2001 permit us, taking the evolution of the population of Aragón as a possible archetype, to establish the characteristic patterns and behaviours of this type of areas. This knowledge is, without doubt, basic for successfully designing the correct regional and supra-regional policies that will allow the reduction of economic and demographic imbalances, giving rise to a better structured territory.

Keywords.- Rural areas, population, Aragón, European Union, Pareto's distribution, transition matrix, spatial autocorrelation

JEL, **classification** R10, R40, R30

1.- INTRODUCTION

The autonomous community of Aragón (Spain), with 47,720 km^2 and 1,204,215 inhabitants in 2001, is made up of three provinces (Huesca, Teruel and Zaragoza). It belongs to the NUT-1 north-east region, is to be found in the north-east of the Iberian Peninsula, has no access to the Mediterranean and forms the frontier with France in the central part of the Pyrenees (see Figure 1).

Figure 1. Position of Aragón in Europe

The case of Aragón is especially interesting in that it shows some characteristic peculiarities that make it a prototype of a certain type of region in Europe and, hence, worth studying. We must justify, therefore, what these special characteristics are or, to put it another way, of what type of behaviours Aragón is a prototype.

According to the report Europe 2000+ of the European Commission, the so-called **"**Continental Diagonal**"**, to which Aragón belongs, is made up of three types of zones: more urbanised and dynamic zones; rural zones with urban tissue and, finally, fragile and structurally weak rural areas. The whole of Aragón, except its capital (Zaragoza), is included in this last category.

The fragile and structurally weak rural areas present certain common characteristics that we will now define. Firstly, they are areas with a low population density (see Figure 6 in the following section) and a markedly rural character. Secondly, and related to the first, their urban structure is very under-developed, there being no intermediate-sized cities; effectively, in Aragón the metropolitan area of Zaragoza represents 53% of the total population and almost 65% of the regional Gross Value Added. These strong territorial imbalances, that are a consequence of a very concentrated economic landscape, are seen in the fact that the second largest city of Aragón is Huesca, with only 46,243 inhabitants in 2001.

Thirdly, these rural zones have low birth-rates and, until recently, negative net migratory balances, especially among the youngest and more dynamic population. The immediate consequence of all this is an aged society, with the serious problems that this situation brings: reduction of human capital and an increase in the costs of the social and health services. Finally, they are areas of a markedly peripheral nature, where the insufficient size of the nuclei and the low density of population result in low returns on the infrastructures of development and a deficient access to basic public services; among which we should especially highlight the deficient communications infrastructures, a consequence of the occasionally complex orography (58.74% of the surface of Aragón is above 600 metres in altitude and 31.19% is above 1000 metres).

What other European regions fit, generally speaking, into these behaviour patterns? Table 1 shows those regions that in 1998 had a population density lower than 40 inhabitants per km^2. According to the information contained in this table, and although there are exceptions, we can draw up a standard definition of this type of region, of the type for which we have chosen Aragón as our subject of study: percentage of employment in agricultural above the European average, difficult physical environment and a percentage of the population aged over 65 years above the average of the EU15.

Table 1. Some indicators for EU15 regions with population density below 40 inhab./km^2

	Population density (inhab./km^2) 1998	Per capita GDP (EU=100) 1998	Share of employment in agriculture, 1999	Percentage of population aged over 65 years 1998
EU 15	**117.4**	**100.0**	**4.5**	**15.6**
GREECE				
Anatoliki Makedonia, Thraki	39.7	55.4	38.4	16.9
Dytiki Makedonia	32.1	59.9	24.5	16.7
Ipeiros	40.5	41.8	24.7	18.6
SPAIN				
Aragón	*24.7*	*88.1*	*8.3*	*20.7*
Castilla y León	26.5	74.2	11.1	20.8
Castilla-La Mancha	21.5	67.0	11.7	18.7
Extremadura	26.0	50.2	15.0	17.3
FRANCE				
Corse	29.9	77.0	8.2	17.8
IRELAND				
Border, Midland and Western	29.4	79.3		
ITALY				
Valle D'Aosta	36.7	129.8	5.4	18.2
PORTUGAL				
Alentejo	19.0	66.8	13.0	21.4
FINLAND				
Itä-Suomi	9.9	75.1	12.6	16.4
Väli-Suomi	16.5	83.6	11.2	16.1
Pohjois-Suomi	4.4	87.3	9.3	12.8
Etela-Suomi	34.5	93.0	6.3	16.2
Aland	16.7	122.2	9.1	16.2
SWEDEN				
Ostra Mellansverige	38.7	93.2	2.8	17.4
Norra Mellansverige	13.2	95.7	3.8	19.7
Mellersta Norrland	5.5	97.8	4.7	19.9
Övre Norrland	3.4	98.2	3.7	17.1
Smaland Med Öama	24.2	100.5	3.4	16.7
UNITED KINGDOM				
Highlands & Islands	9.3	76.9	5.2	

Source: Second report on economic and social cohesion, European Commission, 2001.

A low population and with a growing tendency to age can mean the end of any possibilities of long-term growth, whatever the level of the income per capita of the region. This is a fundamental fact, given that, as we can see in Table 1, many regions do not enter either into Objective 1 of the European Structural Funds, nor, in some cases into Objective 2 and, nevertheless, the structural characteristics to which we have referred in this introduction may condition and endanger their future growth. From this perspective, it is understandable that certain European regions, among them Aragón, are proposing access to the European Funds using other variables distinct from the mere inspection of the level of income per capita (these other variables could be the percentage of the population of over 65 years old, the density of population, the percentage of agricultural population or the percentage of female workers).

The objective of the paper, therefore, is none other than to analyse with the adequate instruments the characteristics and evolution of the population of Aragón during the whole of the twentieth century, understanding that the conclusions might be applicable to other regions of similar characteristics. Evidently, the behaviour of Aragón during the twentieth century may not be exactly applicable to that experienced by the 22 regions of Table 1. To be able to conclude that they have undergone a similar evolution in time it would be necessary to analyse individually each of the 22 zones, something which is beyond the objective of this paper. Nevertheless, the fact that in 2001 they show notable points in common, makes it tempting to think that they might have also coincided in their temporal dynamics throughout the twentieth century. In any case, we are taking as a working hypothesis that the case of Aragón can act as a mirror in which other regions can be reflected. Thus, a

better knowledge of what has occurred in one concretely studied case can guide us towards the correct definition of the regional policies that will allow us to generate economic activities capable of fixing and attracting population.

The paper is organised as follows. In Section 2 a descriptive analysis of the population data of Aragón from 1900 until 2001 is carried out. In Section 3 we study the statistical distribution of the size of Aragonese cities and their evolution, both with a paretian specification as well as a complementary non-paretian one. The fourth section explores how intense the movements within the distribution of the ranking of the cities of Aragón have been during the century from which we have data. The fifth section studies the geographical location of the Aragonese population nuclei that have entered and left the list of the one hundred biggest between 1900 and 2001, analysing whether there are statistical regularities of the spatial type. Finally, the conclusions close the paper.

2.- DESCRIPTIVE ANALYSIS OF THE DATA ON POPULATION (1900-2001)

In this section we are going to try to show in some detail, but with simple tools, the principal characteristics that define or have defined the structure of the Aragonese population in the last one hundred years. We leave the more sophisticated analysis in which statistical and econometric techniques are employed to achieve an identical end for later sections.

In Figure 2 is shown, with a base of 100 in 1900, the evolution of the population of Aragón and, as a comparison, that of Spain. Whereas the Spanish population has more than doubled in those one hundred years, the Aragonese has not even grown 25%, even experiencing a slight drop between 1981 and 1991. This fact shows a first conclusion, namely, the low population dynamism of Aragón during the twentieth century, with a very moderate growth.

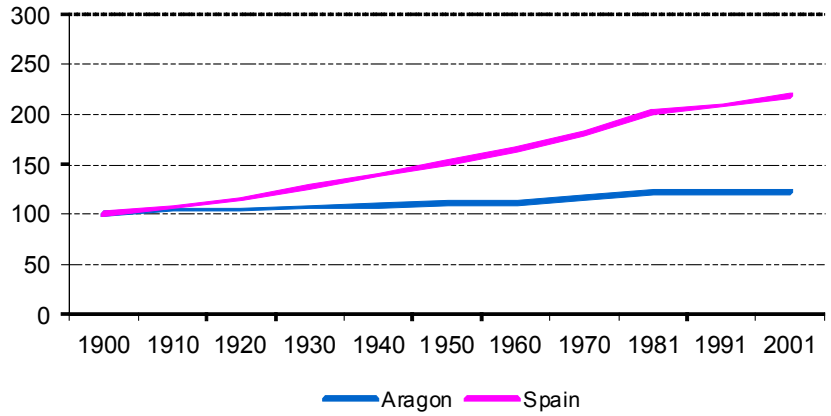

Figure 2. Population of Aragón and Spain during the 20th century (1900=100)

A second very important conclusion which we are going to explore in depth is the different behaviour of the capital, Zaragoza, on the one hand, and the rest of Aragón, on the other. Figure 3 shows, with a base of 100 in 1900, the population of Zaragoza and that of Aragón excluding Zaragoza. The first offers a spectacular growth: from 1900 to 2001 its population increased six-fold, the sixties and seventies being the time of greatest population increase, coinciding with a period of intense migratory flows from the rural to the urban environment. The second stays stable until 1950 after which it begins to fall.

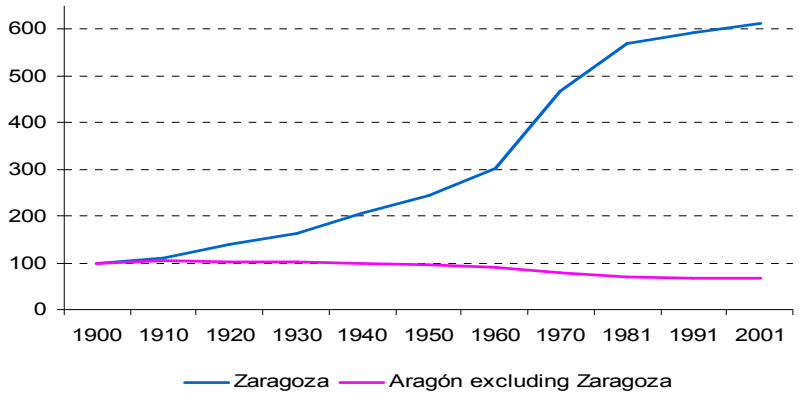

Figure 3. Population of Zaragoza and the rest of Aragón (1900=100)

We could further analyse the unequal evolution that the Aragonese population has undergone according to whether its character is urban (residents in municipalities of more than 10000 inhabitants), rural (1000 or fewer inhabitants) or transitional (between 1001 and 10000 inhabitants). Figure 4 shows the evolution of the absolute population of each of the three categories, while Table 2 offers the same information in terms of percentages.

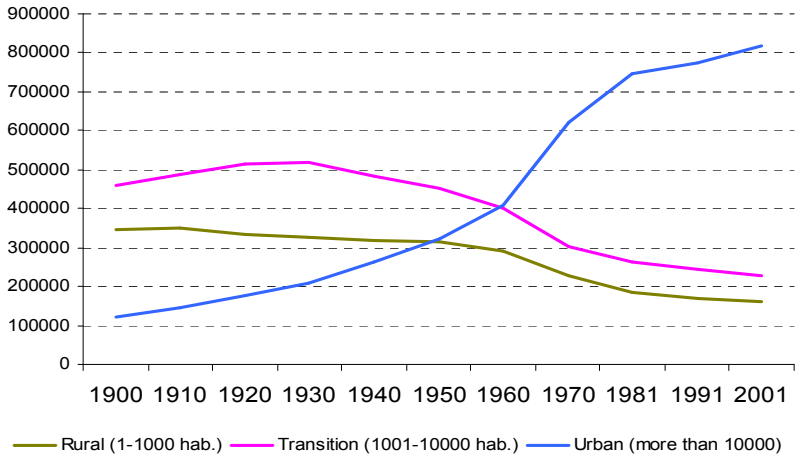

Figure 4. Evolution of the population in Aragón by kind of residence (rural/urban)

Table 2. Distribution between rural and urban areas of the population in Aragón

	Rural (1-1000 inhab.)	Transition (1001-10000 inhab.)	Urban (more than 10000)
1900	37.41	49.50	13.09
1910	35.52	49.62	14.86
1920	32.43	50.19	17.38
1930	30.86	49.48	19.66
1940	29.82	45.43	24.75
1950	28,88	41.54	29.58
1960	26.42	36.55	37.02
1970	19.73	26.28	53.99
1981	15.47	22.12	62.41
1991	14.27	20.56	65.18
2001	13.25	19.01	67.74

In 1900 almost half the population lived in transition nuclei and only 13% in urban areas. The weight of the rural population decreases systematically during the century and that of the transition population does so after 1920. The urban population, both in absolute terms as well as in percentages, grows continuously to the detriment of the other two types of population; this growth is especially intense in the sixties and seventies. In 2001 the panorama is completely different to that of 1900: the nuclei of more than 10000 inhabitants account for almost 68% of the total population, while those of a rural character represent only 13%.

Having analysed the general structure of the Aragonese population, the dichotomy between the capital, Zaragoza, and the rest of Aragón and the urban-rural structure throughout the twentieth century, it is now time to consider the smaller geographical units known as "comarcas" -the three Aragonese provinces (NUT-3) are divided into units named comarcas, which are more or less equivalent to UK counties. Figures 5 and 6 show, respectively, the growth rate of the population of each comarca from 1900 to 2001 and the population density in 2001.

As can be seen, altogether during the century, only six comarcas show increases, three of them corresponding to the provincial capitals. Zaragoza comarca stands out, with a growth of 456.51%. On the other hand, population losses have been substantial in many zones. As for the information contained on Figure 6, the results are crushing: only two comarcas have more than 50 inhabitants per km^2 (the Spanish average is almost 81), Zaragoza and its comarca again being the most densely populated zone with 286.94 inhabitants per km^2. On the contrary, most of the territory (some fifteen comarcas) have fewer than ten inhabitants per km^2, figures that can almost be classified as a demographic desert.

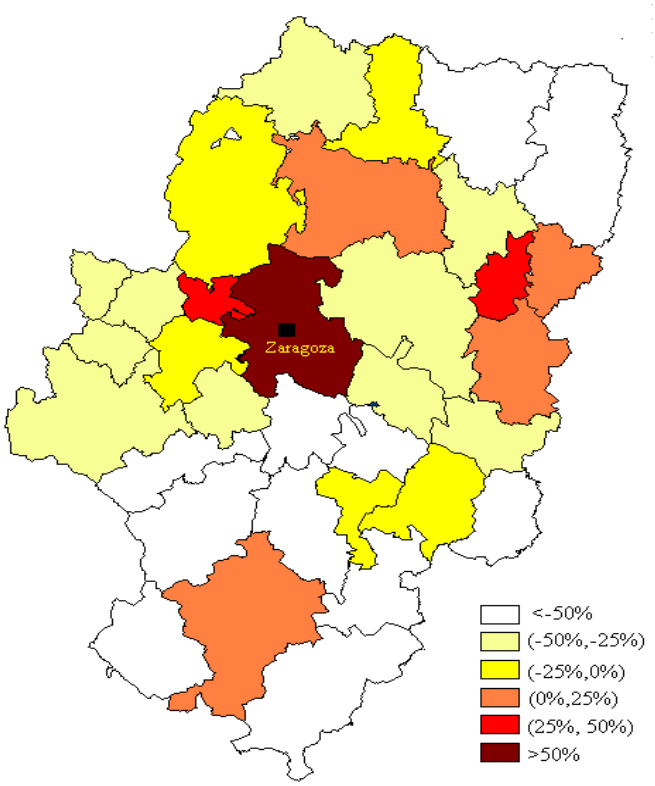

Figure 5. Population growth rate during the period 1900-2001

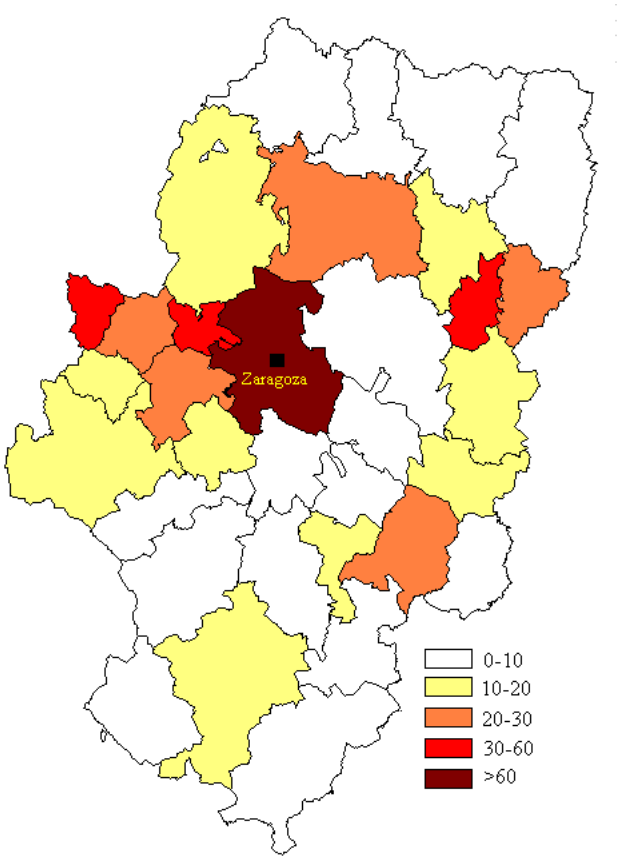

Figure 6. Population density in 2001 (inhabitants per km^2)

To finish this descriptive analysis of the population structure of Aragón during the twentieth century we are going to look at the municipalities. Table 3 shows them grouped according to size.

The first conclusion that can be derived from the information contained in the table is that during the one hundred years studied Aragón has lost more than two hundred municipalities. Secondly, there is only one nucleus, Zaragoza, that had more than 50,000 inhabitants throughout the period. Likewise, the distribution of the size of the nuclei has undergone radical changes. For simplicity's sake we are going to compare only the extreme years, that is, 1900 and 2001. In 1900 the small municipalities of fewer than 100 inhabitants practically did not exist (0.42% of the total), while those of between 101 and 5000 inhabitants accounted for almost all (98.52%). In 2001 the distribution of the size of the nuclei is very different: almost three quarters of the municipalities have fewer than 500 inhabitants, the nuclei of between 501 and 5000 people show the lowest figures of the whole century and the only size that expands during the period considered is that of between 10001 and 50000 inhabitants, which increases from two in 1900 to eleven in 2001. All this evolution is indicative of a strong urbanisation process in a few municipalities to the detriment of the majority of nuclei which during these one hundred years have lost population or have disappeared as independent entities.

Table 3. Distribution of Aragonese municipalities by population

	Population of the municipality (inhabitants)							
Year	1-100	101-500	501-1000	1001-5000	5001 - 10000	10001-50000	>50000	TOTAL
1900	4	436	272	225	7	2	1	947
1910	2	410	290	233	8	3	1	947
1920	2	387	299	243	11	3	1	946
1930	2	407	278	241	12	3	1	944
1940	4	432	261	230	10	4	1	942
1950	8	453	252	207	10	5	1	936
1960	28	512	202	173	12	7	1	935
1970	59	448	158	137	7	10	1	820
1981	95	382	118	109	9	10	1	724
1991	115	400	95	99	9	10	1	729
2001	149	382	87	92	8	11	1	730

3.- THE SIZE DISTRIBUTION OF ARAGONESE POPULATION NUCLEI

The size distribution of towns, as Richardson [8] points out, presents its own peculiarities in that they are strongly asymmetric distributions. Effectively, there are many towns of small size and only a few large ones, in such a way that the number of towns in each class decreases as the size that characterises the class increases. Because of the above-mentioned characteristics, the number of statistical distributions that have been used in the literature to explain urban structures is small. Fundamentally there have been three: lognormal distribution, Pareto distribution and a special case of the latter, the rank-size distribution, popularly known as Zipf's [12] law.

The size distribution of cities follows a Pareto distribution or follows a potential law if:

$$R(T) = aT^{-b} \qquad (1)$$

where R is the rank (value one for the biggest nucleus, value two for the second biggest, ...) or the number of towns with a population of T or more, T is the population of the towns and a and b are parameters, the latter known as Pareto's exponent, that because of its construction is always positive. It is the value of b that generates the distribution of city sizes.

The higher the value of b, the closer the towns are in population size. At the limit, if b tends to infinity, all the towns will be the same size. When b is equal to one, we obtain the well-known rank-size rule or Zipf's law (rank multiplied by size is equal to the population of the biggest town). To sum up, Pareto's exponent can be interpreted as an index of metropolisation (taken from Suárez-Villa [10]), in that values decreasing in time indicate relatively more important roles for the larger towns and, therefore, a higher metropolitan concentration; on the other hand, a rising trend represents a larger dispersion of the population outside the large metropolitan areas and a more balanced distribution between urban places of different sizes.

Before giving the results, we are going to describe, in some detail, the characteristics of the data-base used.

3.1.- *Data base*

The data have been taken from the Instituto Nacional de Estadística (www.ine.es) for the years 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1981, 1991 and 2001, the last period available.

A relevant question to clarify is the adequate sample size to employ, because the work of Rosen and Resnick [9], Guérin-Pace [6] and Urzúa [11] demonstrate the sensitiveness of the results to the sample size used. To avoid this bias and to give robustness to the conclusions, we have taken four sample sizes (N) for each year: the largest 50, 100, 150 and 200 Aragonese nuclei.

We have not used sample sizes of more than 200 municipalities, for example, 500 or the total number, 730. The reason for this is very simple; doing so would mean considering nuclei with very few inhabitants, which would, without doubt, introduce biases in the results. Remember also that both Pareto's distribution (Section 3.2) and non-paretian distributions (Section 3.3) are designed for the towns in the upper part of the distribution, that is, considering only the larger municipalities (see Gabaix [5]).

3.2.- *Application of Pareto's distribution to the Aragonese case*

In this section we are going to present the results of the estimation of (1) for Aragón in its linearised double logarithmic form:

$$\ln R = \ln a - b\ln T \qquad (2)$$

distinguishing between whether or not we consider the capital, Zaragoza, as part of the sample. This decision seems adequate because, as we have seen in the descriptive analysis of the previous section, Zaragoza is a clear outlier. Furthermore, the results themselves will confirm the convenience of adopting this distinction (with and without Zaragoza), given that they will be, as we will see later, very different from one case to another.

These results are shown in Tables 4 and 5, in which we see the estimations of *b* and, below them in brackets, their t-ratio. The goodness of fit is optimal, with an R^2 that oscillates between 0.89 and 0.99, and the estimation of parameter *a* is always positive. At the same time, Pareto's exponent is always very significant. With respect to the strict fulfilment of Zipf's law (*b*=1) we can conclude that the estimations of this parameter are always statistically different to one (the results of this test are not presented although they can be inferred from the information contained in Tables 4 and 5). In consequence, for the Aragonese case, we find econometric evidence in favour of the fact that Zipf's law is simply not verified.

Table 4. Estimation of Pareto's exponent *b* including the city of Zaragoza

	N=50	***N=100***	***N=150***	***N=200***
1900	1.366	1.583	1.662	1.696
	(21.54)	(36.40)	(53.57)	(71.61)
1910	1.351	1.566	1.638	1.663
	(21.64)	(36.57)	(54.28)	(73.02)
1920	1.29	1.497	1.582	1.61
	(19.86)	(34.81)	(50.55)	(67.99)
1930	1.234	1.436	1.529	1.556
	(20.40)	(34.83)	(49.67)	(66.81)
1940	1.161	1.342	1.436	1.476
	(20.28)	(35.52)	(49.54)	(65.54)
1950	1.105	1.276	1.367	1.407
	(21.16)	(36.48)	(50.37)	(66.16)
1960	1.041	1.188	1.263	1.289
	(22.38)	(39.38)	(54.89)	(73.04)
1970	0.926	1.044	1.111	1.139
	(23.60)	(42.14)	(57.58)	(75.57)
1981	0.866	0.963	1.017	1.036
	(26.10)	(46.98)	(64.63)	(85.73)
1991	0.846	0.928	0.978	0.993
	(26.98)	(49.72)	(68.32)	(90.79)
2001	0.833	0.91	0.947	0.954
	(27.65)	(52.20)	(74.46)	(100.4)

Table 5. Estimation of Pareto's exponent *b* excluding the city of Zaragoza

	N=50	*N=100*	*N=150*	*N=200*
1900	2.022	2.049	2.013	1.971
	(49.17)	(101.0)	(143.3)	(175.8)
1910	2.015	2.043	1.983	1.93
	(65.63)	(131.4)	(168.7)	(188.3)
1920	1.973	1.974	1.94	1.885
	(48.62)	(102.9)	(146.4)	(168.5)
1930	1.86	1.887	1.878	1.824
	(47.64)	(97.33)	(147.7)	(167.3)
1940	1.761	1.758	1.767	1.74
	(49.12)	(99.92)	(150.4)	(190.6)
1950	1.644	1.656	1.674	1.654
	(51.24)	(102.0)	(153.1)	(194.9)
1960	1.507	1.512	1.52	1.492
	(43.14)	(90.63)	(135.5)	(167.0)
1970	1.321	1.31	1.327	1.313
	(46.91)	(96.34)	(143.2)	(183.8)
1981	1.192	1.182	1.193	1.177
	(46.67)	(96.32)	(143.9)	(184.4)
1991	1.146	1.123	1.134	1.118
	(43.17)	(86351)	(129.3)	(165.7)
2001	1.112	1.091	1.087	1.063
	(39.96)	(83.96)	(124.7)	(155.1)

More interesting, because of its higher economic content, is the analysis of the temporal evolution of the estimations of the parameter of metropolisation *b*.

The first important conclusion that can be drawn from both tables is the unequivocal decreasing tendency over time of $\hat{b}$, that is to say, in agreement with what we explained before, during the century the differences between the population of the municipalities increase or, in other words, the distribution becomes more and more divergent, with greater inequalities. Secondly, the value of $\hat{b}$ in Table 5 is systematically larger than its equivalent in Table 4, so that including the capital, Zaragoza, as seems logical, makes the differences more intense. At the same time, from Table 4 (from Table 5 no regular behaviour can be deduced) it can be inferred that $\hat{b}_{N=200} > \hat{b}_{N=150} > \hat{b}_{N=100} > \hat{b}_{N=50}$, which implies that the inequality in the distribution grows with the size of the towns, in such a way that it is maximum when N=50, the sample size that corresponds to the largest nuclei.

3.3.- *Non-paretian behaviour*

In general, Pareto's law adjust reasonably well to the size distribution of the cities. However, some authors have proposed the possibility that the relationship between rank and size may not be lineal, as it is presented in (2), but that it may contain some non-lineal terms, distancing us in consequence from a purely paretian behaviour. Non-linearity is going to be introduced in accordance with the extension of (2) proposed by Rosen and Resnick [9]. Equation (2) now becomes:

$$\ln R = \ln a' + b' \ln T + c' (\ln T)^2 \qquad (3)$$

Parameter *a'* is positive and *b'* is negative, although the key parameter is now *c'*, which represents the second derivative of ln*R* with respect to ln*T* and which is interpreted in the following way. If *c'* is positive, the temporal evolution of the size of the towns is positively correlated to their population, that is to say, there is a kind of scale economies in which the bigger towns grow faster. We can also point out that in this case the number of intermediate towns is lower than that which the exact fulfilment of Zipf's law would predict. On the other hand, if *c'* is negative there is a negative correlation between relative improvements in the ranking and size; it is a convergent growth, as

opposed to the previous one which is divergent. Finally, if *c'* is null, we have a parallel evolution and the so-called law of Gibrat or of the proportional effect is fulfilled, which implies that the towns grow or shrink stochastically with a common average and variance, in such a way that the probability distribution of the growth rate does not depend on the original size.

What type of evolution – divergent, convergent or parallel – has occurred in Aragón during the twentieth century? We are now going to summarise the results of the estimation of (3), with and without the capital, Zaragoza.

Parameter *c'* is always significant. The goodness of fit is very high, with values of R^2, not presented, above 0.97. Concentrating on the question formulated in the previous paragraph, again we find a profound change in the evolution of the Aragonese urban structure depending on whether or not we consider its principal nucleus. Including the capital, Zaragoza, we detect a process of concentration of population in the biggest towns, which grow between 1900 and 2001 at a higher than average rhythm ($\hat{c}'>0$). Without Zaragoza, the Aragonese urban structure experiences an evolution of the opposite sign, in which according to the data of 2001 the region is still immersed, consisting of a slowing down or stagnation of the growth of the big towns and a higher dynamism in the intermediate towns throughout the century ($\hat{c}'<0$).

We would like to highlight the tremendous importance of Zaragoza in the population structure of Aragón. It is a differentiating (distorting) element. In effect, the difference between the samples used above is of only one observation, and yet, the behaviours inferred from them are not only not coincident but opposite. As seems logical, if we include the big city of Zaragoza, the evolution is divergent, the capital accentuates the differences and the opposite, convergent evolution, occurs if it is not taken into consideration.

4.- MOVEMENTS WITHIN THE DISTRIBUTION

In the previous section we have analysed the size distribution of the towns from an essentially static point of view, that is, without paying attention to the intrasample movements that are produced within the distribution. This is a shortcoming that will have to be remedied, because it is difficult to accept that in a period of one century the urban structure has not undergone profound changes. In other words, it may be that the distribution, as such, does not change substantially between periods and, nevertheless, big changes have occurred in the relative position of the towns in the distribution. In any case, it is a question that requires our attention and to which we are going to dedicate this section.

To this end we have to employ a dynamic methodology, so that it is capable of explicitly detecting the movements of towns between periods, allowing us to see what is going to be the future distribution of the size of towns and of describing what happens to the whole sample, not only to an average element as occurs in the classical regression analysis. Precisely, in this work we are going to use the methodology that Quah [7] proposed as an alternative to the so-called sigma and beta convergences, used in the empirical analysis of the convergence in growth rates between countries. It is a methodology that, for the case of towns, has already been used, as far as we know, in Eaton and Eckstein [4] for France and Japan and in Dobkins and Ioannides [3] for the United States.

Turning to the empirical application for Aragón, the use of Markov chains requires discretizing the set of possible values of population, so that it becomes a finite set. We follow the procedure of Eaton and Eckstein [4], that defines, for each period, six states in the following way[1]: towns whose population is less than 0.3 times the average, towns between 0.3 and 0.5 times the average, between 0.5 and 0.75, between 0.75 and 1, between 1 and 2 and, lastly, towns larger than 2 times the average. This average is obtained from the one hundred largest Aragonese nuclei in each period.

Nevertheless, our proposal differs from that of Eaton and Eckstein [4] in one essential question which has to do with the different urban behaviour of France and Japan, on the one hand, and Aragón, on the other. They argue that the French and Japanese urban structures during the twentieth century have been stable, with a parallel-type growth. As a consequence, the towns they take (39 for France and 40 for Japan) are the same during all the temporal horizon considered. This result does not

[1] Alternative cell divisions have been tried, and give results that are qualitatively coincident with those presented in the text.

hold for the case of Aragón. As we will see in more detail below, of the 100 largest Aragonese nuclei in 1900, only 63 are still among the one hundred largest in 2001. In other words, a notable variation has occurred in the urban hierarchy of Aragón during the century.

Eaton and Eckstein [4] do not need to consider the possibility that there are towns entering and leaving the sample of the largest one hundred, but we must bear it in mind in the definition of the transition matrix. Because of this, we have introduced a seventh state, further to those already enumerated. This seventh state is made up of the one hundred towns that, in each period, occupy the positions 101 to 200 in the ranking. The transitions from the other states to the seventh are towns that leave the sample of the one hundred largest, while the transitions from the seventh state to the others reflect the case of towns that enter the sample of the one hundred largest.

Table 6 shows the first order transition matrix, with ten-year jumps for the whole period 1900-2001. The seventh state is called 'rest'. Likewise, in bold type, the last line offers the ergodic probabilities associated with each of the states.

Several conclusions can de drawn from this matrix. First, the persistence, given by the values on the diagonal, is superior in the extreme states; in other words, if a town is very large or very small, it will not easily change its status. Second, we cannot conclude that a parallel growth has occurred, because in this case the elements on the diagonal would be very close to one, indicating that the hierarchy or ranking of the towns has hardly changed over time. On the other hand, several of the values on the diagonal are significantly different to one[2] and, in consequence, we can affirm that the size distribution of the Aragonese population nuclei has undergone appreciable intrasample movements during the twentieth century. In this respect, the state of the towns with a size between 0.5 and 0.75 times the average (fourth row of the transition matrix) stands out, because from this state each and every one of the other states can be attained.

Table 6. Transition matrix for Aragonese municipalities (1900-2001)

	Cell's upper endpoint (relative to the mean)						
	∞	***2***	***1***	***0.75***	***0.5***	***0.3***	***Rest***
∞	0.947	0.053	0	0	0	0	0
2	0	0.891	0.109	0	0	0	0
1	0	0.067	0.653	0.267	0.013	0	0
0.75	0.001	0.004	0.026	0.684	0.268	0.004	0.013
0.5	0	0	0.001	0.024	0.684	0.179	0.112
0.3	0	0	0	0	0.018	0.872	0.110
Rest	0	0	0	0.001	0.028	0.035	0.936
Ergodic	**0.0002**	**0.0012**	**0.0013**	**0.0091**	**0.0794**	**0.2825**	**0.6263**

Third, with respect to the ergodic probabilities, it should be pointed out that, in the long-run distribution, the most probable state is 'rest', followed by the adjacent state, the two of them making up more than 90% of the probability. To be honest, the panorama that the long-run distribution shows is more than a little discouraging, but analysing, with all the tools used up to now, what has happened to the Aragonese population in the twentieth century, it has to be admitted that the result was also to be expected. Effectively, the history of the last century has been one of the disappearance of nuclei and of population loss in most of the surviving ones, with only a few towns showing a dynamic behaviour. And this is precisely what the ergodic probabilities show us: if the movements in the sample period are repeated an infinite number of times, the deduction is that there is a strong tendency towards a greater

[2] The average value of an element on the diagonal for the case of Aragón is 0.81. For Japan (see Eaton and Eckstein, 1997) it is 0.88, appreciably higher.

proliferation of small nuclei with only a few towns of any appreciable size. Among these, Zaragoza, which is, logically, always in the state of nuclei whose size is larger than twice the average, stands out.

5.- NUCLEI THAT ENTER AND LEAVE THE SAMPLE: A SPATIAL ANALYSIS

The previous section has shown, among other results, that the hierarchy of Aragonese towns has undergone changes during the twentieth century. As we have already mentioned, of the one hundred largest municipalities in 1900, only 63 maintained this condition in 2001, and consequently 37 new emerging nuclei have substituted those that have lost their place in the ranking.

It is worth checking if these towns, both those that have entered and those that have left, present any type of spatial regularity in the territory of Aragón. If this were so, that is to say, if the towns that enter and/or leave can be grouped in some way in space, we can try to look for the causes that have given place to this behaviour. Figure 7 shows the geographical location of the 37 towns that, during the course of the century, have fallen out of the top 100. Figure 8 does the same with those that have substituted them.

Our a priori suspicions that there could be some type of spatial regularity, has been confirmed. The nuclei that leave on Figure 7 are concentrated mainly in three zones: Pyrenees and Pre-pyrenees, the south of the province of Zaragoza and the east of the province of Teruel, the latter two areas forming a type of boomerang. What characterises these zones? Three fundamental facts. Firstly, a high altitude above sea level, frequently above one thousand metres, which turns these municipalities into habitats that can be qualified as hostile or, better still, relatively hostile compared to other alternative locations that can guarantee a more profitable farming exploitation and a milder climate.

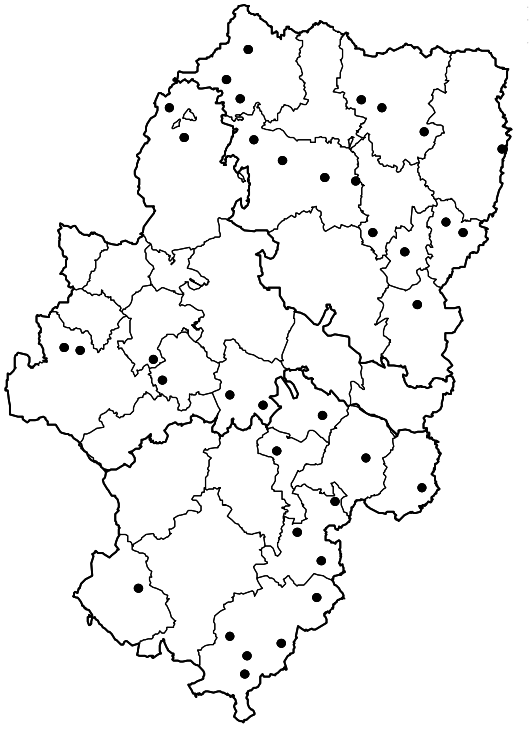

Figure 7. Cities that have left the sample of the largest 100 between 1901 and 2001

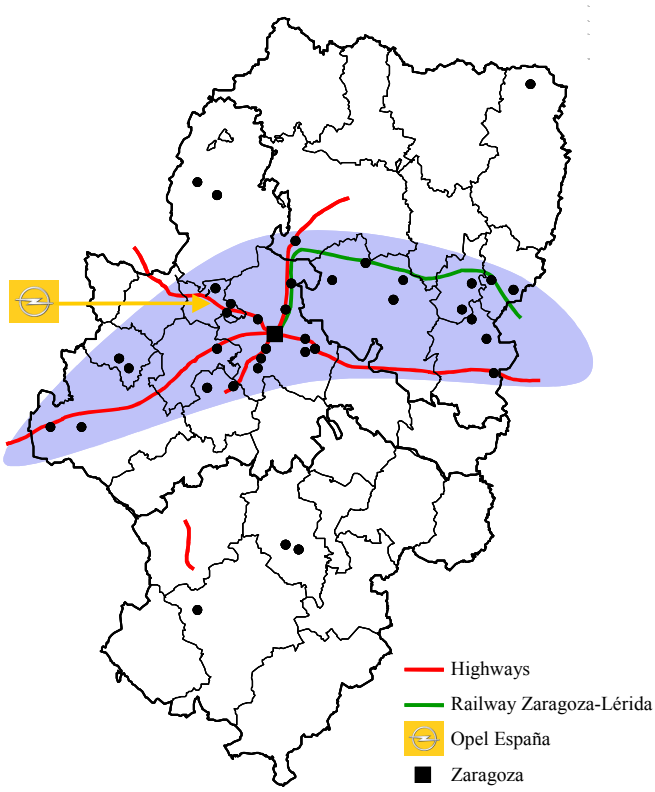

Figure 8. Cities that have entered the sample of the largest 100 between 1901 and 2001

Secondly, obsolete transport infrastructures, with difficult and costly access by road and rail; they are nuclei situated at some distance from the Aragonese networks of highways and railways. Thirdly, they are comarcas with little or no industrial presence; throughout the twentieth century, and not only in Aragón but also in Spain in general, there has been an intense process of substitution of employment in the primary sector for employment in the industrial and service sectors. In these comarcas, the loss of agricultural employment has not been offset by a compensatory growth in industrial employment.

As for the emerging nuclei, the information given by Figure 8 is even clearer. The towns are concentrated around what we could call, from its shape, and following its European homologue[3], the 'Aragonese banana'. Why are these emerging towns concentrated in this zone? Again, we can propose three reasons. In the first place, the proximity to the capital, Zaragoza, which exercises a positive influence on its surroundings. Zaragoza is the great city of industry and services in Aragón, to which must be added its geographically central position, the fact that it is the political and administrative capital of the Autonomous Community, as well as the hub of the transport networks and the financial and business centre of Aragón. All this gives Zaragoza its primary position in the Aragonese economic sphere, and explains its capacity to generate important nuclei around it. Secondly, the setting up of the Opel factory in Figueruelas in 1982 (see Figure 8) has, without doubt, had a dynamising effect on the surrounding population nuclei; the economic impact that the installation of this factory has had on employment and the value added of Aragón can be qualified as very relevant (see Aznar and Montañés, [1]). Finally, the role of transport infrastructures in fixing the population is very important: on Figure 8 we have traced the lines of the highways that Aragón had in 2003[4]: it is interesting how the location of the nuclei entering the 100 largest municipalities follows these lines so closely. It is difficult to exaggerate the political implications raised by this result, that the construction of the adequate transport infrastructures is a necessary step for attracting population.

[3] There are two European bananas, areas that contain a concentration of industrial activity: the traditional one that covers the south of England, Belgium and the Netherlands, the north of France, the German zone of the Rhür and the north of Italy, and the other, formed more recently, that is located in the Southwest arc of the Mediterranean.

[4] We have added the railway line between Zaragoza and Lérida because an important number of the emerging nuclei are located beside it.

The analysis until now has been merely descriptive. However, the results obtained from Figures 7 and 8 suggest the possibility of the existence of some type of dependency or spatial autocorrelation, given the geographical concentration of the towns on both maps. The intuitive idea is simple. The null hypothesis to test is that of spatial independence, that is, that the location of the 37 nuclei that, for example, leave the sample, is completely random in space and does not present any type of regularity. The rejection of the hypothesis implies admitting that the towns that present a certain characteristic, in our case, leaving the sample, are spatially grouped in determined comarcas.

The technical aspects of the test can be consulted in Cliff and Ord [2]. The results are the following. The location of the nuclei that leave the sample do not present any spatial regularity, given that the absence of spatial dependence is accepted at the 5% level of significance. On the other hand, we can conclude that the location of the nuclei that enter the sample is not random, but that, by rejecting the null hypothesis of no spatial correlation, there is some type of regularity, the emerging nuclei being concentrated, as we have mentioned earlier, in the comarcas close to the capital, Zaragoza, to the car factory of Opel-España and in those through which highways pass.

6.- CONCLUSIONS

The analysis of the Spanish region of Aragón has been carried out from complementary points of view which, without doubt, gives great robustness to the conclusions reached. Similarly, the period considered (1900-2001) is long enough to be able to ignore the influence of cycles and for the results to be qualified as long-term.

We would like to stress that the Autonomous Community of Aragón has been chosen as a study case, as an archetype in which other European regions with similar demographic and structural characteristics can be reflected. In other words, what follows has been deduced for the case of Aragón but we think it can be applicable, at least in part, to other European geographical areas.

The conclusions are multiple and, to show them more clearly, we are going to number them, maintaining more or less the order in which they have been obtained in the course of the paper.

1.- A merely descriptive analysis of the evolution of the population data of the last century has given, as a first result, the low population dynamism of Aragón as a whole (with a growth of 25% in 100 years); in many cases it has a negative character which affects most of the municipalities of the Autonomous Community. In other words, perhaps superfluous, only a few nuclei, mainly of an urban type, have shown a clearly positive behaviour. This evolution has led, in the final year of the sample, 2001, to population densities in some comarcas (inhabitants per square kilometre) that place many zones on the verge of what could be considered a demographic desert.

2.- In contrast to the general evolution, the behaviour of the provincial capitals and, above all, of the capital, Zaragoza, has been very positive throughout the period studied. We can say, very generally, and thus, aware that we are eliminating many relevant nuances, that there is an important dichotomy between the capital, Zaragoza, and the rest of Aragón. In any case, the demographic growth of the capital, Zaragoza, during the twentieth century, can be classified as spectacular, having multiplied its population in this time by a factor of over six, more than that of the largest Spanish cities[5].

3.- The estimation, period by period, of Pareto's distribution allows us to reach a double conclusion. Firstly, that during the twentieth century the statistical distribution of the size of the population nuclei of Aragón has become more and more unequal, the differences between the dimensions of the nuclei becoming bigger with. In other words, the evolution has been divergent: in 1900 the accordion was closed up and in 2001 it was opened out, to use a musical simile. Secondly, that the so-called Zipf's law, according to which if the largest town in the area studied has 100 inhabitants, the second will have 50, the third 33 and so on successively, does not hold for the Autonomous Community of Aragón in any year.

4.- The capital, Zaragoza, is a clear *outlier* in the Aragonese urban structure. Its inclusion or not in the sample is capable of generating results not only not coincident but even of the opposite sign, so that Zaragoza distorts the conclusions obtained. Effectively, when we estimate econometrically the non-paretian distribution that we consider in this paper, if we incorporate the capital, Zaragoza, it is

[5] In effect, from 1900 to 2001 Madrid has multiplied its population by 5.44, Sevilla by 4.61, Bilbao by 4.20, Valencia by 3.45 and Barcelona by 2.82.

deduced that the evolution of the municipalities has been divergent (see conclusion 3), in such a way that the differences have been accentuated in time. If we eliminate Zaragoza, the evolution is, on the contrary, of a convergent character, that is, the differences decrease. This is to say that the fundamental element that causes the existence of the pronounced inequalities in the distribution of the Aragonese population nuclei is, precisely, its capital.

5.- The distribution of the size of the towns of a geographical area is a reality that changes over time. These changes can be of low intensity or of a certain relevance. The corresponding estimated transition matrix will give us the solution to this question. In the case of Aragón, we can affirm that the intrasample movements have been important during the last century, with the result that we can in no way talk of a parallel evolution of the whole distribution in which the relative positions of the nuclei would have been maintained.

6.- Along the lines of the previous conclusion, the sample of the one hundred largest towns of Aragón in 1900 is quite different from the top one hundred in 2001. Only 63 nuclei are present in both lists. Having reached this point, the relevant analysis consists of checking whether the towns that enter and leave the list present any regularity in the geographical space of Aragón. The 37 that leave are mainly to be found in the Pyrenees and Pre-pyrenees, the south of the province of Zaragoza and the east of the province of Teruel, even though the pertinent spatial autocorrelation test does not allow us to affirm that these regularities are significant, statistically speaking. More interesting, because of the results that they imply, is the study of the 37 nuclei that enter, because this time the test does indicate the existence of statistically significant spatial regularities. Where is this "Aragonese banana" of dynamic nuclei located? Around the capital, Zaragoza (thus, external urbanisation economies are produced), around Opel España (that also generates positive externalities) and, above all, following markedly the network of highways of Aragón (see Figure 8). This result carries clear political implications: if we want to settle the population in its own territory it is important that the nuclei are well connected by means of adequate transport infrastructures.

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AGRI-FOOD TRADITIONAL PRODUCTS: FROM CERTIFICATION TO THE MARKET - PORTUGUESE RECENT EVOLUTION

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Abstract

(EC) Regulations 2081/92 and 2082/92, replaced by Council Regulations (EC) 510/2006 and 509/2006, respectively, are an important contribution to establishing the foundations of European Policy on agri-food quality. They include the protection of agricultural as well as food product designations at European level, particularly those which bear a close relationship with their production area and which, due to their geographical origin and/or specific modes of production, present distinctive characteristics. Under those regulations a thousand designations are estimated to be protected within the European Union, of which about eight hundred are regularly present in the markets, accounting for a 14.2 billion Euro turnover. Portugal alone has 120 protected designations (15% of all European designations) which originate a seventy million Euro turnover (0.5% of the turnover generated by the PDO/PGI at European level). Fifteen years after the first PDO/PGI products have appeared on the national market, we believe it is important to look into the state of the art of these products in Portugal. The main goal of the present paper is to provide an overall view on the main trends of the PDO/PGI products sector at national level. The methodology used consists of a descriptive analysis of a set of specific indicators regarding three main variables: Production; Prices and Commercialization. Globally, this type of products is not very commercially widespread, despite the positive sustained evolution registered by some. As a rule these products have a poor productive dimension, which in a way may explain the lack of internationalization of the sector.

Key-words: Portugal, Protected Designation of Origin and Protected Geographical Indication, policies, market, consumers, perceptions and preferences.

JEL Classification: R11; O18; O30

INTRODUCTION

Quality policies in EU

EC Regulations 2081/92[6] and 2082/92[7], replaced by Council Regulations 510/2006 (JOUE, 2006a) and 509/2006 (JOUE, 2006b), respectively, both of 20 March 2006, regulated by (EC) Regulation 1898/2006 of 14 December 2006[8] and (EC) Regulation 1216/2007 of 18 October 2007[9], respectively, are at the heart of European policies on agri-food quality. They include the protection of agricultural

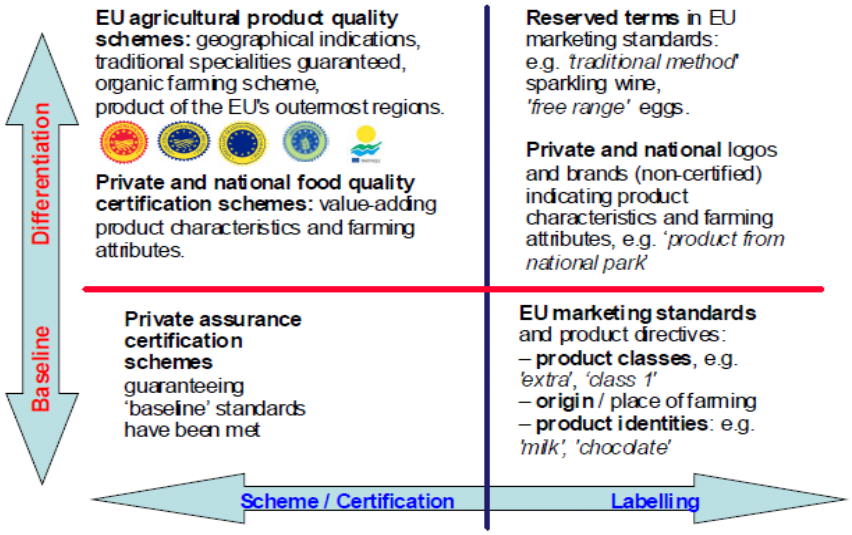
[6] In relation to protecting geographic indications and designations of origin of agricultural and food products.

[7] In relation to protecting agricultural and food products recognized as traditional specialties guaranteed.

[8] Which establishes the guidelines for Council Regulation 510/2006 regarding protection of geographic indications and designations of origin of agricultural and food products.

[9] Which establishes the guidelines for Council Regulation 510/2006 regarding agricultural and food products considered as traditional specialties guaranteed.

as well as food products designations at European level, particularly those which bear a close relationship with their production area (CE, 2008c) and which, due to their geographical origin and/or specific modes of production, present distinctive characteristics referred to in specialized literature as Specific or High Quality Products. (Tibério, 2007: 17). The European specific Quality Policy was improved with the publication of the Green Paper on agricultural products' quality in 2008, which includes: norms applied to products, agricultural production requirements and quality systems (CCE, 2008b). Along with other documents regarding biologic modes of production and integrated production, the above mentioned Regulations take on as their main goal to value the specific quality of a given type of agri-food products within the European Union, while assuming their double dimension as both an instrument of agri-food quality and agricultural policy and of rural development. As it is stated in the Foreword to (EC) Regulation 510/2006 (JOUE, 2006a), *it is necessary to favour the diversification of agricultural production so that a better equilibrium between market supply and demand may be obtained. Promoting a whole range of products with distinctive characteristics may become an important asset in the rural world, namely in less favoured or peripheral areas, through improving the farmers' income on the one hand and settling population in those areas, on the other.*
Agricultural quality policy has evolved significantly over the years. However, this evolution has taken place on a piecemeal basis — instrument by instrument, sector by sector. Combining the various instruments into a more coherent whole and developing the overall policy would help it to deliver even stronger results. This further development must be sufficiently flexible, take account of the private and national schemes that dominate the market and ensure innovation. The full picture is shown in Figure 1.



Source: CE (2009: 5)

Figure 1. Quality and assurance certification schemes and marketing standards

Schemes can be either 'certification-type' or 'labelling-type'. Certification is best when the undertakings made are complex; these are usually laid down in a detailed specification and checked periodically (e.g. annually), for example by a certifying body. Labelling measures are best for relatively straightforward claims that are normally self-declared by producers and subject to official controls. Both certification and labelling can show that a product meets baseline standards. They can also be used to indicate value-adding qualities beyond baseline standards — either product characteristics or farming attributes.
Consultations on the development of agricultural product quality policy began in 2006 with a stakeholder hearing, followed by a conference in Brussels on 5-6 February 2007. The Commission also launched policy reviews of the schemes for geographical indications for agricultural products and foodstuffs and for traditional specialties guaranteed. This work culminated in the Green Paper4 consultation and the High Level Conference on Agricultural Product Quality held in Prague on 12-13 March 2009.

The main messages from stakeholders included strong support for the EU's main quality schemes (geographical indications and organic farming) and marketing standards, but also called for simplification and streamlining. Farmers, producers and consumers urged greater use of place of farming labelling. On the other hand, processors and retailers warned that it can be difficult to track the farming origins of ingredients in processed foodstuffs. For all schemes — EU, private and national — defense of the single market and simplification were also strong messages. Some stakeholders, especially processors, warned against developing incoherent schemes that could cause confusion in the marketplace.

In the light of these consultations and examination of the current measures, the Commission has identified three main issues to be addressed in developing agricultural product quality policy, namely CE (2009).

– Information: to improve communication between farmers, buyers and consumers about agricultural product qualities;
– Coherence: to increase the coherence of EU agricultural product quality policy instruments;
– Complexity: to make it easier for farmers, producers and consumers to use and understand the various schemes and labelling terms.

The strategic orientations set out in this Communication will now form the focus of the Commission's debate on future policy. Agricultural product quality policy should contribute to achievement of the objectives of the CAP. In particular, sustainability of farming systems should be further enhanced through quality policy, and the farming attributes of products of such systems should be better known and communicated to citizens and consumers. Against this background, it is proposed to develop agricultural product quality policy through a structured approach (Figure 2), comprising CE (2009).

– For certification-type schemes, the development of guidelines for good functioning of certification schemes, and ensuring coherence of any new EU schemes.
– For labelling-type measures, development of EU marketing standards within the single Common Market Organisation.

In addition, existing EU schemes and marketing standards should be simplified and clarified wherever possible.

Source: CE (2009: 7)

Figure 2. Structure for development of agricultural quality and assurance certification schemes and marketing standards

In recent years several authors have studied the application of European regulations concerning Protected Designation of Origin and valorisation of quality traditional agri-food products in Portugal. The works published so far deal with the conceptual aspects associated with this topic, especially the social and economic importance of those products and their possible contribution to local development (Carvalho 1995; Barros, 1998; Tibério and Cristóvão, 1998; Vieira, 2008); the social and technical construction of specific quality (Fragata and Condado, 1996; Simões, 1998; Fragata, 1999, 2003a and 2003b); Tibério, Cristóvão e Fragata, 2001;Tibério and Cristóvão, 2001, 2004a; Silva, 2002; Tibério, 2004a, b, Tibério and Cristóvão, 2007a,b); the functioning of designations, their relationship with the market, their marketing and commercialization (Marques and Teixeira, 1998; Pacheco, 1996, 2001; Marreiros, 1997 and 2004; Diniz, 1999; Cristóvão, Tibério and Teixeira, 2001; Fragata, *et al.*, 2002;

Matos, 2003; Teixeira (2001 and 2004); Fragata *et al*., 2007; Tibério and Cristóvão, 2004b, 2005 e 2007b; Hagatong, 2008; Moita, 2009; Monteiro 1999; Monteiro and Lucas 2001; Santos 1998; Santos, 2009; Tibério and Cristóvão, 2008 e 2009) and several aspects related to protecting the product's brand name (Ribeiro and Martins, 1996; Salavessa and Almeida, 2001).
Despite the great diversity of studies carried out in this field, and fifteen years after the first PDO/PGI products have appeared on the national market, it is, nevertheless, important to make an overall assessment of the state of the art regarding this type of products in Portugal. In this paper the authors wish to make an assessment of how European quality policies have been applied (EC Regulations 2081/92 and 2082/92), focussing mainly on the great evolution trends of these products in what concerns their relationship with the markets.

Aim and Methodology

The main purpose of this paper is to offer both a general and sectoral view of the PDO/PGI product national sector's main trends, departing from the analysis of quantitative information on production, prices and commercialization of protected products in Portugal. The sectors under scrutiny are: Beef, Sheep and Goat Meat, Pork, Sausage Products, Honey, Cheeses, Olive Oil, Fruits and Horticultural products and Cereals.
The methodology consists of a descriptive, global and sectoral analysis, both dynamic and static, of a specific set of indicators in three main variables: Production, Prices and Commercialization. The period under survey comprises the years from 1997 to 2007. The static analysis is based on 2007, which corresponds to the last year on which there is available quantitative information for the sector[10].
As concerns production the following indicators are taken into consideration: Number of products; adherent producers; production volume; evolution of production; market share of the different products; relative importance of PDO/PGI products of each sector in their reference markets[11]. Within the context of the price variable, certain comparisons are established whenever possible: between most frequent prices at the moment of the first transaction[12]; between PDO/PGI products and *standard* products[13]; between generated turnovers; and the sector's relative importance in the context of PDO/PGI's national segment.
The commercialization variable comprises: the indicator analysis: distribution channels; producer groups' [14] importance in the value chain; main destination markets (national, regional or local and international).
The quantitative information that has been analysed was obtained through secondary information sources, namely through annual reports issued by the Instituto de Desenvolvimento Rural e Hidráulica (HIDRa, 2001, 2002, 2003, 2004, 2005, 2006), the Direcção Geral de Agricultura e Desenvolvimento Rural – DGADR (General Agricultural and Rural Development Board, 2007) and Gabinete de Planeamento e Políticas – GPP (Planning and Policies Office, 2010). The present analysis is complemented by a bibliographic research based on research studies, case studies, reports and several other documents.

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[10] The supporting information is made available by the no longer existing Institute of Rural Development and Hydraulics (HIDRa) and by the Gabinete de Planeamento e Políticas –GPP (Planning and Policies Office), an office within the Ministério da Agricultura do Desenvolvimento Rural e das Pescas – MADRP (Ministry of Agriculture, Rural Development and Fishing), which is currently responsible for the management of PDO, PGI and TSG designations in a national context.

[11] A product's reference market is defined by the product itself and its closest byproducts. (Tibério, 2004a: 163). In the context of the present article, the reference market of a PDO/PGI product is the market defined by the standard product sector in which the PDO/PGI product is integrated.

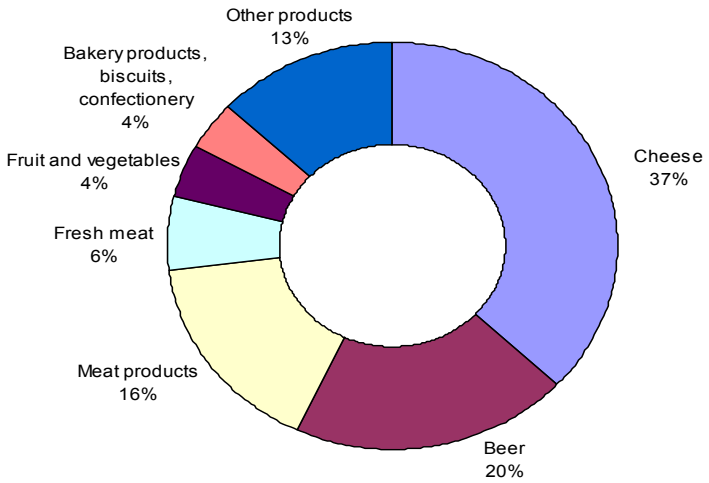
[12] Prices paid to the Producers Association or to whom is selling to the final consumer at the first transaction. .

[13] Non-certified product of the same reference sector or transacted without certification.

[14] Entities which are responsible for managing the designations.

Results
PDO/PGI/TSG products in the European Union

Around 800 products with a protected brand name (PDO/PGI/TSG)15 are estimated to circulate in the European market and worldwide and are responsible for an approximately 14.2 billion Euro turnover (DGA, 2010). As regards PDO/PGI production value, the main countries are Italy (33% of the total) Germany (25%), France (17%), United Kingdom (8%), Spain (6%), Greece (4%) and Austria (1%) (DGA, 2010). Cheeses, beers and meat products together represent about 75% (in value) of DOP/PGI in the European Union (Figure 3).



Source: Adapted from DGA (General Agricultural Board), 2010

Figure 3. % of total turnover for PDO/PGI agricultural products

When one considers the number of products, France (22%), Italy (21%)[16] and Portugal (15%) come in first and the cheese (25%), fruit and horticultural product (20%) and fresh meat (15%) sectors are the most representative (europe.eu.int/comm/agriculture/qual/).

After the Enlargement of the European Union, and in view of the growing interest shown by producers, there has been a sudden increase of registration requests in recent years. The Commissioner for Agriculture and Rural Development considers the registration of the 1000th designation to be an important development for quality regimes, and one that proves their enormous potential, bringing visibility onto European quality products while valuing agricultural traditions and the rural heritage (DGA, 2011). Currently the number of quality agricultural and food products under community protection is estimated to be around 1,000[17] and they include (DGA, 2011): 505 Protected Designations of Origin (PDO), 465 Protected Geographic Indications (PGI) and 30 Traditional Specialties Guaranteed (TSG).

Portuguese market for PDO/PGI products: present and future
General aspects

Of the 120 Portuguese products with a protected brand name, 57 are PDO, 59 PGI and 3 TSG (GPP, 2010: 5). The traditional sausage (31%), fruit (18%), cheese (12%) and beef (12%) sectors are the most representative (Table 1).

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15 Until June 2008, 799 designations had been registered (446 PDO and 333 PGI) (EC, 2008: 6).

16 France and Italy alone are responsible for over 40% of the protected brands and together with Germany, a Greece, Portugal and Spain represent about 90% of all the protected designations (CE, 2008: 6).

17 The «Piacentinu Ennese» (PDO), is an Italian sheep cheese, which became the 1000th registered designation under the Community labelling legislation for quality agricultural and food products.

Table 1. PDO/PGI products' distribution per sector (2007)

Sectors	Nº of Products	%
Beef and veal	13	11%
Lamb meat	8	7%
Kid goat meat	5	4%
Pork	2	2%
Sausages	37	31%
Honey	9	8%
Cheeses	14	12%
Cottage cheese	1	1%
Olive Oils	6	5%
Fruits	21	18%
Vegetables and cereals	3	3%
Bakery products	1	1%
TOTAL	**120**	**100%**

Source: GPP, 2010: 5

Despite the great diversity of products, their full integration in the market is still to happen and their heterogeneity is obvious (Table 2).

Table 2. PDO/PGI products' presence in the market (2007)

Sectors	No of Products	Commercialized Products	%
Beef and veal	13	9	69%
Lamb meat	8	2	25%
Kid goat meat	5	3	60%
Pork	2	2	100%
Sausages	37	26	70%
Honey	9	6	67%
Cheeses	14	13	93%
Cottage cheese	1	1	100%
Olive Oils	6	5	83%
Fruits	21	14	64%
Vegetables and cereals	3	1	33%
Bakery products	1	0	0%
TOTAL	**120**	**82**	**68%**

Source: GPP, 2010: 5

Around 15% of European Union's PDO/PGI/TSG products are from Portugal; however, in general they create a low turnover and have a low economic value, since the volume of business is only of 70 million Euros, approximately (0.5% of the value of the European production). The available data (Table 3) are still insufficient to draw any solid conclusions as to this indicator's trend, either globally or at a sectoral level.

Table 3. Value of PDO/PGI production (EUR)

Sectors	2004	2005	2006	2007	%
Beef	9,601,000	11,786,000	10,314,432	10,948,994	**15.7**
Lamb meat	1,573,000	1,567,000	568,679	948,984	**1.4**
Kid goat meat	262,000	186,000	77,026	194,423	**0.3**
Pork meat	1,192,000	761,000	132,472	46,379	**0.1**
Sausages	2,289,000	1,826,000	1,326,957	2,048,888	**2.9**
Honey	456,000	524,000	703,778	825,723	**1.2**
Cheeses	13,632,000	11,066,000	12,524,486	12,968,882	**18.6**
Olive Oils	5,004,000	8,995,000	8,447,718	10,107,792	**14.5**
Fruits	27,934,000	45,343,000	19,295,114	31,592,346	**45.3**
Vegetables and cereals (potatoes)	-	-	189,420	50,490	**0.1**
TOTAL	**61,943,000**	**82,054,000**	**53,580,082**	**69,732,901**	**100**

Source: GPP, 2010: 5

The static analysis (year 2007) shows that fruits (46%), cheeses (19%), beef (16%) and olive oil (14%) together represent 95% of the global value of national PDO/PGI production (Figure 4).

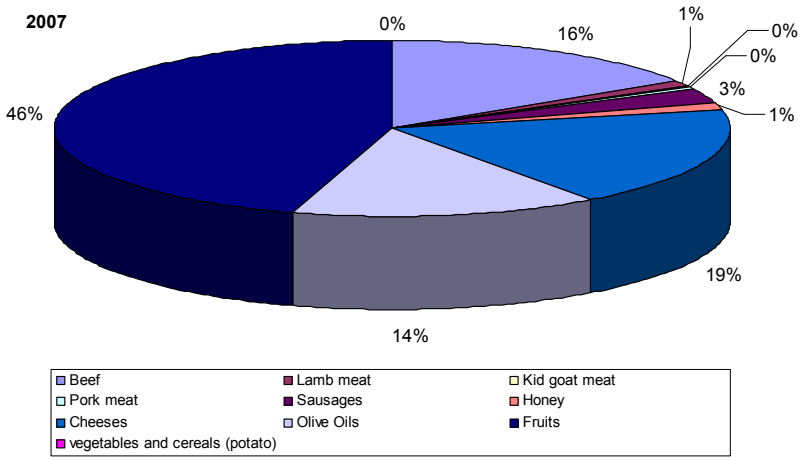

Figure 4. Value of PDO/PGI production per sector

PDO/PGI product national sector's institutional tissue is composed of seventy Groups of Producers (Designation Managing Entities) and eleven Private Control and Certification Bodies (www.gppaa.min-agricultura.pt).

Sectoral aspects
Beef

Products and evolution of production

In the beef sector, there are thirteen protected products[18] (11% of the total at national level): nine PDO, three PGI and one TSG. Four of these products have not yet entered the market. The sector covers about 2900 farms which provide the market with 2200 tons of meat, approximately. Production distribution is represented in Figure 5. *Carnalentejana* (meat from the Alentejo region) leads the market (60%), very much ahead *carnes Mirandesa* (meat from the Miranda region) (12%), *Barrosã* (from Barroso) (9%) and *Maronesa* (from the mountains of Marão) (9%). The latter are competing to

[18] Carne Arouquesa PDO, Carne Barrosã PDO, Carne Cachena da Peneda, Carne da Charneca, Carne de Bovino Cruzado Lameiros de Barroso IGP, Carne dos Açores IGP, Carne Marinhoa PDO, Carne Maronesa PDO, Carne Mertolenga PDO, Carne Mirandesa PDO, Carnalenteana PDO, Vitela de Lafões e Carne de Bovino Tradicional do Montado ETG (Registo Provisório.

achieve the second place in the market. *Carnes Arouquesa* (meat from the Arouca region) (5%) and *dos Açores* (from the autonomous region of the Azores) (3%) share the remaining market segment between themselves. Four other products are not available in the market regularly.

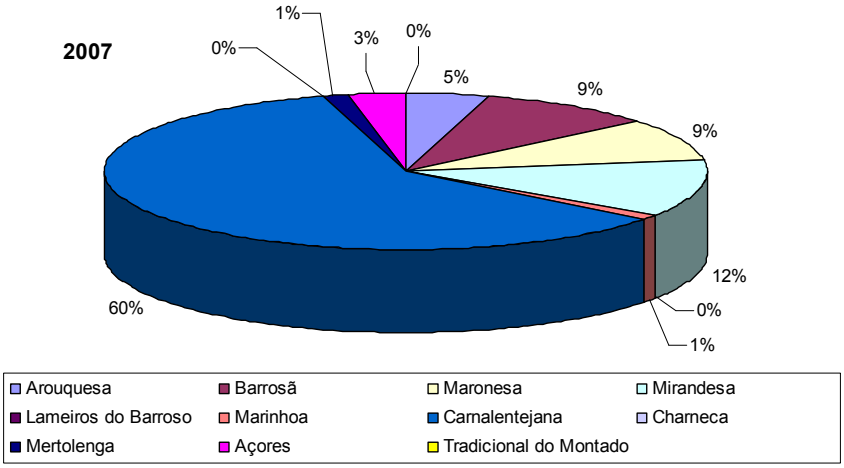

Figure 5. PDO/PGI beef meat per product

The PDO/PGI meat production went through a positive and sustained evolution between 1997 and 2007 (Figure 6) and represents 2.7% of the national production of beef meat approved for consumption (GPP, 2010: 43).

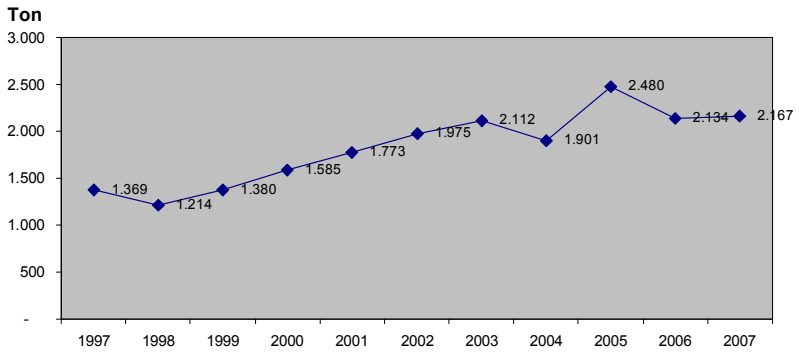

Figure 6. Evolution of PDO/PGI beef meat production.

Prices and production value

The 2168 tons of PDO/PGI beef meat that were commercialized in 2007 represented an eleven million Euros worth of volume of business, approximately (Figure 7), which is equivalent to an average price of Euro 5.00 per kilo of carcass weight at the first transaction and is 16% of the national PDO/PGI production value.

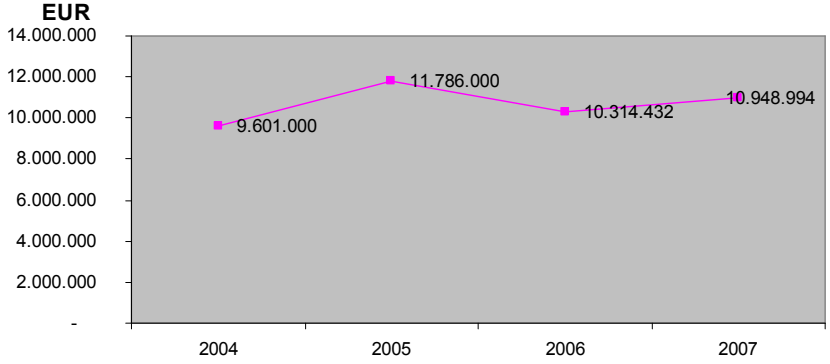

Figure 7. Volume of business generated by the PDO/PGI beef sector

Market prices for PDO/PGI beef meat show some oscillation inter-products and within the same product, depending on the segments, whether it is the veal, calf or cow segment. The prices for "veal" oscillate between a minimum of Euro 3.75 per kilo of carcass weight for *carnalentejana* and a maximum of Euro 9.00 per kilo of carcass weight for *carne Mirandesa*, which together with *carne Barrosã* (Euro 7.00 per kilo of carcass weight), register the highest difference in producer's price when compared to non-certified meat (Euro 5.00 per kilo of carcass weight).

Commercialization

Portuguese PDO/PGI beef meat reaches the market mainly through great distribution (75%). However, not all the products follow the same procedures (Figure 8). *Carnalentejana* and *Barrosã* (the two most representative products) favour middle-sized and large food retail distribution centres (95%). *Mirandesa*, *Maronesa* and *Arouquesa* meat have a distribution structure divided by butcher's shops, middle sized and large retail stores/supermarkets/hypermarkets, food and catering, direct selling and fairs. Food and catering is especially relevant as far as *Carne Arouquesa* is concerned (30%), while *Carne Maronesa* is mainly sold at local butcher's shops (35% of the meat traded).

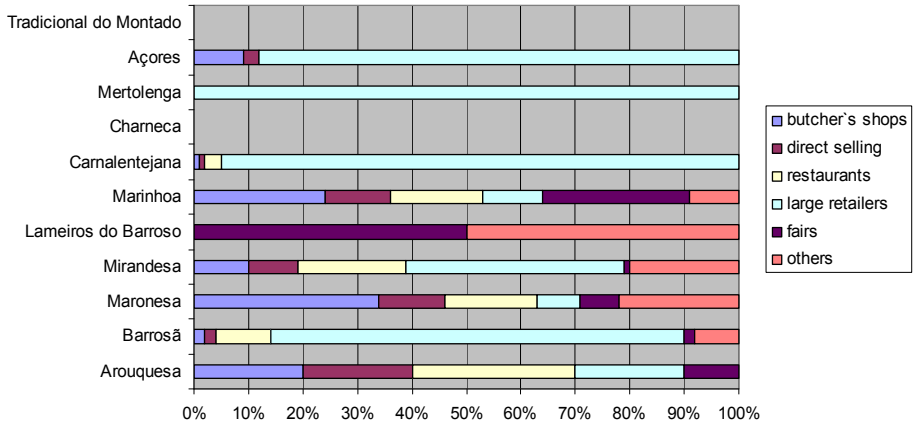

Figure 8. PDO/PGI beef meat trade

Products are sold by their respective groups of producers, (95%), by individual producers (0.2%) or some other entity (4.8%) (GPP, 2010: 40). The national (91.5 %) and the local market (8%) are their main destination markets (GPP, 2010: 41). Producer groups have an active role in the product's value chain, by controlling the commercialization process on an exclusive basis. Exporting is non-existent.

Sheep meat

Products and evolution of production

This sector registers eight PDO/PGI products (7% of the national total)[19]: three PDO and five PGI (GPP, 2010:14). Only two are available in the market. 155 tons of meat are produced in 65 sheep farms (GPP, 2010:15). The *Borrego do Nordeste Alentejano* (a lamb from the pastures of north-eastern Alentejo) (153 tons) leads the market. The production of *Borrego Terrincho* is but residual. The remaining products are not traded with their respective designation of quality.

PDO sheep meat production represents 5.6% of the sector's national production (GPP, 2010:43), but it has witnessed an irregular evolution, which has been particularly negative in the last four years of the period under survey (Figure 9). In 2003 this product's market was worth 10% of its reference market (Fragata *et al*, 2007: 7).

[19] *Borrego da Beira* (PGI) *Borrego de Montemor-o-Novo* (PGI), *Borrego do Baixo Alentejo* (PGI), *Borrego do Nordeste Alentejano* (PGI), *Borrego Serra da Estrela* (PDO), *Borrego Terrincho* (PDO), *Cordeiro Bragançano* (PDO), *Cordeiro de Barroso* (PGI).

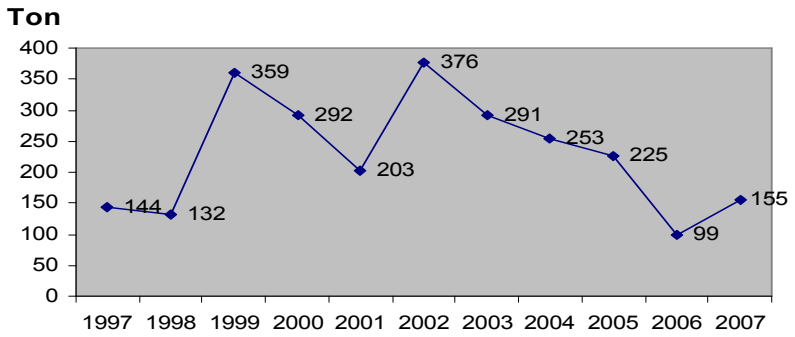

Figure 9. Evolution of PDO/PGI lamb production

In 2005, 225 tons of PDO sheep meat were placed in the market, which included five different products, resulting from the slaughtering of 19,000 animals (Figure 10). *Borrego de Montemor-o-Novo* and *Borrego do Baixo Alentejo* were not commercialized in 2006 or 2007 (GPP, 2010: 14).

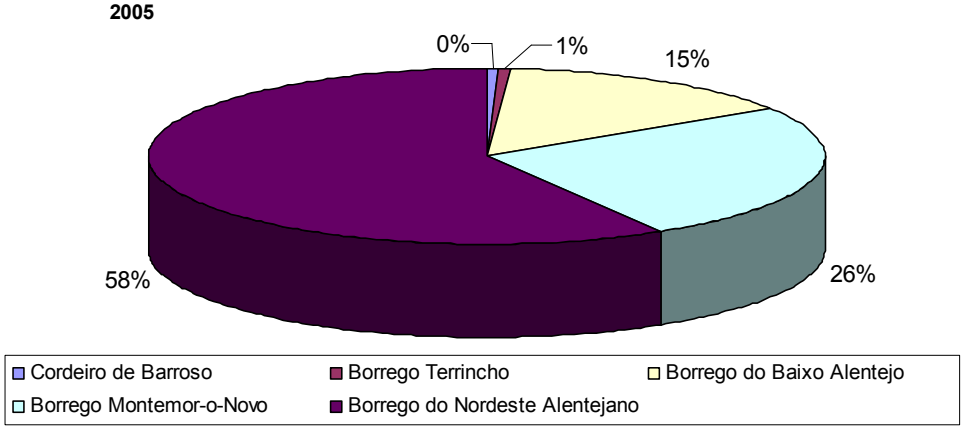

Figure 10. PDO sheep meat per product

Prices and production value

When we talk about *Borrego do Nordeste Alentejano* we are referring to carcasses weighting over13 kilos, often reaching a market price at the first transaction around Euro 6.00 per kilo of carcass weight. This price is significantly higher than the producer's price for non certified meat, which is only Euro 2.50 per kilo of carcass weight. *Borrego Terrincho* weights less than 7 kilos and its producer's price (Euro 7.00 for kilo of carcass weight) is also higher than the price of non certified meat (Euro 5.00 per kilo of carcass weight). Prices were stable along the period under survey.
Production value has been dropping (Figure 11) as a result of the negative growth of production and represents only 1.4% of the global value of national PDO/PGI production.

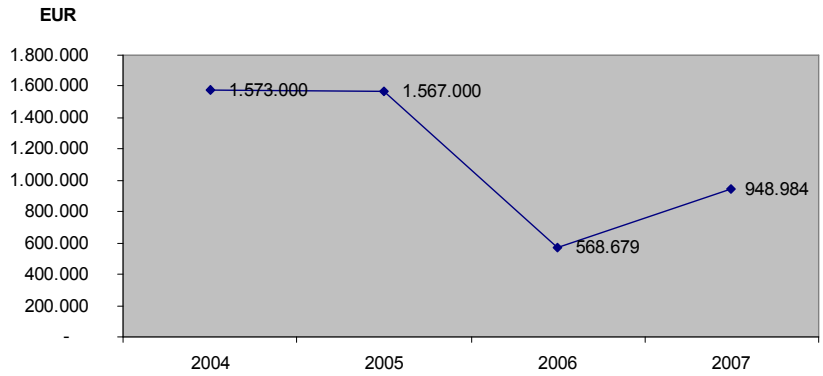

Figure 11. Volume of business generated by PDO/PGI sheep meat sector

Commercialization

The *Borrego do Nordeste Alentejano* is sold through large retail stores/supermarkets/hypermarkets (90% of the market). *Borrego Terrincho*, a small scale product, favours food and catering (60%) and traditional retail commerce/butcher's shops (39%). Whenever the sector's offer includes other products, the main commercialization channel used is the large food chain stores.
Products are sold by their respective Groups of Producers (100%) (GPP, 2010: 40). Their main destination markets are the national market (98 %) and the local one (2%) (GPP, 2010: 41).

Goat meat

Products and evolution of production

In the kid-goat sector, there are five protected brand names registered[20] (4% of the national total), one PDO and four PGI, although only three are represented in commercial terms (GPP, 2010: 17). 205 farms produce 16 tons of meat, approximately, as a result of the slaughtering of three thousand kid-goats (an average weight of 5kilos per carcass weight), distributed as shown in Figure 12.

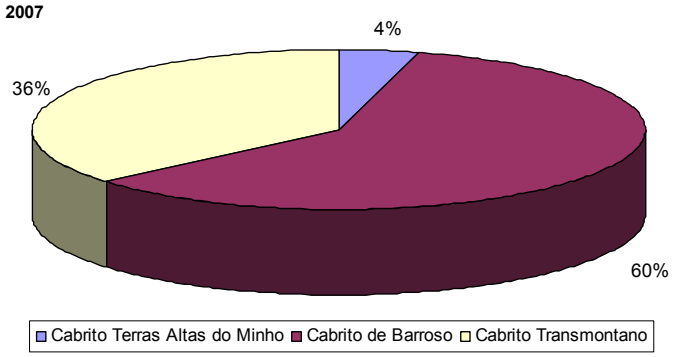

Figure 12. PDO/PGI kid-goat meat per type of product

PDO kid-goat meat production has evolved negatively (Figure 13) and now represents 1.8 % of the national production of goat meat approved for human consumption (GPP, 2010: 43).

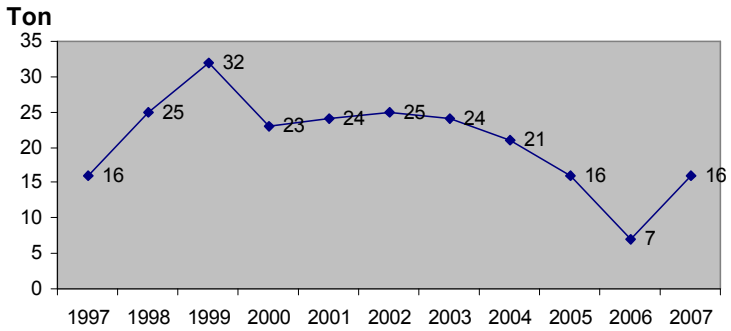

Figure 13. Evolution of PDO/PGI goat meat production.

Prices and production value

Prices vary from product to product (GPP, 2010: 18): *Cabrito Serrano Transmontano* (Euro 10 per kilo of carcass weight), *Cabrito de Barroso* (Euro 13 per kilo of carcass weight) and *Cabrito das Terras Altas do Minho* (Euro 14 per kilo of carcass weight) and are higher than those of non certified meat (Euro 9 per kilo of carcass weight for *Cabrito Serrano Transmontano* and Euro 10.50 per kilo of carcass weight for *Cabrito de Barroso*). Despite the positive price differential, producers show little or

[20] *Cabrito da Beira* PGI, *Cabrito da Gralheira* PGI, *Cabrito das Terras Altas do Minho* PGI, *Cabrito de Barroso* PGI and *Cabrito Serrano Transmontano* PDO.

no responsiveness towards designations. The production value has evolved negatively as a result of a production slowdown; in 2007 it reached 194, 000 Euros (GPP, 2010: 17), (Figure 14) and it represented only 0.1% of the value of national PDO/GPI production.

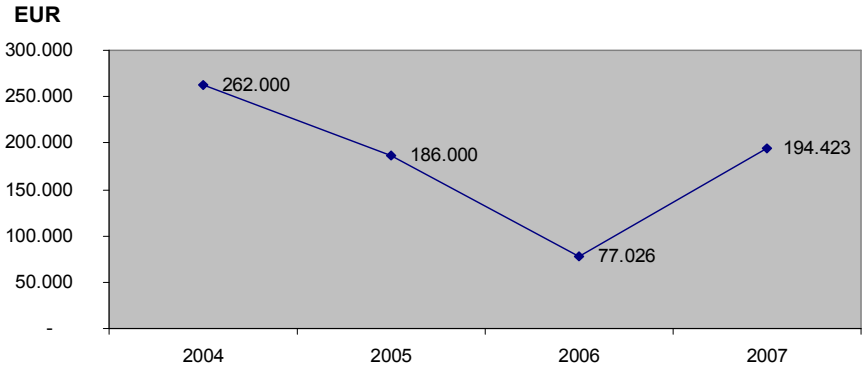

Figure 14. Volume of business generated by the PDO/GPI goat meat sector

Commercialization

Large retail stores/supermarkets/hypermarkets control the PDO goat meat trade. This is even more so when one refers to *Cabrito das Terras Altas do Minho* and *Cabrito do Barroso*. The *Cabrito Transmontano* lies on a distribution system which depends less on one distribution channel and favours food and catering instead (Figure 15).

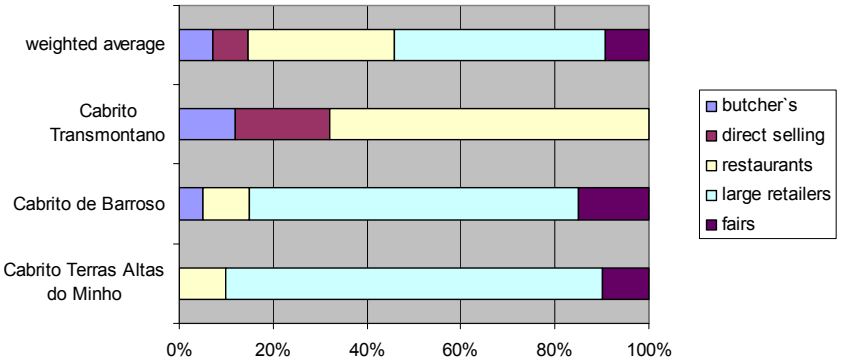

Figure 15. PDO/PGI goat meat trade

Products are sold by their respective Groups of Producers (93%), or by some other entity (7%) (GPP, 2010: 40). The local and national markets (62% and 38 %, respectively) are their main destination markets (GPP, 2010: 41). Not unlike what happens with other PDO/PGI fresh meats, exporting is non-existent.

Pork

Products and evolution of production

Only two brand names are protected in the pork meat sector[21] (GPP, 2010: 20), in which these are relatively new processes. Commercialization of these products started in 2000 when eighty-five tons of *Carne de Porco Alentejano* were launched in the market, following the slaughtering of about 1,000 animals. The production of this product evolved positively until 2005, when 230 tons of meat, resulting from the slaughtering of 230,000 animals, were commercialized. *Carne de Bísaro Transmontano* (an autochthonous pig breed from Trás-os-Montes), is an even newer product which

[21] *Carne de Bisaro Transmontano* PDO and *Carne de Porco Transmontano* PDO.

began being commercialized only in 2006 (36 animals slaughtered and 3 tons of meat). In the current year, there has been a sudden decrease in the production of *Porco Alentejano* (Figure 16).

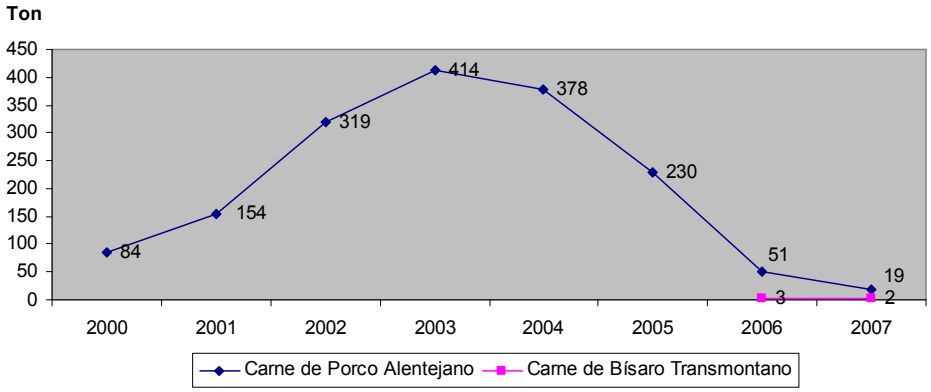

Figure 16. PDO/PGI pork meat evolution

In 2006 the number of farms producing PDO pork meat was 49. In the following year, however, only 27 were identified, of which 26 in the production area of *Porco Alentejano*. These farms supplied the market with 20 tons of meat. The *Carne de Porco Alentejano* (pork meat from the Alentejo region) is responsible for quite a large share of the market (Figure 17), representing only 0.01% of the pork national market approved for human consumption (GPP: 2010, 43). In 2003 the market share was 0.1%.

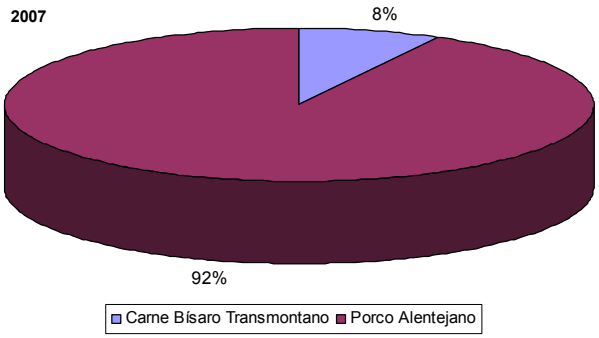

Figure 17. PDO/GPI pork meat per type of product

Prices and production value

In 2007 prices in the Producer Groups were 2.5 Euros per kilo and 3.5 Euros per kilo for *Porco Alentejano* and *Bísaro Transmontano*, respectively (GPP, 2010:20). In 2002 *Carne de Porco Alentejano* was sold at 580$00 (the old Portuguese currency equivalent to Euro 2.90). In 2003 and 2004 it reached Euro 3.15 and Euro 3.31, respectively. Price evolution accounts for the evolution in production as well as for production value, which have been very negative (Figure 18).

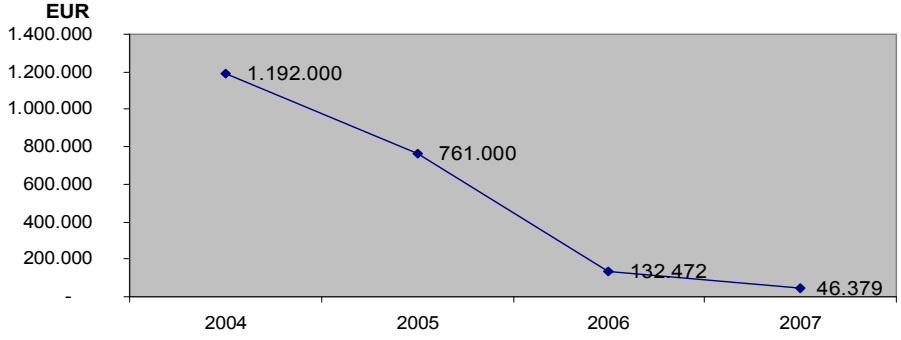

Figure 18. Volume of business generated by PDO/PGI pork sector

Commercialization

On the whole, PDO/GPI pork meat is subject to a balanced commercialization process. However, while producers of *Carne de Porco Alentejano* have managed to diversify their channels, producers of *Carne de Porco Bísaro* favour the food and catering channel (Figure 19).

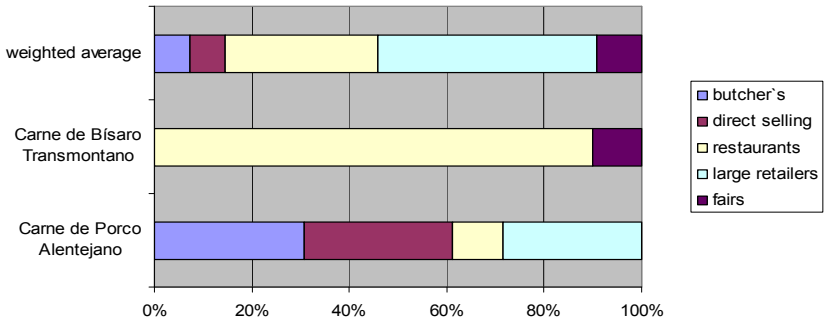

Figure 19. PDO pork trade

Products are sold by their respective Groups of Producers (92%) or by individual producers (7%%) (GPP, 2010: 40). Their main destination markets are the national market (86 %) and the local market (14%) (GPP, 2010: 41). It is in the PDO sector that individual pork producers assume a greater protagonism as regards selling and distributing their products. Exporting in this sector is also non-existent.

Traditional sausages

Products and evolution of production

The traditional and very specific sausage sector, with 37 PDO/PGI (one PDO, thirty five PGI, and one STG), is particularly rich in origin-protected labels, 70% of which are present in the market and reach a total volume of production of 190 tons (GPP, 2010: 22,23). The "Alheira de Mirandela"[22] STG (100 tons, 53%) and the "Presunto de Barrancos" PDO (Ham from Barrancos) (30 tons, 16%) along with some products of the Portalegre region are distinguished by their production volumes and lead the market of these products in Portugal (Table 4). The remaining products are small or micro scale productions.

[22] It is a very specific sausage.

Table 4. PDO/PGI sausage product production (2007)

Products	Kg	%
Alheira de Mirandela	101,598	53.4
Lombo Branco Portalegre	1,984	1.0
Lombo Enguitado Portalegre	808	0.4
Painho de Portalegre	9,776	5.1
Chouriço Mouro de Portalegre	638	0.3
Morcela de Assar de Portalegre	6,738	3.5
Morcela de Cozer de Portalegre	165	0.1
Farinheira de Portalegre	10,704	5.6
Chouriço de Portalegre	10,111	5.3
Presunto de Barrancos	29,625	15.6
Linguiça de Portalegre	365	0.2
Salpicão de Vinhais	2,810	1.5
Linguiça de Vinhais	3,096	1.6
Chouriço de Carne, Estremoz e Borba	67	0.0
Chouriço Grosso, Estremoz e Borba	252	0.1
Farinheira, Estremoz e Borba	1,932	1.0
Morcela, Estremoz e Borba	362	0.2
Paia de Lombo, Estremoz e Borba	43	0.0
Paia de Toucinho, Estremoz e Borba	-	-
Paio, Estremoz e Borba	2,532	1.3
Cacholeira Branca de Portalegre	-	-
Alheira de Vinhais	3,881	2.0
Butelo de Vinhais	611	0.3
Chouriça de Carne de Barroso	572	0.3
Chouriça Doce de Vinhais	349	0.2
Chouriço Azedo de Vinhais	403	0.2
Presunto e Paleta de Campo Maior e Elvas	760	0.4
Presunto e Paleta de Santana da Serra	-	-
TOTAL	**190,182**	**100**

Source: GPP (2010)

Production of this type of products occurs in about 30 processing units located in their respective regions of production (Trás-os-Montes and Alentejo).

The number of products that are currently available in the market increased between 1997 (10 products) and 2007 (26 products). Nevertheless, the national production of this type of products has experienced an irregular evolution, even negative in the last six years (Figure 20), representing only 1% of the national sausage production.

The *Alheira de Mirandela* and *Presunto de Barrancos* are mostly responsible for the above mentioned evolution.

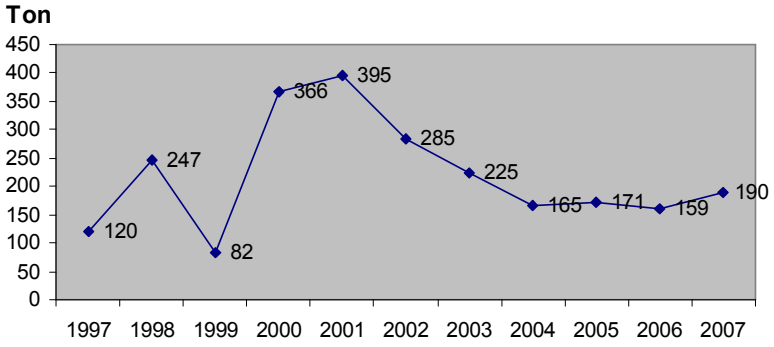

Figure 20. Evolution of production of PDO/PGI traditional and very specific sausage products

Prices and production value

Production volume reaches 2 million Euros (GPP, 2010: 43), evolving as shown in Figure 21 and it is worth about 3% of the national PDO/PGI production value.

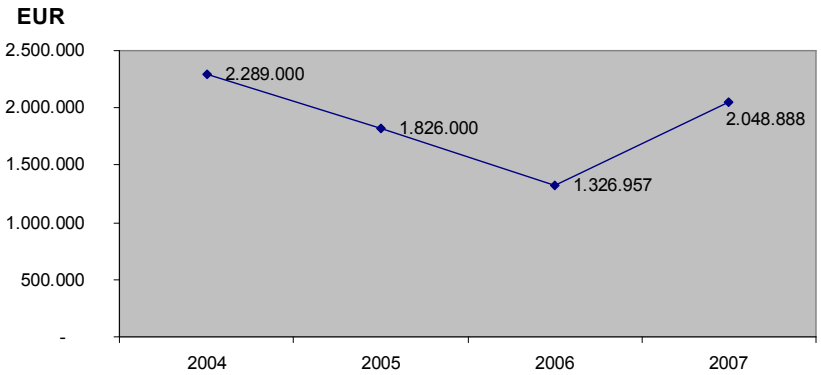

Figure 21. Volume of business generated by PDO/PGI traditional sausage sector

Prices vary a lot given the products' wide diversity and typical qualities: different types of meat or bread related products, or with other ingredients are processed according to the traditions and know-how of each region. *Alheira de Mirandela* and other similar bread related products have the lowest prices in the market. *Salpicão de Vinhais*, *Presunto de Campo Maior* and *Elvas*, *Linguiça de Vinhais* and *Paio de Lombo de Estremoz* and *Borba* on the contrary, reach the highest prices (Figure 22). As a rule, PDO/PGI products are far more expensive than non-certified ones.

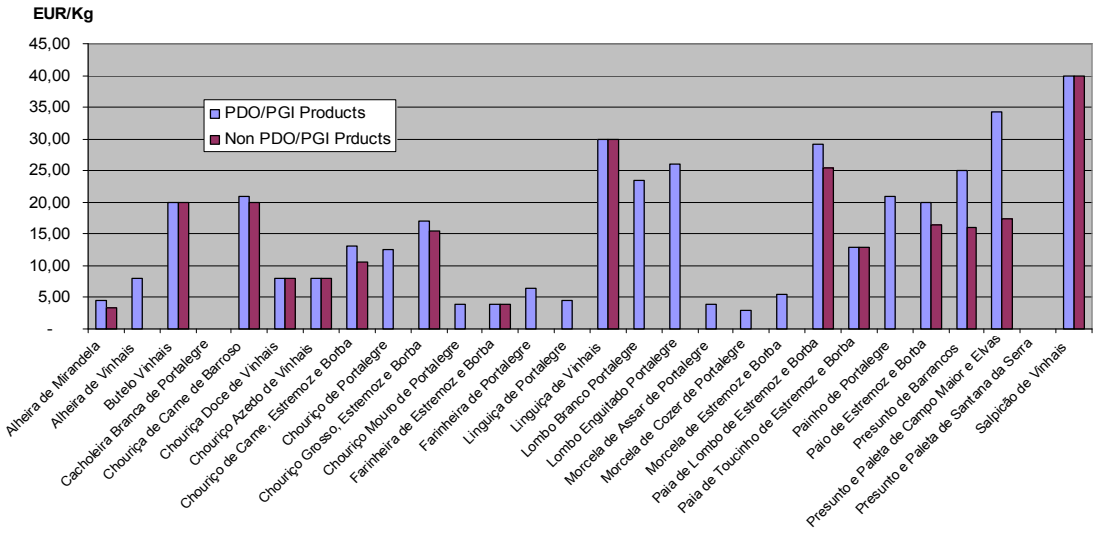

Figure 22. Price comparison between PDO/PGI and non-PDO/PGI sausage products

Commercialization

On the whole, large retail stores/supermarkets/hypermarkets play an important role in the commercialization process of PDO/PGI sausage products. Both *Alheira de Mirandela* and most of the products from Portalegre are sold mainly through that channel, unlike *Fumeiro de Vinhais* and some products from Estremoz and Borba (in the Alentejo region), whose distribution channels are diversified. Regional sectoral fairs are also very important for *Fumeiro de Barroso* and some products from Estremoz and Borba. As for *Presuntos de Barrancos*, *Presuntos de Campo Maior* and *Presuntos de Elvas*, their distribution is done by wholesale traders (Figure 23).

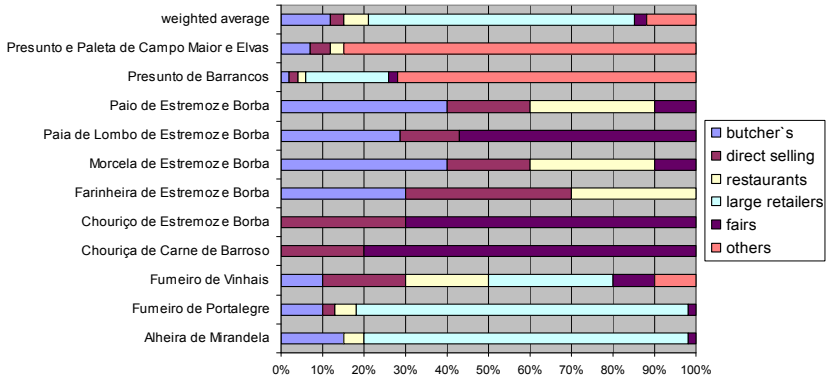

Figure 23. Commercialization of PDO/PGI sausage products

These products are sold by individual producers (65%) or by some other entity (35%) (GPP, 2010: 40). Their main destination markets are the national market (79.4 %), the local market (12,8%) and the international market (1.4% within the European Union and 6.4% outside) (GPP, 2010: 41). Producer Groups do not intervene in PDO sausage products' commercialization. Exporting, mainly outside the European Union, is somehow significant.

Honey

Products and evolution of production

There are nine PDO ***honeys*** in Portugal[23], but only six are available in the market (GPP, 2010: 27). The PDO honey production increased from 1997 to 2001, decreased to 2003, and increased again afterwards (Figure 24), as a result of new products entering the market. In 2007 it represented 2.5% of the national honey production (GPP, 2010: 43).

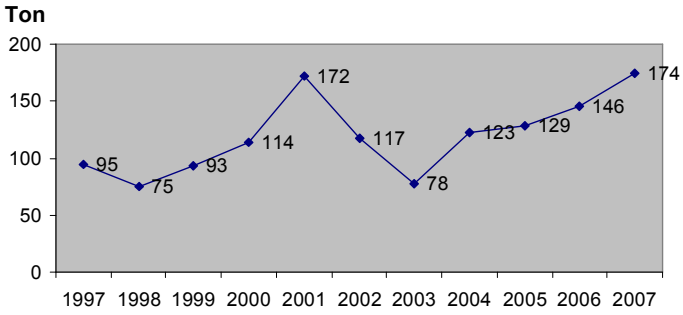

Figure 24. Evolution of PDO/PGI honey production

[23] Mel da Serra da Lousã PDO, Mel da Serra de Monchique PDO, Mel da Terra Quente PDO, Mel das Terás altas do Minho PDO, Mel de Barroso PDO, Mel do Alentejo PDO, Mel do Parque de Montesinho PDO, Mel do Ribatejo Norte PDO, Mel dos Açores PDO.

The sector is composed of 360 apiculturists, 22 mil beehives and the production is 174,000 tons of honey (GPP, 2010: 27). *Mel de Barroso* and *Mel do Parque de Montesinho* are leaders in the market. *Mel da Serra da Lousã* comes in third, far behind the other two (Figure 25).

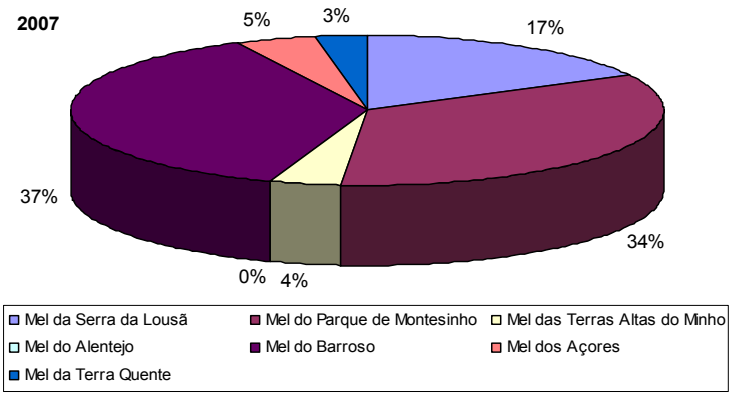

Figure 25. PDO honey per type of product

Prices and production value

Producers' prices vary a lot from product to product (Figure 26) and have been steady over the years.

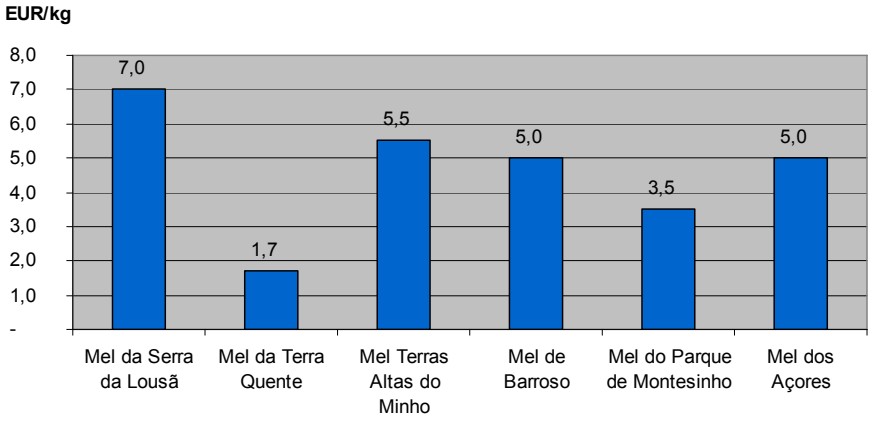

Figure 26. PDO/GPI honey prices

The volume of business associated with this type of products is very near 826,000 Euros (GPP, 2010: 43), it is worth 1.2 % do of the national PDO/GPI production and has been evolving as shown in Figure 27.

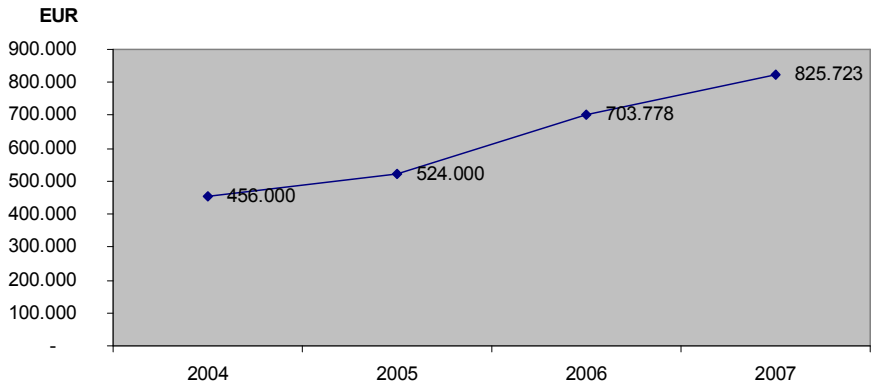

Figure 27. Volume of business generated by the PDO/GPI honey sector

Commercialization

The values weighted show the diversification of commercialization channels. However it is possible to highlight three products which favour a specific commercial channel: *Mel dos Açores* (retail stores/supermarkets/hypermarkets); *Mel das Terras Altas do Minho* (fairs); *Mel da Terra Quente* (processing units and honey packers) (Figure 28).

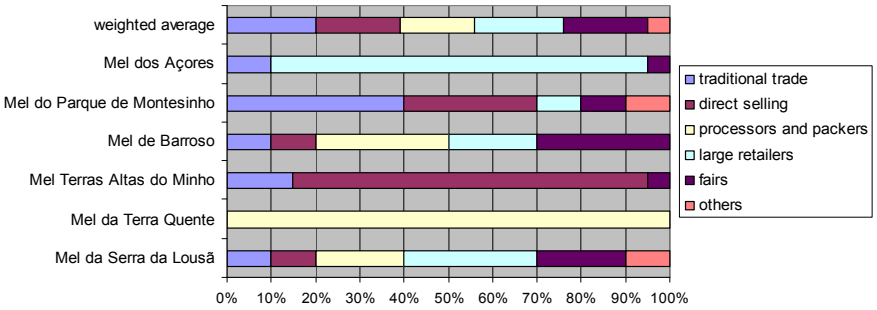

Figure 28. PDO/GPI honey commercialization

Products are sold by their respective Groups of Producers (84%) or by individual producers (16%) (GPP, 2010: 40). Their main destination markets are the national market (62 %), the local market (29%) and the international market – EU (8%) (GPP, 2010: 41). Individual producers take on an active role both in the process and in the product's commercialization. The PDO honey sector is taking the first steps towards internationalization.

Cheese

Products and evolution of production

The 14 Portuguese PDO/PGI ***cheeses***[24] are as follows: sheep cheese (seven), goat cheese (one), and cheese from a mixture of sheep's and goat's milk (four) and cow milk cheese (two). They are produced in 820 farms and 70 processing plants all over the country (GPP, 2010: 7). Figures 29 and 30 show the distribution of farms and processing plants according to the different products.

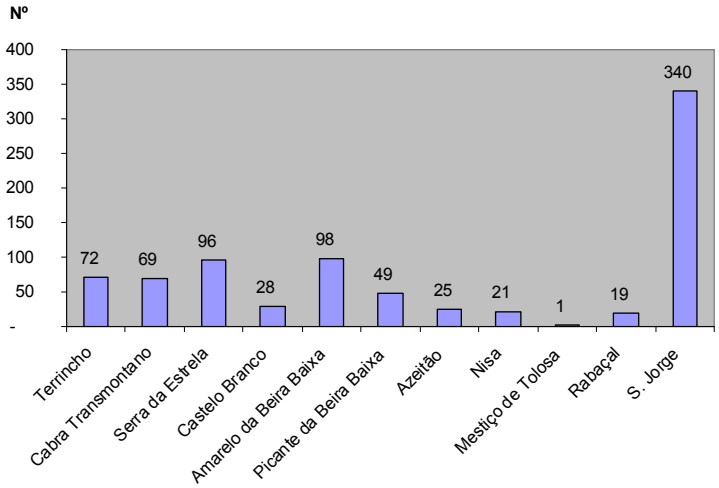

Figure 29. Farms engaged in the production of PDO cheese

[24] *Queijo de Azeitão PDO, Queijos da Beira Baixa PDO (Queijo Amarelo Da Beira Baixa, Queijo de Castelo Branco e Queijo Picante da Beira Baixa), Queijo de Cabra Transmontano PDO, Queijo de Évora PDO, Queijo de Nisa PDO, Queijo de Serpa PDO, Queijo do Pico PDO, Queijo Mestiço de Tolosa IGP, Queijo Rabaçal PDO, Queijo S. Jorge PDO, Queijo Serra da Estrela PDO, Queijo Terrincho PDO and Requeijão Serra da Estrela PDO.*

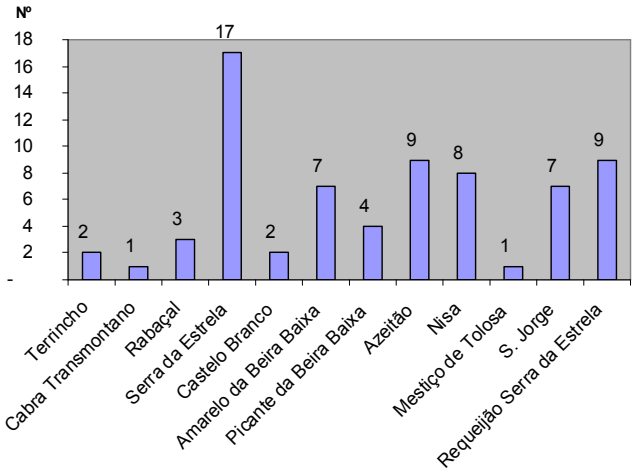

Figure 30. PDO cheese processing plants

The sheep and/or goat PDO cheese production reveals stability - around 1.4 tons (Figure 31) - and accounts for 2.3% of the national production of that sort of cured cheese (GPP, 2010:43).

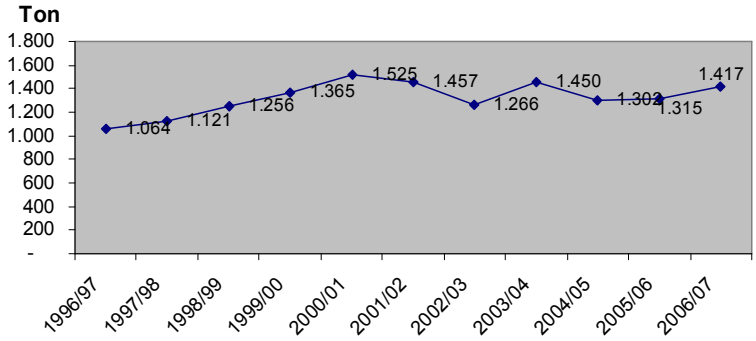

Figure 31. Evolution of PDO cheese production

Queijo de S. Jorge (cow milk cheese), with a 48% production volume, and the sheep cheeses from Azeitão (12%), Serra da Estrela (7%) and Nisa (7%) are the most representative (Figure 32).

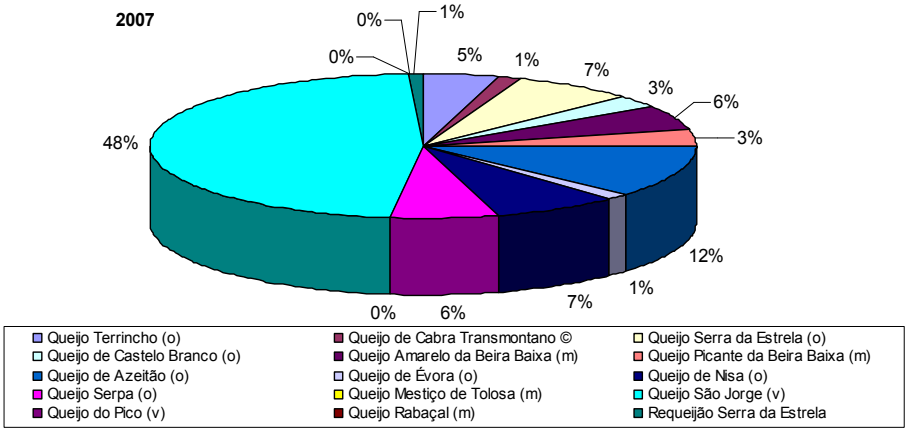

Figure 32. PDO cheese per type of product

Prices and production value

PDO cheese prices show some stability. Figure 33 shows the prices practised during the 2007 cheese season. Although *Queijo de S. Jorge* is a cow milk cheese, it reaches lower prices at the first transaction, whereas *Queijo Mestiço de Tolosa* followed by the cheeses from Azeitão and Nisa, both

sheep cheeses, are the most valued. In most cases PDO products are more valued, compared to other cheeses not bearing a PDO (GPP, 2010: 8).

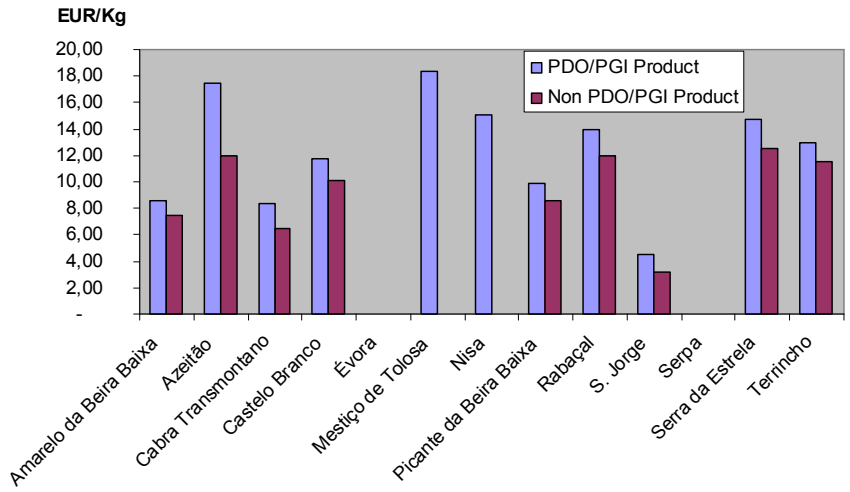

Figure 33. PDO/GPI cheese prices

As it is shown in Figure 34, the production value of these products is about 13 million Euros (GPP, 2010: 43) and represents nearly 19% of the business value generated by PDO products' national market.

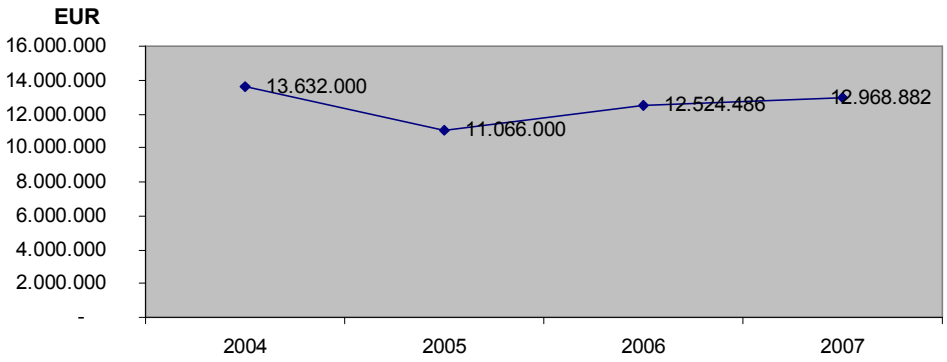

Figure 34. Volume of business generated by PDO/PGI cheese sector

Commercialization

Processing and packing plants, along with retail stores/supermarkets/hypermarkets, ensure the distribution of PDO/GPI cheese. Cheeses like *Rabaçal*, *de Cabra Transmomtano* and *Terrincho* have seen their distribution channels diversified (Figure 35).

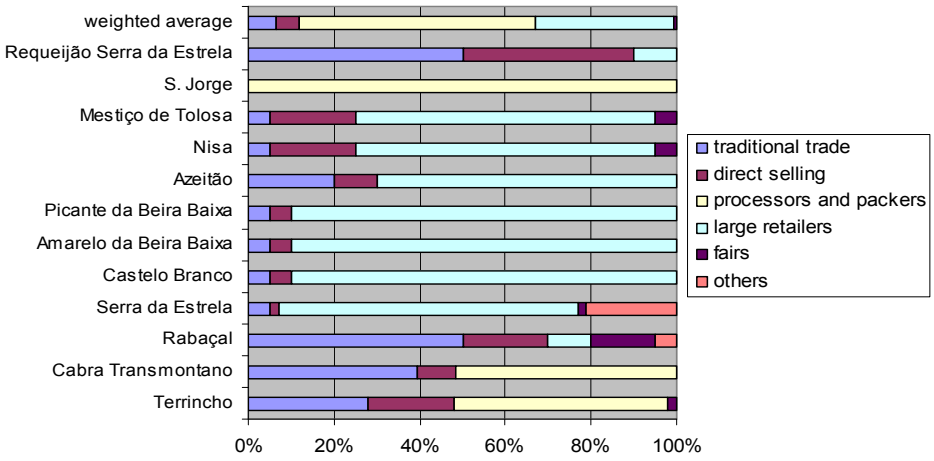

Figure 35. PDO/GPI cheese commercialization

Products are sold by their respective Groups of Producers (51%), by individual producers (21%) or by some other entity (28%) (GPP, 2010: 40). The national market (79 %), the local market (17%) and the international market – EU (4%) are their main destination markets (GPP, 2010: 41). In this sector, Producer Groups do not hold the exclusivity for commercialization and the sector's internationalization is just beginning.

Olive oil

Products and evolution of production

In the ***olive oil*** sector, there are seven PDO products[25], responsible for 2.3 million litres of overall production, which is equivalent to 7% of the national olive oil production (GPP, 2010: 43). After an initial period of growth, PDO olive oil production in Portugal seems to be decreasing, although in 2003/2004 there was another period of growth (Figure 36).

About 8,000 farms produce these products, occupying an area of approximately 35,000 hectares (GPP, 2010: 30).

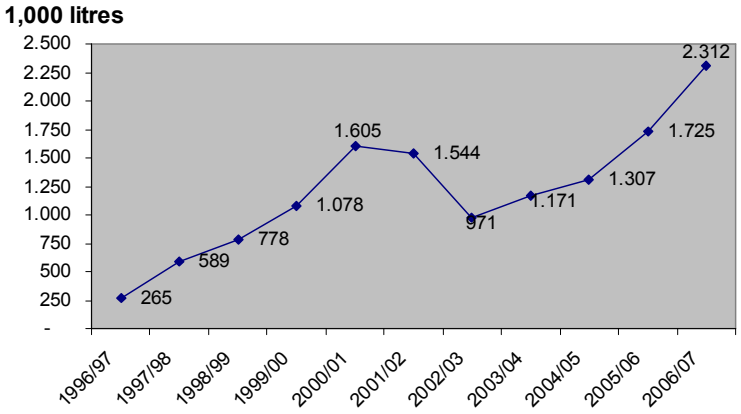

Figure 36. Evolution of PDO olive oil production

[25] *Azeites do Norte Alentejano, Azeite de Trás-os-Montes, Azeites da Beira Interior (Beira Baixa* and *Beira Alta), Azeites do Ribatejo, Azeite de Moura, Azeite do Alentejo Interior*.

Azeite de Moura is number one in the market, followed by *Azeite de Trás-os-Montes*, which comes in second, considerably far behind the leader (Figure 37).

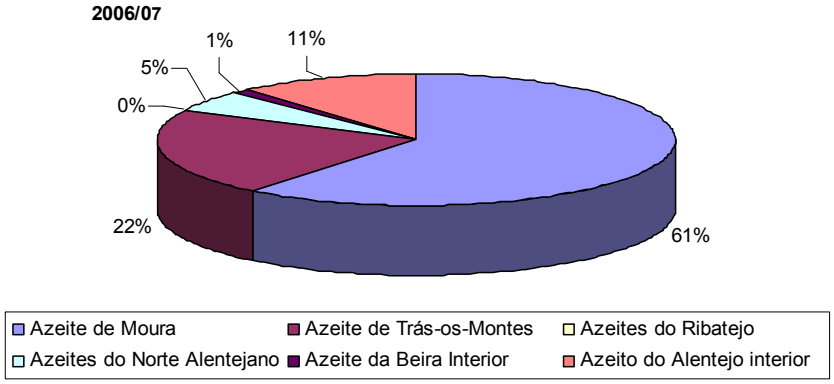

Figure 37. PDO olive oil per type of product

Prices and production value

PDO olive oil prices show some homogeneity - varying between Euro 4.00 per litre (*Azeite de Trás-os-Montes*) and Euro 6.00 per litre (*Azeites de Beira Interior* and *Azeite do Alentejo Interior*) - besides being stable (GPP, 2010: 31). Volume of business grew twice as much between 2004 and 2007 (Figure 38) and represents 15% of the value generated by Portuguese labelled products.

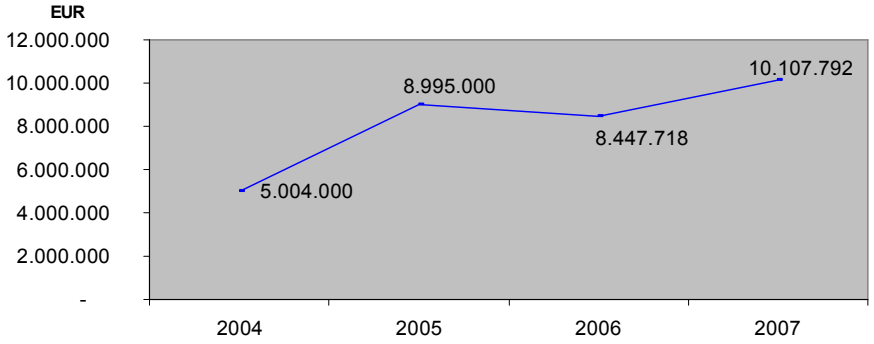

Figure 38. Volume of business generated by the PDO olive oil sector

Commercialization

Large retail stores/supermarkets/hypermarkets are the favourite commercial channel for this type of products. Operators for *Azeite do Alentejo Interior* and *Azeite da Beira Interior* prefer selling the product directly, whereas *Azeite de Trás-os-Montes* has diversified commercialization channels (Figure 39).

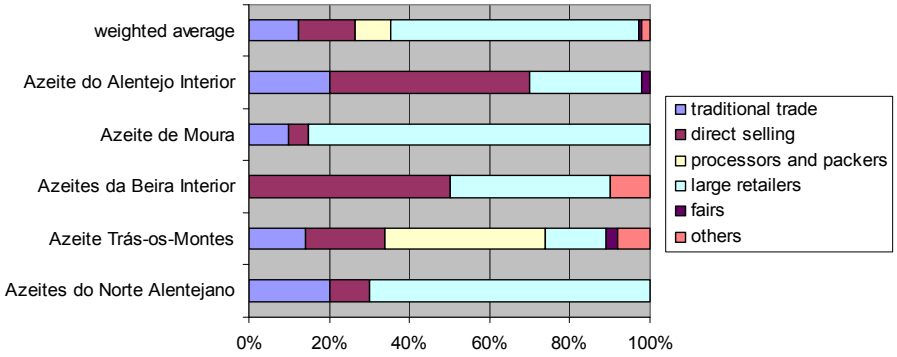

Figure 39. PDO/PGI olive oil commercialization

Products are sold by their respective Groups of Producers (31%), by individual producers (7%) or by some other entity (7%) (GPP, 2010: 40). Their main destination markets are the national market (85 %), the local market (9.5%) and the international market (within the EU, 4.4% and outside the EU, 1%) (GPP, 2010: 41). In the PDO olive oil sector, Producer Groups have little intervention as far as the product's chain of value is concerned. The sector's process of internationalization is still rather incipient, despite its relevancy for the economic survival of specific regions of the country.

Fruits

Products and evolution of production

The 21 PDO/PGI ***fresh fruits*** include several products such as apples (five products), chestnuts (three) olives (two) cherries (two), pineapples (two), pears (one), peaches (one), prunes (one), almonds (one), passion fruit (one), citrus (one) and cherimoyas (one), most of them currently available in the market (GPP, 2010: 33). The volume of the PDO/PGI fresh fruit production has been increasing (Figure 40) and it now represents 7% of the national production for the various categories of fruits considered (GPP, 2010: 43).

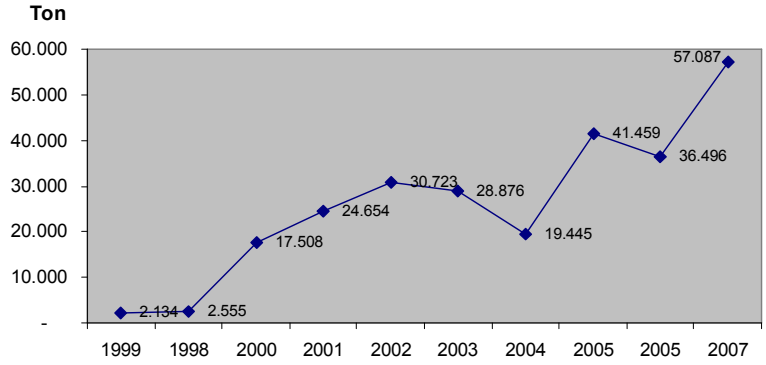

Figure 40. Evolution of PDO/PGI fresh fruit production

The PDO "Pera Rocha do Oeste" (a pear from the central western part of the country) is the most important product with 92% of the PDO/PGI fresh fruit production (Figure 41). The remaining products are mostly small-scale products.

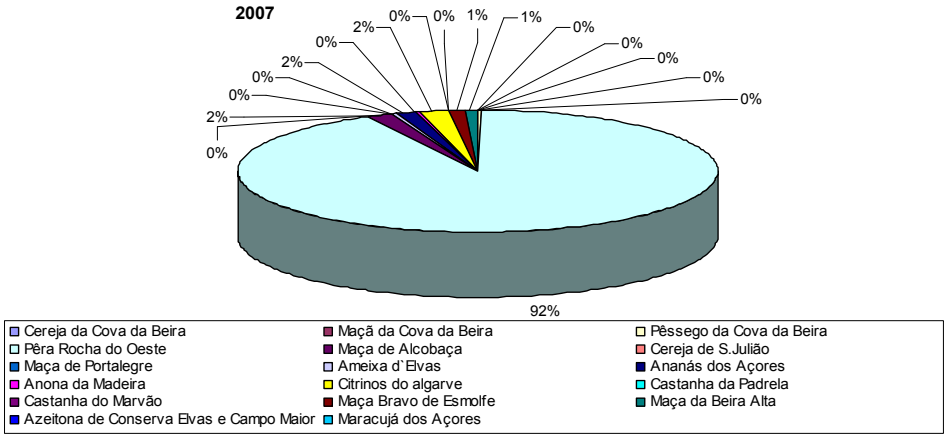

Figure 41. PDO/PGI fruits per type of product

The sector consists of 1200 farms at national level which cultivate 5,500 hectares. *Pêra Rocha do Oeste* (pears) (62% of the farms and 54% of the area), Citrus from Algarve (13% of the farms and 18 % of the area) and *Maçã de Alcobaça* (apples from the Alcobaça region) (12% of the farms and16 % of the area) are the most important products (GPP, 2010: 34).

Prices and production value

Given the great variety of products, there is also a large variation in prices; furthermore, there is not enough information available as to allow a comparison between PDO/PGI prices in their respective reference markets and non-certified products' prices. Production value in this sector is of 35 million Euros and its evolution is a little irregular (Figure 42), representing 45% of the value generated by the national PDO/PGI products sector.

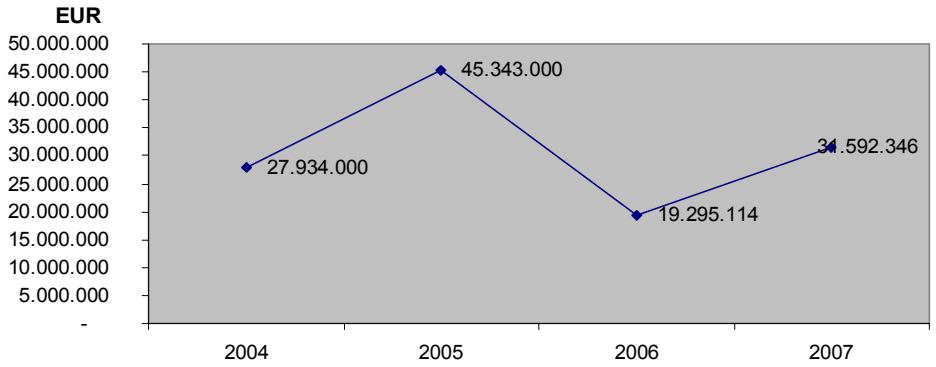

Figure 42. Volume of business generated by the PDO/PGI fruit sector

Commercialization

Portuguese PDO/PGI fruits are sold by their respective Groups of Producers (90%), by individual producers (1%) or by some other entity (9%) (GPP, 2010: 40) via large retail stores/supermarkets/hypermarkets (98%) and small traditional stores (2%). Their main destination markets are the international market (58% within the EU and 29% outside the EU), the national market (12 %), and the local or regional market (1%) (GPP, 2010: 41). In other words, the PDO/PGI fruit sector is an internationalized sector, thanks, among others, to Pêra Rocha.

Horticultural products and Cereals

The process of registering brand names is still very recent as regards horticultural products and cereals. Therefore, there are only three protected brand names for those products, so far. [26] *Batata de Trás-os-Montes* (potatoes produced in Trás-os-Montes region) is the only product available in the market. Its commercialization process began in 2006, with a production volume of 547 tons, which dropped to 187 tons in 2007. Currently it represents 0.03% of the product's national production (INE, 2007). The *Batata de Trás-os-Montes* is sold by its respective producers' group (100%) (GPP, 2010: 40) to the national market (100 %) (GPP, 2010: 41), via large retail stores/supermarkets/hypermarkets (99%) and traditional stores (1%). Its average market price is Euro 0.30 per Kg (GPP, 2010).

Conclusions

There are already over a thousand agri-food products with a protected designation (PDO/PGI/TSG) according to the European agricultural product quality policy. About eight-hundred of these products are regularly available in the market and generated over 14 billion Euro worth of volume of business. Portugal represents around 15% of those products (120), but only 0.5% (70 million Euros) of the overall volume of business. These indicators clearly show that most Portuguese PDO/PGI products are small scale, have a weak presence in the market and a low economic value. As a matter of fact, they are worth only 0.56% of the volume of business generated by the national agri-food industry.
Portuguese qualified products are distributed according to the following designations: PDO (48%), PGI (49.5%) TSG (2.5%). The sectors of traditional sausage (31%), fresh meat (24%), fruits (18%)

[26] *Arroz Carolino das Lezírias Ribatejanas* GI (rice from Ribatejo), *Batata de Trás-os-Montes* PGI and *Batata Doce de Aljezur* GI (sweet potato from the Algarve).

and cheeses (12%) are the most representative in number of products. As regards volume of business, the most important sectors are: Fruit (45%), cheese (19%), fresh meat (17%) and olive oil (15%) sectors.

Fresh meat sector

- Beef products with a protected brand name amount to 11% of the protected brand names and 16% (11 million Euros) of national PDO production value. Production and its corresponding volume of business registered a sustained growth during the period under survey (1997-2007). Both the national and the regional market absorbed the whole of the production and Producer Groups control the commercialization process, especially via the large food distribution chains. *Carnalentejana* (60%) leads the market.
- Sheep and goat meat have a weak performance in the market, since together they represent 11% of brand names but only 1.7% of national PDO/PGI production value. Their evolution has been negative. *Borrego do Nordeste Alentejano* (sheep meat), with 58% of the market and *Cabrito de Barroso* (kid-goat from Barroso) with 60%, lead their respective markets. Producer Groups have the exclusivity for commercialization and place the product on the national market through great distribution.
- The PDO/PGI pork meat market is mainly defined by *Carne de Porco Alentejano*; it has evolved negatively and is worth only 0.1 % of the national PDO/PGI market. In this sector individual producers have some protagonism in the product's value chain.
- In the fresh meat sector there is no exporting business.

Traditional sausage sector

- Traditional sausage products represent 31% of national PDO/PGI products but only 3% of the volume of business. These indicators point to the great diversity of these small scale products, which are produced in specific regions of the country. Producer Groups have no interference on the production and commercialization of these products. Exporting outside the European Union has been gaining some prominence.

Honey sector

- Protected brand names in this sector represent 8% of all PDO/GPI products but their commercial value is only 1.2%. Despite its little dimension, the sector has been evolving positively and diversifying its commercialization channels while seeking internationalization through individual producers' active participation.

Cheese sector

- PDO/GPI cheese sector has experienced a slow growth, but it represents 19 % of the volume of business and 12% of all protected brand names, which makes it one of the most important sectors in the qualified products' niche. Producer Groups have at their disposal production plants and are responsible for selling the products but it does not mean that as filiere managers they stop individual producers from joining in. The sector is very keen on seeking its internationalization.

Olive oil Sector

- Along with the cheese sector, the PDO/PGI olive oil sector is one of the most important in the segment. It represents 7% of the national olive oil production and 15% of the whole PDO/PGI production value. It is a sector in which Producer Groups have the least interference on the product's value chain, making room for private initiative. Regardless of the sector's national and regional economic relevance, internationalization is still rather incipient. *Azeite de Moura* is the leader product in the market.

Fresh Fruit Sector

– PDO/PGI fruit sector is recognised overseas and has evolved positively, leading the PDO/PGI segment market in Portugal (45% of the volume of business and 18% of the number of products). *Pera Rocha do Oeste* (92%) leads the sector and represents 7% of the fresh fruit national production.

In conclusion, some Portuguese PDO/PGI products may be said to show rather positive evolution trends (beef meat, honey, cheese, olive oil and fresh fruits). However, the fact that 32% of the products are not available in the market together with the little economic weight of some of them on their reference market are a clear indication that there is still a long way to go regarding their promotion and marketing. The products are commercialized by their respective group of producers (87%), by individual producers (2%) or some other entity (11%) and the national market is their main destination. Producers and other entities favour intensive distribution and distribution channels are diversified. There are significant differences among the various sectors and the products of the same sector. However, certain channels predominate. As a rule small retailers do not play an important role in the distribution process, which is mostly controlled by large retail stores/supermarkets/hypermarkets. The food and catering channel does not play a significant role in the distribution of PDO/PGI products.

The quantitative information examined in this paper is not enough to allow us to assess the causes for and differences between the dynamics studied. Yet, previous case studies refer some of the aspects we have highlighted. In general terms, PDO/PGI production in Portugal has been increasing gradually, but its market share is still low in the context of its respective reference markets. Tibério (2004) points out some factors which may account for this situation, such as: (i) the diversity of resources, and the dynamics and capacities of the PDO/PGI managing entities to differentiate and to commercialize the product; (ii) the "top-down" generation of some processes of PDO/PGI registration and management; (iii) the nature of each product and its productive and commercial dimension; (iv) the sustainability of the traditional channels in the retail trade.

As regards the development of PDO/PGI supply chains in Trás-os-Montes (Portugal), Tibério (2007: 131, 2009: 189) claims there is still room for improvement, but difficulties of a structural nature are not to be expected, since the products' development is mostly dependent on their competitive position (internal environment) rather than on the attractiveness of their reference market (external environment).

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NETWORKED SCHOOLS AND EDUCATION INEQUALITIES IN BORDER AREAS

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Abstract
The focus of this paper is on network integration issues and their potential to support the development of ICTs applications in education in border and peripheral areas. The paper elaborates on the concept of 'networked school' as the core of educational applications in such areas, considered as a 'gate', through which they can get access to knowledge stock and information outside their frontiers. Such developments can complement traditional educational processes at the primary and secondary school level, but also enhance vocational training prospects in less privileged regions.

***Keywords**: ICTs applications, education, training, networked school, peripheral regions*

JEL, **classification** R10, R40, R30

1. Introduction

Network integration is a crucial aspect in the context of the information economy, due to its potential to ensure 'connectivity' among regions, through integrated transport and communication networks. Especially the later is considered as the cornerstone of various telematic applications, applying in many fields of the economic and social environments e.g. e-commerce, e-training, virtual organization, teleworking, telemedicine.

Such applications provide a promising prospect especially for border areas (e.g. peripheral, isolated or less developed regions), due to their potential for removing various types of *barriers* established in these regions, strongly conditioning their development potential.

The focus of the present paper is on the role of ICT applications in the field of education in border areas. More specifically, the paper concentrates on the role of specific applications in education in these areas. In chapter 2 the main characteristics of the border areas are discussed, together with aspects relating to educational inequality. Chapter 3 focus is on the technical aspects of network integration – the 'technology' – in border areas. In Chapter 4, the prospects of education in a network environment are studied, where, among others, some basic definitions as well as issues involved are discussed. Chapter 5 concentrates on the concept of 'networked school' as the 'core' of potential educational applications in border areas – the 'users' of the technology. In this framework various network-based learning environments are presented, together with their prospects and limitations for educational purposes at the various levels. Finally, in chapter 5 conclusions and prospects are drawn.

2. Peripheral Areas and Educational Inequality

Various definitions of border areas can be found in the literature. In this context border areas are defined as peripheral areas – not necessarily lagging or underdeveloped, which are less oriented towards the center and more to the external economic world (Nijkamp [17]). Border areas can also be considered as countries or regions at the boundaries of the developed world, which also have the role of 'gateway function' between developing and developed countries (Giaoutzi and Stratigea [9], Giaoutzi et al. [10]). In the European context, the distinction between 'internal' and 'external' border regions has also been introduced, differentiating thus a frontier between two EC members from an EC member with a non-member respectively (Hitiris [14], Armstrong and Taylor [3], Geenhuizen et al. [7]). Border areas are also defined as regions distinguished by a certain type of *discontinuity* in terms of their specific geographical characteristics (Reichman [21], Ratti and Reichman [20]). Other studies perceive border areas as being equivalent to frontier between states (Anderson [2], Boot and Van der Veen [5], Corvers and Hassink [6]).

An important characteristic of border regions is discontinuity, which becomes much more evident in a network structure (Reichman [21], Rossera and Ratti [23]). They may include discontinuous communication infrastructures for transport, telecommunications, legal codes and procedures and missing or dissimilar institutional mechanisms that help regulate and enforce property rights, commercial transactions and contractual arrangements. These discontinuities usually account for *development lags*, which lead to significant *transboundary disparities* (Giaoutzi [8]).

In contrast with peripheral regions, border region barriers are more difficult to break down, since they are the product of both domestic and international political structures and of development lags. In most cases, border areas are having very little influence on the decision-making processes of the central government, even in matters that have a direct impact on them. Therefore these barriers are tending to be less permeable over the long term, especially on infrastructural development, innovation diffusion and public resource investments (Reichman [21]).

From their definition, it is evident that border regions can play a dual role in the spatial system, acting as both *barriers* in a spatial network and *contact points* for spatial flows. Border regions, in their 'barrier role', are hampering the smooth flow of goods, persons and information, while in their role as 'contact points' they partially allow this flow by applying a filter function (Blaas and Nijkamp [4]). The role assigned to a border region - namely barrier or contact point - is strongly dependent upon its connectivity to other regions, which refers to the region's network infrastructure and its performance.

It would be expected that border regions or peripheral regions in general would be more inclined towards the adoption of advanced communications systems, thus compensating for the physical distance drawback and its consequences. Various studies though, focusing upon the issue of variations in the up-take and adoption of advanced communications systems and their applications in border areas, have revealed a consistent pattern in the opposite direction. In fact, they have concluded that it is the *complexity*, which drives the demand for electronic communications and not the distance between communicating parties (ACCORDE [1]).

Apart from the complexity paradigm, which consists of a main barrier in adoption and use of advanced communications systems and their applications in border areas, certain other barriers are also applying in this respect, which can be summarized into the following categories:

- Barriers relating to the lack or inadequacy of the necessary *telecommunications infrastructure*; less favored regions are usually characterized by poor infrastructure, leading thus to restricted range of applications with poor quality and high costs (Giaoutzi and Stratigea [9]).
- Barriers relating to the lack of *sufficient information* on the potential role of various applications of advanced telecommunications systems towards increasing efficiency in border regions.
- Barriers in the *organizational system*, reflecting poor and ineffective organizational schemes (both public and private) present in border areas, which limit the ability to manage complex situations (Parker and Hudson [19]).
- Barriers in the *regional economic system*, relating to the 'resistance' of border economies in the transition from traditional to service or information economies. Culture, tradition, education and training facilities etc. are several of the main factors beyond this resistance (Giaoutzi and Stratigea [9]).

- Barriers at *adoption rates* of ICTs, relating to cost barriers involved in joining the network, qualification barriers associated with the existence of sufficient skills to effectively adopt such technologies and service provision barriers, linked to the limited support of potential users by skilled professionals in the field.

In order to overcome these barriers, two directions of action are of importance, namely the:

- Network integration aspects (the technology); and
- Promotion of user-oriented applications in various fields (the users).

The first relates to the provision of *cross border infrastructure* as a 'tool' supporting the introduction of various applications in border areas i.e. the 'technology' to be used. This is strongly related to available funds and political priorities of the central government in respect to regional development; and technical aspects of network integration, i.e. technological requirements of the necessary network infrastructure.

The second is focusing on the promotion of the *user-oriented applications* in the various fields of activity. This implies the 'use' of the specific technology in order to solve various types of problems. It is clear that the latter may consist of a very time-consuming process, especially in the context of border areas, as it is largely based on the cultural aspects of local communities, the existing stock of knowledge, the financial aspects involved for the adoption/use of these applications (e.g. proper equipment costs), the lack of skills for handling such applications, etc., which determine the demand for such kind of applications.

Evidence from various empirical studies shows that adoption and use of advanced communication systems and their application can, apart from the economic dimension, contribute also to the social dimension of border areas, improving social services such as education, health and administration of government services. The improvement of such services in border areas can have multiplier effects on local economies as a whole (Reichman [21]).

In the sequel, the role of such systems in the field of education will be considered. The reason for such an approach is that education, especially in the early stages of human's life, can largely contribute to the change of attitude against technology of a very dynamic component of the population of local communities, the young people, by increasing their knowledge and skills in respect to advanced services and by providing a 'gate' to the external world and opportunities. This, in turn, can affect the patterns of use of these technologies. It may also increase the knowledge stock of schools on behalf of the education process as well as their ability to interact with other school communities and exchange experiences on various educational issues. The latter is quite important in the context of border regions, where access inequality deprives schools from getting experiences and knowledge and interacting with school environments and other sources of knowledge and information outside their frontiers.

3. Aspects of Network Integration in Border Areas

Networks have long been discussed as a revolutionary technology that will drive the evolution of all aspects of human life in the future. The Internet, initially a military network (ARPANET), later an academic network and lately an integrated business and communication network has been expanding with amazingly high rates. Something that non-technical audiences often ignore is the fact that the technologies that today form the Internet are not initially developed with security and manageability in mind. In the real life, every user has some experience of bad or not stable lines and generally of poor quality of service, both at the network and the application level.

Nevertheless, the technical infrastructure of the Internet is neither homogeneous nor granted to be everywhere. It is quite clear that no dominant entity exists on the Internet. No single authority has the power to decide upon connectivity, technologies, security, or anything at all. There is a vast range of even competing technologies that co-exist and collaborate to form the global network, often drawn as a cloud that is perceived as the Internet.

Access to Internet requires the subscription to an Internet Service Provider (ISP). Becoming an ISP requires investments on expensive network and hardware infrastructure, which brings into discussion the issue of business viability and profitability. ISPs have never been and will never be social utility providers, such as power and water public-owned companies existing in various countries. If the critical market mass does not exist in one region, ISPs either do not offer their

services, or raise the prices. This goes along with telecom companies' policies. Since the liberation and privatization of telecommunications in Europe, almost everyone is connected to current digital networks offering voice telephony services. However, the technical infrastructure of such networks does not always permit high-speed Internet connectivity, according to the current perception of network bandwidth and to the requirements of advanced Internet applications.

The less-favored areas with respect to high-speed Internet connectivity are the border areas, where investments both from ISPs and telecom companies are still considered of high risk and low profit, compared to alternative options. There are several reasons for this, ranging from the number of non-urban and border residents, to the educational level and cultural characteristics of such populations, which do not push citizens to consider Internet access as a necessity. Of course this gradually changes, however not with the rates that would be required for the creation of the critical mass mentioned above.

Investments made in backbone networks usually concern the connectivity of large urban centers at very high speeds. New mid-level high speed technologies, such as optical metropolitan area networks are also commercially available. Yet, in most cases they are not available to border areas, where the dial-up connection is the most common case of Internet connectivity for both individuals and organizations. Hence, it would be realistic not to consider the availability of high-speed Internet connectivity of border schools as granted.

In the light of the liberalization of the telecommunications market, the goal of reaching the status of effective and equitable infrastructure provision, especially for border or disadvantaged areas, can be succeeded through several schemes such as (Hudson, [15]):

- Provision of incentives, through competition or concession to telecommunications operators;
- Policies to foster investments and competition in the telecommunication industry in order to assure continuous innovation and aggressive pricing of services;
- Requirements of licenses or franchises, like the *U*niversal *S*ervice *O*bligation (USO) condition, as a prerequisite of license provision to operators, applied by many countries; or the carrier of last resort model, via which the dominant carrier, entitled to a subsidy, has the obligation to provide the service if no other carrier will;
- Various forms of subsidization of services in areas, which are thought as less profitable to serve. Subsidies may apply in both high cost areas (isolated areas, areas with very low population etc.) and disadvantaged areas or customers, relating to areas or groups, which cannot afford the costs of getting access to and use of such services. Some countries are applying the route-averaging model, which requires all rates to be averaged so that every customer is paying uniform distance charges, regardless the location.

4. Education in Network Environments

The use of Internet and particularly the World Wide Web has widened the potential of information gathering and exchange. 'Netizens' have access to vast information sources; learners have access to experts-based learning resources, widely dispersed in the cyberspace, which would, otherwise, not be accessible. At the same time, networks offer many broadcasting possibilities. Practically everyone can set up a web page and distribute information worldwide. Computer-mediated communication is rapidly expanding, enabling people with shared interests to create and sustain relationships and virtual communities. Put in the context of education, despite the lack of physical contact, CMC facilities allow students to support the exchange of knowledge and information and to *'realize' a sense of belonging* [Hiltz and Wellman [13], McConnell [16]).

Network technologies are used as the cornerstones of the new learning environments within educational systems. Such environments support or even partially automate the instructional process. The use of new pedagogical frameworks in network environments is encouraged. It is desirable and in some cases common case that collaborative learning and peer learning co-exist within the new pedagogical frameworks.

Hiltz and Wellman [13] defines collaborative learning as '… a learning that emphasizes group or cooperative efforts among faculty and students. It stresses the importance of active participation and interaction on both the students and the instructors' side. Knowledge is viewed as a *social construct*,

and therefore the educational process is facilitated by social interaction in an environment that facilitates peer interaction, evaluation and cooperation'.

In order to discuss the issue of education in a network environment, it is essential to clarify the meaning of three key terms, namely culture, training and education.

Culture is used to denote all kinds of stimulations that people receive from their social environment throughout their whole life. It is what a social environment 'broadcasts' in terms of social behaviour codes, ethics, customs, and values. Culture is by no means a collection of knowledge. It relates to the conception of the historical evolution by the individual, which partly corresponds to a non-determined amount of knowledge.

The second key term is *training*, which refers to the process of delivering knowledge from one part to another, so that a defined goal can be achieved. For example, in vocational training the objective of the knowledge delivery process is to support persons in obtaining the skills required to enter a specific job market.

Education, the third key term, as a notion and a social activity, relates both to culture and training. It is offered starting from the first years of a person's life, as an organized social process for delivering culture, ethics and values, as well as some knowledge, in case of vocational training. However, the provision of skills required to find a job is not its main objective. Education is a social service that primarily aims at reproducing and evolving the society itself.

Culture is 'broadcasted' by everything in a social environment: family, school, personal relations, media, computers, fashion, music, etc. Paradigms and messages of any kind are 'transmitted' by society in general to every single individual, and vice versa. Their perception depends on economical, geographical, historical, and cultural conditions. This diversity in perception generates the powers that push the wheel of social evolution. Bearing this in mind, it is important to distinguish between the means and the purpose. The same means can be used either to favour one purpose, or equally well to harm another, depending on the nature and the characteristics of the parties involved. It is the use, not the tool itself, which makes the difference between 'good' and 'bad'.

New computer and network-based tools (hypermedia, Internet, World Wide Web) have stimulated a vast number of investigations into the opportunities and challenges of putting these tools into the field of education (Retalis et al. [22]). Their adoption in the education field can lead to the effective removal of various types of constraints, which can be properly crossed by using computer networks. This fact is quite essential in the context of peripheral and border areas.

Theoretically speaking, one would expect that the education community defines the way computer networks are used in education. However, this is not usually the case. Although the 'marriage' between the 'technology push' and the 'learning pull' is desired to be dominated by the latter, educators are seldom the policy makers for incorporating computer networks in the learning process. Thus, in many cases, the driving force for putting computers into schools is the 'technological determinism'.

Integrated global computer networks are certainly a catalyst for change, which could bring about a new revolution in education. A revolution that deals with the philosophy of how one teaches, the relationship between teacher and student, the classroom structure, the relationship of the networked school and its external environment and the nature of curriculum.

Network deployments in the education field are enabling technologies for the collapse of several barriers existing today in terms of providing access to knowledge and opportunity, especially in geographically dispersed schools. Technology can also be a barometer of that change, providing of what is working and what is not. However, the definition of the networked school that provides equal access to culture, knowledge and social awareness, has still a long way to go.

Networked learning environments, as being time and space independent, have brought up new possibilities for collaborative learning (McConnell [16] in all scales: individual, classroom and school-wide (Collis and Smith [11]). The effectiveness of collaborative learning does not depend on the networks themselves, but on the definition and understanding of the roles of teachers and students in such learning contexts. Operating in a network-based educational context may generate a feeling of 'virtual symbiosis', although real social contact may never take place. However, networks are thought as the *prerequisite* for the realization of learning environments.

Networks also facilitate learners to become 'peer tutors'. Fellow students (peers) can ask individual or small group of students to present assignments to one another for discussion and

criticism. One exemplar case could be that all the assignments (different for each group of students) are on-line in order to enable the easy access to this material, the easy commenting by other students or groups of students and the exchange of ideas on the problem solving process.

5. Networked-based Learning Schemes

Controversial issues concerning the educational philosophy of different learning environments lie on the dilemma about teacher's role: '*A sage on the stage or a guide on the side?*' Figure 1 presents this concept, as well as the learning environment characteristics in each case.

In the case of traditional classroom (1a), the learning environment is homogeneous and learners have actual social contact with the tutor and their colleagues. The single handbook, the restrictions imposed by location, and of course the weaknesses of the tutor are usually mentioned as important shortcomings of this paradigm (Norman and Spoher [18]).

Figure 1b illustrates the 'learner-centered' approach, where by using network infrastructure and educational software, students benefit by accessing knowledge from many sources and thus many points of view (experts, virtual tutors, remote tutors etc.).

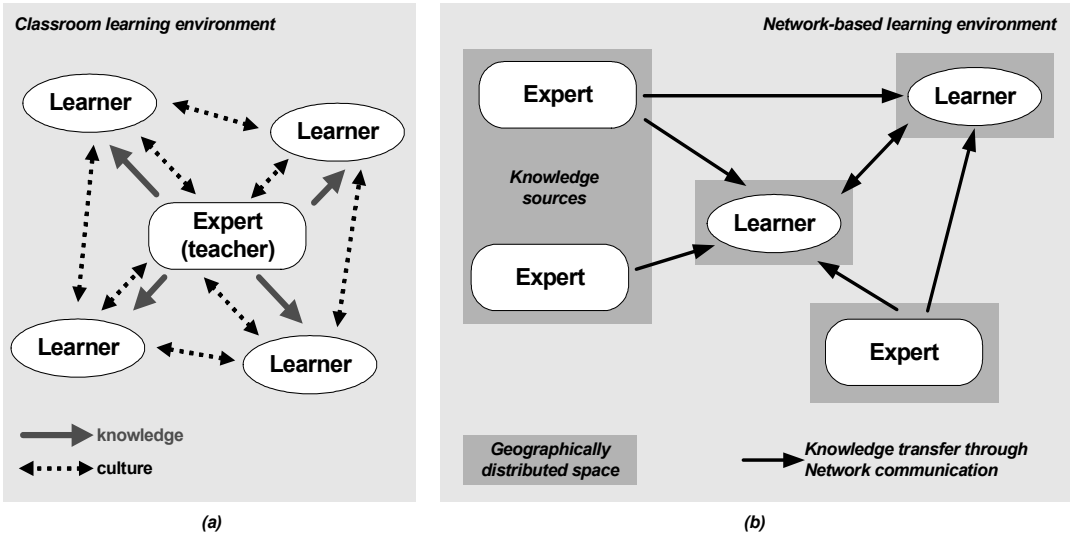

Figure 1: The traditional and the network-based learning space

Networked schools eliminate indeed time and geographical barriers, which is necessary in order to remove or reduce educational inequalities. They provide learners with access to information and learning resources 'when, where, how and as much as they want'. One extreme perception of the networked school is a 'wall-less' and 'paper-less' set of virtual, geographically distributed classrooms, 'open' to a wide population of learners (Graziadeli [12]). Disadvantaged children and other groups of non-privileged population (due to geographical, financial, socially and health reasons) can have access to school at their own convenient way.

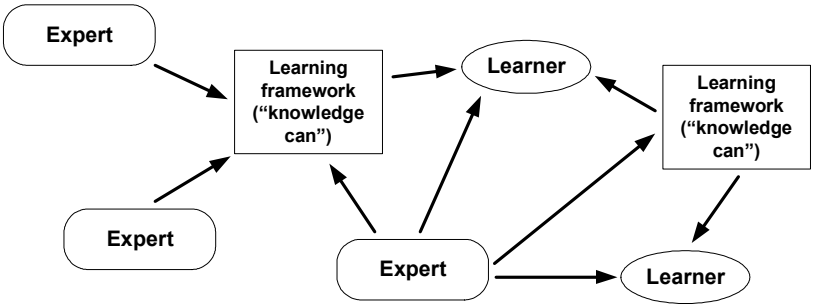

Figure 2: Modern network learning spaces involve both experts and software

Moreover, tutors and learners can communicate asynchronously at their preferable time of the day, having, as a result, more time for other creative activities. It is also stated that off-line interaction between teacher and students has better results in the quality of messages exchanged, than when they interact on-line or in person. Main reasons for this are that all parts have more time to think before sending a message as well as that, in some cases, students are reluctant to participate in classroom conversations. Modern learning frameworks incorporate learning material in 'knowledge cans'. By making such services available through the Internet, even asynchronous interaction between tutors and learners is not needed (Figure 2). Instead, all the work is done by software in the 'knowledge cans'.

As expected, there are not only pros in the networked school paradigm. In a traditional classroom learning environment, tutors give students their own ethical and cultural paradigm, which students, influenced from other stimuli as well, can decide whether to follow or not. In such a process, a young person learns how to be a member of a community, not of a virtual community, but of a real one. On the other hand, the networked learning environment is quite *heterogeneous*. Although perhaps 'bare' knowledge can be communicated better, the live paradigm of the inspiring tutor cannot be communicated to students. Independence from time and place might be a 'plus', but it has little to do with the fundamental nature of the educational process in elementary and secondary schools.

Researchers involved in this field, often have a strong technical background that guides them to invent new learning approaches in order to better exploit networks. Attention is focused on 'how to stress current educational practice in order to heavily use new technologies'. To support such positions, numerous references to current practice shortcomings are made.

However, since the educational process is a highly social process, involving 'real time' face to face interaction among the different actors, it seems that problems related to that process in border regions could not be solved by simply replacing classrooms with networks, teachers with multimedia databases and media streaming, and social interaction with computer messaging. The way young people learn highly depends on the unique characteristics of the social environment they belong to. Diversity is a source of evolution in nature as well as in society and this diversity is clearly reflected in both structures and contents of educational systems around the world. What seems to work under certain conditions is not guaranteed to do so anywhere else. Current network-based learning approaches do not seem to take this into consideration. Therefore they prove to be useful only under certain conditions.

Equity in access to the instructional process is a topic where actual progress is made indeed by using networks in education. However, this progress is rather quantitative than qualitative. The common denominator of those who have access to some instructional process increases, but so does the diversity between 'best' and 'some' education. The smoothing of social inequalities is fairly behind the numerical increase of those who have access to some elementary education.

Although education network environments may prove useful in reducing various barriers, applying in specific types of regions, and more specifically in peripheral and border areas, this seems to be accomplished by the adoption of the necessary scheme, relative to the type of educational level. It seems that the 'truth' lies neither on the unconditional acceptance of the proper technological applications, nor on the complete denial of them in the education field. It lies on the *proper use* of technology as a tool, under certain conditions, in every single educational context.

Culture is not something an educational structure can communicate by using impersonal tools. Tutors have been and will always be sources of inspiration and living examples for their students. Network-based technology cannot change that. The multi-faceted crisis of our era has its causes, among other things, in the lack of young people visions for the future, in the consumer-centered world, in the lack of historic consciousness etc. It is common knowledge that the most important role in the resolution of this crisis is to be played by the content of culture and education - not by the tools used to deliver knowledge.

These tools can be used effectively by assigning to them a complementary supporting role, while education retains its cultural, social and training role. Putting the two paradigms work together, as illustrated in Figure 3, can defeat several shortcomings of improper or unconditional usage of networks in education. The traditional classroom keeps its role in educating social-aware and responsible citizens, whereas network-based tools provide access to knowledge resources and services that would otherwise be unavailable. Schools located in border or other non-privileged areas can, by properly incorporating network technologies in the educational process, have access to a useful tool

for narrowing the gap of opportunities they offer to students, compared to those offered to students of schools in urban areas.

Networks in primary and secondary education continue to be seen as a bolt rather than an integral structure to quality provision in education. The networked school is not a panacea for the problems that are faced by the educational systems, but can add significant value to the learning process and cope with physical or other kinds of 'isolation' problems of students in border and peripheral regions, to the extent that they keep their role in culture provision. Particularly in border areas, the networked school is an opportunity for fighting educational inequalities and unequal access to educational opportunities, keeping always in mind that networks are just media - not social environments.

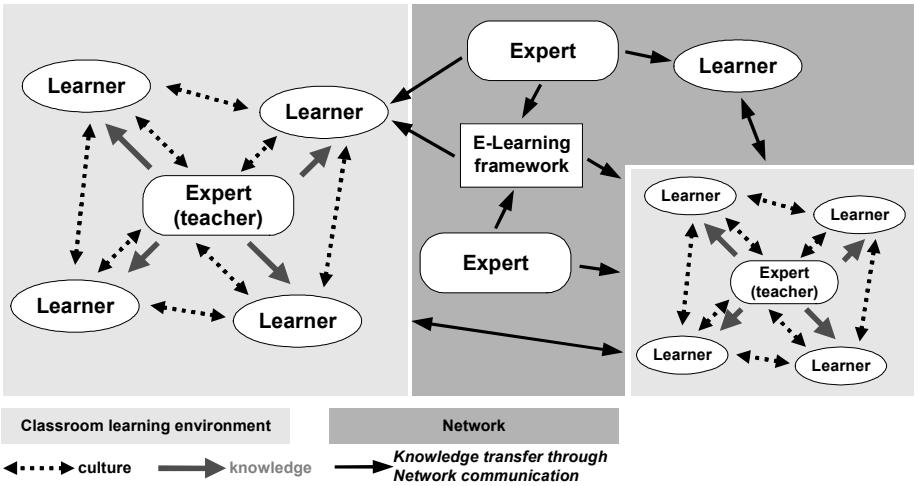

Figure 3: A synthesis of educational paradigms towards the networked elementary and secondary school

6. Conclusions and Prospects

The issue of network integration is a crucial aspect in the context of the network economy in terms of ensuring equal and efficient access of border and peripheral regions to knowledge, resources and opportunities. Nevertheless, advanced communications and their applications are not sufficient to overcome problems of peripherality and lagging development faced by border regions. Although they provide the 'core' for the development of various applications, they still have to be combined with a broader bundle of strategies that address problems of uneven regional development and opportunity in order to effectively support such regions.

Policy initiatives therefore focusing on the creation of an environment in which advanced services are offered should be combined with other policies as well, aiming at developing and diffusing these services among users (e.g. education, training, incentives to adopt such services, subsidization of costs involved in early adopters).

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MUNICIPAL SOLID WASTE MANAGEMENT OF TOYOHASHI CITY: AN ANALYSIS BY ENVIRONMENTAL KUZNETS CURVE

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Abstract:
Agglomeration of economic activities and decline in rural population are expanding city size in Japan. Chubu region is developing as a center for manufacturing and seaport related economic activities and Toyohashi, a mid-sized city in the region, is becoming a successful area for manufacturing and trading. As a result, alike other cities of Japan, the city is growing vertically and substantial daily output of waste by city dwellers is creating difficult situation to endorse proper processing technology and space for landfill. Mid-sized cities are facing difficult situation to combat such waste as the trend of generation, composition, and relevant management remain complicated. This paper provides an overview of municipal solid waste situation in Toyohashi city and estimates effectiveness of central and local level initiatives to manage the dilemma. The results of the study show that from 1980 to 2005, increase in municipal solid wastes generation can be explained by the growth in per capita EL. Evidences from Environmental Kuznets Curve (EKC) analysis reflect the effectiveness of governmental initiatives. The study also finds that technology of waste to power is effective even in a mid-sized city. The shortcoming of the study can be described as the limitation in research sample and data influence on the results coming out from market orientation. Technology mix and variety in direction toward the waste generation, disposal and economic benefit analysis was not taken care of by the study.
Keywords: *Municipal Solid Waste, City Economic Level, City Expenditure for Waste Management, Environmental Kuznets Curve, Toyohashi city.*
JEL, **classification** R10, R40, R30

1. Introduction

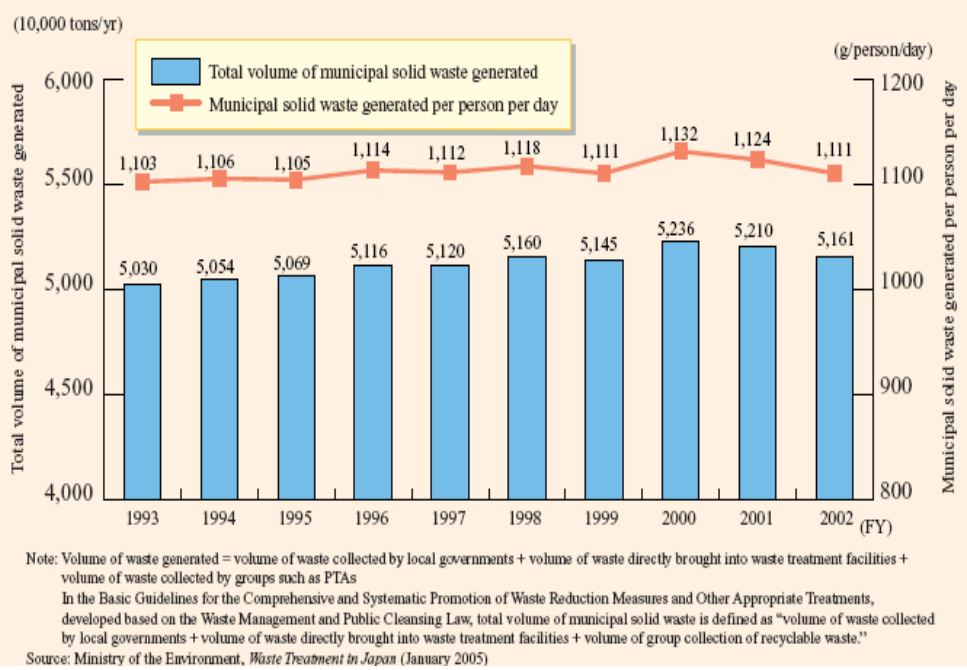
Rapid urbanization together with its increasing economic activities in city areas are causing greater challenges to urban environmental management. The typical structure, scale and scope of city economic development are creating uninvited impacts on the safety of the natural environment. Cities are emerging as the driving force of the economic activities and are supplying essential knowledge of production and innovation. The future cities are therefore a vital element of the global future. Understanding the relationship between city development and environmental collision is therefore critical. An important aspect of city activities is the generation of various forms of waste. Industrial, commercial, municipal activities within the city generates large scale of wastes than rural settings and are becoming the most important environmental problems for city (Buenrostro and Bocco 2003 [5]; Pokhrel and Viraraghavan 2005 [23]). Global generation of municipal solid waste in 1997 was 0.49 billion tones (Suocheng et al. 2001 [31]) and it stood at 2.02 billion tons in 2006 (Global Waste Management Market Assessment Report 2007 [9]). The link between growth in wealth and increase in

waste is narrated as the more affluent a society becomes the more waste it generates (Takanori, 2008 [34]). In order to achieve sustainable growth, therefore, elimination or minimization of any negative environmental impacts resulting from economic activities is a necessary criterion.

Study of the Environmental Kuznets Curve, EKC hypothesis provides empirical evidences that some pollutants follow an inverse-U-shaped pattern relative to income. The EKC hypothesis states that for many types of pollution, environmental damage increases up to a certain level of GDP per capita, and then begins to decrease as income increases further. Environmental pollutants for which this relationship holds include particulate matter, sulfur oxides, fossil fuel forms, ambient air impurities, and the rate of tropical deforestation (Mazzanti, et al., 2009 [16]). Different studies have found a range of shapes of the EKC as the shape depends on the pollutant and income growth stage (see Grossman and Krueger, 1991 [10]; Shukla and Parikh, 1992 [28], Shafik and Bandyopadhyay, 1992 [26]; Beckerman, 1992 [3]; Stern, et al 1996 [29]; Stern and Common, 2001 [29]; and Dinda, 2004 [7]). The stake of the argument is vital and arises from the estimation intensity of the environmental pollution imposed by economic system. The major argument arises from the view point that, if the EKC hypothesis appears to be robust, then the perspective of an infinite accumulation of wealth is possible. Theoretically, the EKC relationship can be divided into three parts: scale, composition, and technology (Brock and Taylor, 2005 [4]). If an economy grows in *scale*, all activities increase proportionally including pollution. If growth is not proportional but is accompanied by a change in the *composition* of goods and services produced, then pollution may decline or increase with income. Finally, if richer countries introduce less pollution-intensive production *technologies*, taking environmental quality as a normal good, growth can lead to reduction in pollution (Andreoni and Levinson, 1998 [1]). Panayotou (2001) [21] study provides a brief sketch of the shapes of the EKC. Among the empirical findings, inverse U-shaped by Shafik and Bandyopadhyay (1992) [26], Panayotou (2003) [22], Grossman and Krueger (1995) [11] provide evidences in the line of EKC hypothesis. On the other hand, findings of Vincent (1997) [38], Grossman and Krueger (1993), Grossman and Krueger (1995) [41] show an N-shaped EKC.

Waste Management and Public Cleaning Law of 1970 of Japan define municipal waste as the waste other than industrial waste. Therefore, waste discharged from a household is definitely municipal waste. But some kinds of waste discharged from industrial activities are categorized into municipal waste as they do not fall in the definition of law as industrial waste. Waste generated by activities offices and garbage from restaurants or retail stores, for example, are considered municipal waste. The amount of municipal waste generated in Japan was increased at a higher rate till 1990 and later on the trend is remaining stable (figure 1). Economic, social and regulatory factors worked to curve down the increasing trend (Nakamura, 2007) [19]. The responsibility of managing municipal waste lies on the local authorities. Household activities are the prime generator of municipal solid waste that accounts 68 percent of total municipal waste while the remaining 32 percent come from business activities. Difference in household activities also provides different size and amount of municipal waste. As a result, cities and municipalities are confronting different kinds of challenge to manage municipal waste.

Figure 1: Changes in the total volume of municipal solid waste generated in Japan from 1993 to 2002.



Note: Volume of waste generated = volume of waste collected by local governments + volume of waste directly brought into waste treatment facilities + volume of waste collected by groups such as PTAs
In the Basic Guidelines for the Comprehensive and Systematic Promotion of Waste Reduction Measures and Other Appropriate Treatments, developed based on the Waste Management and Public Cleansing Law, total volume of municipal solid waste is defined as "volume of waste collected by local governments + volume of waste directly brought into waste treatment facilities + volume of group collection of recyclable waste."
Source: Ministry of the Environment, *Waste Treatment in Japan* (January 2005)

Source: Ministry of Environment, Government of Japan, 2011.

Most of the municipalities in Japan treat municipal waste by incineration and dehydration. Because of its limited land area size, the amount of waste treatment by landfills is limited and has been decreasing. In FY2003, of the final disposal volume of municipal waste was about some 8.5 million tons or 16 percent, and the figure was about half the volume of 15 years earlier. In contrast, larger amounts of waste are recycled, and the recycling rate has increased gradually for both municipal and industrial waste. In FY2003, the recycling rate for municipal waste was around 17 percent compared to 5 percent in FY1990, and the recycling rate for industrial waste was about 49 percent versus 38 percent in 1990 (Nakamura, 2007) [19]. The trend of recycling of waste is increasing amid legal pressure like Containers and Packaging Recycling Law, Home Appliances Recycling Law, Food Recycling Law, Construction Material Recycling Law, and so on. A noteworthy feature of waste management in Japan is that the final disposal rate is very low and the waste reduction rate is extremely high. Waste for landfills like woods, waste-oil sludge, and so on are usually burned by incineration as the scope of landfills is very limited. Cost of incineration is high (typically 25,000-40,000 Japanese Yen/ton) and another aspect of incineration is the cost associated to transportation of waste (Ministry of Environment, Japan, 2011 [18]). At present, many of incineration facilities are adopting technology of generating heat and electric power. As a result, the incineration facilities would be able to provide scope for reducing Japan's high dependency of fossil fuels to produce power. Data of Ministry of Environment, Japan, 2011 show that in 2008, 19 percent of the total municipal waste was recycled, 1.8 percent was directly sent for final disposal and 79.1 percent was directly incinerated. In the same year, total cost of municipal waste treatment stood at 1823.5 billion Japanese Yen or 14, 200 Yen per person. At the end of 2008, 300 incinerators were producing electricity. The number is about 23 percent of all incinerators in Japan (MOE, Japan, 2011 [18]). Possibility of generating more electricity by using incinerators, therefore, becoming a growing issue.

In 2000, Japan introduced the concept of "recycle- based society" by introducing the Basic Act for Establishing a Sound Material –Cycle Society. The two side approach of the concept performs to reduce environmental load in one hand and promote effective use of resources and energy on the other hand. The principal objective the concept was establishing "End of Pipe Technology" that process the environmental load materials exhausted from human activity to reduce environmental load (Fujie, Goto, and Usui, 2001 [8]). As a result, in the line of using fossil fuel and mineral wealth for usage of

economic resources and energy, resource circulation and effective use of waste heat was promoted. The well known concept of 3R has been emphasizing since then. Material and chemical recycle, thermal recycle to collect heat and electricity as well as waste recycle is an established concept in Japan. In support of the efforts, Resource Effective Promotion Law, 2001; Food Recycling Law, 2001; Green Purchase Law, 2001; Revision Law Concerning Rational Use of Energy, 2002; and Law for Recycling of Specified Kinds of Home Appliances, 2001 were adopted by the government (Ministry of Economy, Trade and Industry, Japan, 2007 [17]). In principle, all the laws and regulations obligate local authorities or the cities and towns to implement the national level guidelines.

This paper focuses on environmental aspects of refuse municipal solid waste collection and disposal by drawing on delinking literature between per capita income and pollution of Toyohashi city, Japan. Literatures related to EKC, waste management and income can be found in Ozawa (2005) [20], Mazzanti, et al (2009) [16] and, Calcott and Walls (2005) [7]. The structure of this paper is as follows: in section 2 waste generation scenario in Japan has been described. The section also contains a brief description of study area or Toyohashi city. Objective, hypothesis, and estimation method of empirical testing model are illustrated in section 3. Section 4 describes characteristics of panel data. Econometric results of regression analysis are described in section 5. Finally, concluding remarks and policy implication are drawn in section 6.

2. Brief description of waste generation scenario in Japan and in Toyohashi city

Global Warming Law, 1998 and the Kyoto Protocol Target Achievement Plan of Japan ratify 47 prefectural and 1,800 municipalilities to introduce programs to address greenhouse gas emissions. About one third of the local governments adopted the national reduction target while another 40% adopted targets that go beyond the national government's 6% target (Takeuchi and Sugiyama, 2008 [32]). The guidelines of the Fundamental Law for Establishing a Sound Material-Cycle Society sat a numerical target of 'material flow indexes' that identifies the overall flow of materials in the economic sector (MOE, Japan, 2009 [18]). The three aspects of the material flows are:

1. Inlet: Connects resource productivity (=GDP/natural resources, etc. Input) and the target value was set at JPY420,000/ton by 2015;
2. Cycle: cyclical use rate (=cyclical use amount/(natrual resources, etc. Input+cyclical use amount)) and the traget value was set at 14-15% by 2015;
3. Outlet: funal disposal amount and the target value was set at 23 millions tons by 2015 against 110 million tons of 1990 benchmark (MOE, Japan, 2006 [18]).

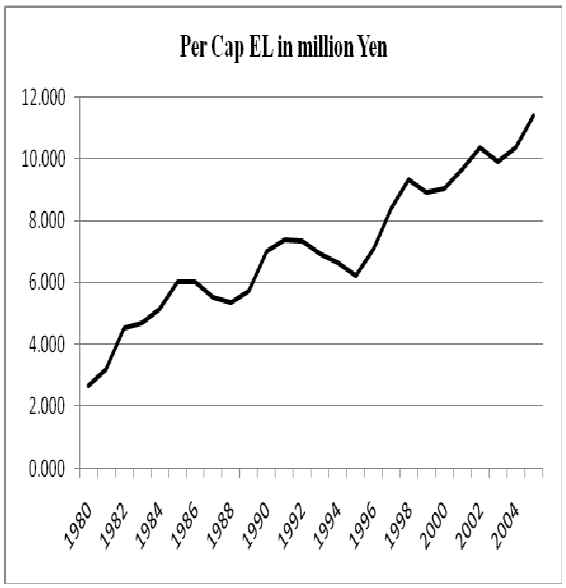
Generation of waste all over Japan remained flat during the years 2000 to 2006. Waste was generated roughly less than 600 million tons every year. The composition of disposal was also remained almost the same during the years. As an example, in 2006, 84.75 million tons were retunred to nature (mostly waste generated in the form of animal manure, rice straw, husks, wheat straw); 29.18 million tons were disposed as final disposal (waste like paper, waste plastic, sludge, rubble, dust, and so on), and 240.7 million tons were reduced by burning (waste generated by sludge, kitchen, paper, human waste, and so on) (MOE, Japan, 2009 [18]). An amount of roughly 200 million tons were disposed off as cyclical use.

Japan has about 1,900 waste incineration facilities and 60% of them are classifed as discontinuous run system incineration facilty (8 hours run per day). 40% of the facilities are continuous running system facilties (16 hour run per day). By volume, only 10% of the waste processing are done by the discontinuous system. The continuous system facility represents only 20% of the total facilities but they dispose off larger amount of the waste (Kusuda, 2002) [12]. Off the 1900 incinerations, about 190 are constructed with a technology to produce electricity and in 2002 the installed power generation capacity was 1000 MW and located in 15 prefectures (NEDO, 2011) [35].

Toyohashi city was formally founded on August 1, 1906 with area size of 19.69 square kilometer and population of 9,900 (Toyohashi City Statistics, 2011). At present the city size is 261.35 square kilometers and population stands at 381,977 (Toyohashi city web page, 2011) [36]. The present population density stands at 1462 per square kilometer. Attractive economic activity like concentration of heavy industries and a large scale sea-port is attracting in-migration to the city and data of Statistics Bureau, Japan provide 10,749 persons migrated to Toyohashi in 2008, 9,779 persons in 2009, and

8,577 persons in 2010. As a result, the city is experiencing vertical expansion as the land area is remaining unchanged since 1960 (Toyohashi city web page, 2011) [36]. Mikawa port which is the biggest export and import hub for automobiles has made Toyohashi city an economically important city. The city is faced to the Pacific and regarded as fertile land for natural resources (SENA, 2010) [25]. Figure 2 and figure 3 shows that during the period of 1980 to 2005, per capita EL (defined later) of the city grew rapidly. In 1980, per capita economic level, EL of the city was 2.647 million yen and the figure stood at 11.409 million yen in 2005. On contrary, the city spending on waste management grew steadily during the same period till 2001 and started falling from 2002. A shift in policy guidelines and technological initiatives can be regarded as the reasoning for such phenomenon.

Figure 2: Growth in per-capita EL of Toyohashi city over the time periods 1980-2005.



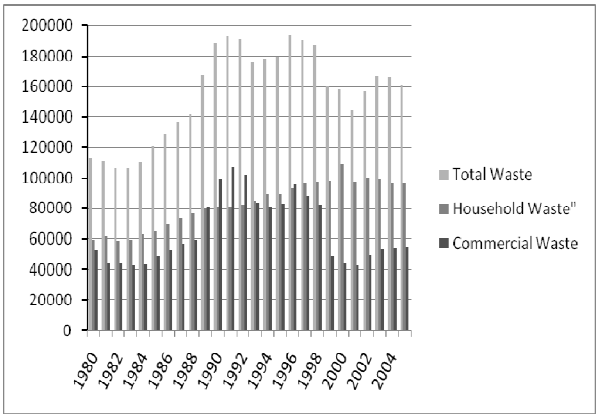
Source: Toyohashi city data, 2011.

Figure 3: Growth in per-capita city spending on waste management of Toyohashi city over the time periods 1980-2005.

Source: Toyohashi city data, 2011.

Growth in economic level as well as in population and economic concentration triggered municipal solid waste generation in the city. Data obtained from Toyohashi city statistics show that during the periods of 1980 to 2005, municipal solid waste was generated at a higher volume till 1998. Later on a slight reduction in the waste has been observed but the figure remained higher than 1980-1989 periods (figure 4).

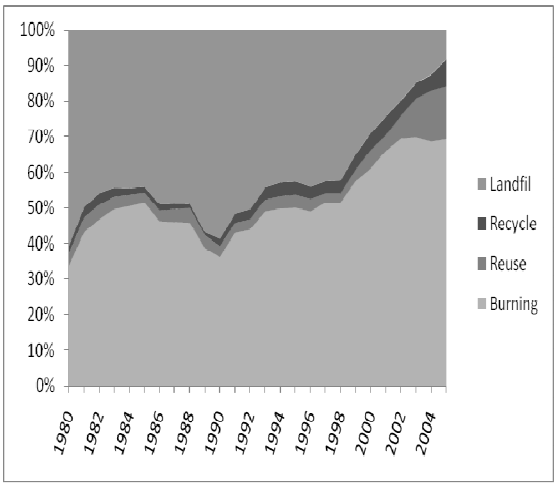
Figure 4: Growth of municipal waste in Toyohashi city over the time periods 1980-2005.



Source: Toyohashi city data, 2011.

Toyohashi city integrated waste treatment facility was commissioned in April, 1980 and the two incinerators plant can burn 250 tonnes of waste per day. The steam-turbine generator has an output capacity of 1,500 KW (CADDET, 1995 [6], Shimuzu, 1984 [27]). Figure 5 gives an idea of waste disposal scenerio over the periods of 1980-2005. The city statistics show that during the periods, minucipal waste diposing using reduction method was increased and landfilling was decreased. Reusing of the waste has shown an increasing trend in recent years.

Figure 5: Clearance of municipal waste of Toyohashi city over the time periods 1980-2005.



Source: Toyohashi city data, 2011.

Clearance of municipal solid waste remains a significant challenge to the cities in Japan as situation leads to a two tier problems: environmental hazards in one hand, and locating reasonable land area for waste disposal on the other hand (Sakai, et al. 2008 [24]). However, possiblities of renewable energy

production could generate a better technological advantage under the changed power generation approach for Japan (Industrial Fuels and Power, 2011 [13]).

3. **Objective, hypothesis, and estimation method:**

This paper focuses present situations and proponents have urged the use of descriptive research method for such state. The method involves cording, description, analysis and the presentation of the present scenarios, compositions or processes of the phenomena. Under the method, the entire research methodology of the paper has considered panel regression analysis to achieve the objectives of the research. The paper considers municipal solid waste generation as the dependent (response) variable of the regression analyses.

The broad objective of this paper is to find the dynamic delinking relationship between pollution or environmental damage and economic growth what is often regarded as Environmental Kuznets Curve (EKC) study. The study attempts to find the relationship between economic growth and municipal solid waste of Toyohashi city, Japan. The broad-spectrum of this paper thereby is to:

1. Outline economy- municipal solid waste generation and disposal pattern following growth of a city;
2. Investigate scope for city government in municipal solid waste management; and
3. Outline potential plan for city to generate energy from municipal solid waste.

The present study aims to focus on following research questions:

1. Does the growth of an economy provide possibility to improve environmental hazards?
2. What is the implication of national level benchmark on a city waste disposal in Japan?
3. Does Toyohashi city following the government target to secure municipal waste management?

It is important to know that local or city governments in Japan have implemented their own anti-environmental pollution measures based on the national guidelines. Since the nation has already achieved high level of income, its economic growth targets need not rest in higher income growth strategies, rather focuses to improve quality of life. Based on this assumption, our study aims to measure city government's initiatives to pursue better quality of life for citizens. Based on the argument above, our study takes following hypothesis:

Hypothesis 1: *The treatment of municipal waste is well-organized in the city that experience growth in income and municipal waste; and therefore develops effective municipal solid waste disposal process.*

Since, better technological administration of municipal waste can open opportunities to produce energy, our study accounts following hypothesis:

Hypothesis 2: *The technology of waste to power energy can be introduced to economically growing city as growth of municipal waste remains expected.*

Multiple regression models have been considered for the purpose of research. The relationship among the variables has been considered as linear. We consider following relationship between economic level and municipal waste:

$$MunicipalSolidWaste \equiv f\left(EconomicLevel, CityExpenditure\right)$$

Using city level panel data, ordinary least square method is applied to estimate the implication of EKC for the city. The reduced form of OLS regression equation takes the form:

$$W_i = \alpha_i + \beta_1 (EL_i / P_i) + \beta_2 (EL_i / P_i)^2 + \beta_3 (CE_i / P_i) + \beta_4 (CE_i / P_i)^2 + \varepsilon_i \quad (1)$$

where W: municipal solid waste generated, EL: economic level of the city, CE: city expenditure for waste treatment, P: population, *i* represents *i*-th period and ε is the error term

4. **Data description:**

Data used in this study analyzes empirical evidence of EKC considering per capita economic level, EL, per capita city expenditure on municipal waste management, and volume of municipal solid waste generated of Toyohashi city. Data for the variables were taken from Toyohashi city statistics for 100 year (2011). The data consist of periodical surveys in the municipality which have been quantifying their own data on yearly basis since 1907. The explanatory variables applied for the analysis are: municipal solid waste generated from households, commercial and other municipal solid waste in tons;

per capita EL obtained from on manufacturing, agriculture and trading output of the city and, per capita city expenditure on waste management obtained from the city accounts. The data set covers the periods from 1980 to 2005. The panel data of the study collects all the relevant data from Toyohashi city annual statistics. So in this study we have 26 year time period and we have 78 observations. The variable is the stated amount in thousand Japanese yen that has been spent for the specific purpose. The descriptive statistics of the data is shown in table1.

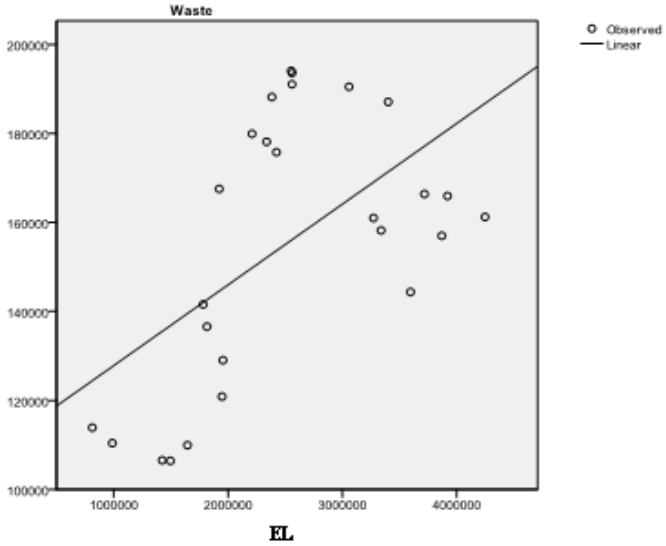
Table 1: Descriptive statistics and definitions of variables

Variable	Definitions	Mean (SD)
W	Annual municipal solid waste generated by households and commercial enterprises in ton	155196.42 (30111.34)
EL	Annual per capita economic output calculated from manufacturing, agriculture, trade in million yen	7.1031 (2.284)
CE	Annual per capita city expenditure on waste collection and treatment in thousand yen	27.7085 (13.842)

N=26

The relationship between per capita EL and municipal solid waste was found significant (R^2=0.94) and has been shown in figure 6. The evidence suggests that EL of the city can be explained for higher generation of municipal waste over the time periods.

Figure 6: Relationship between municipal solid waste and per capita EL of Toyohashi city over the time periods 1980-2005

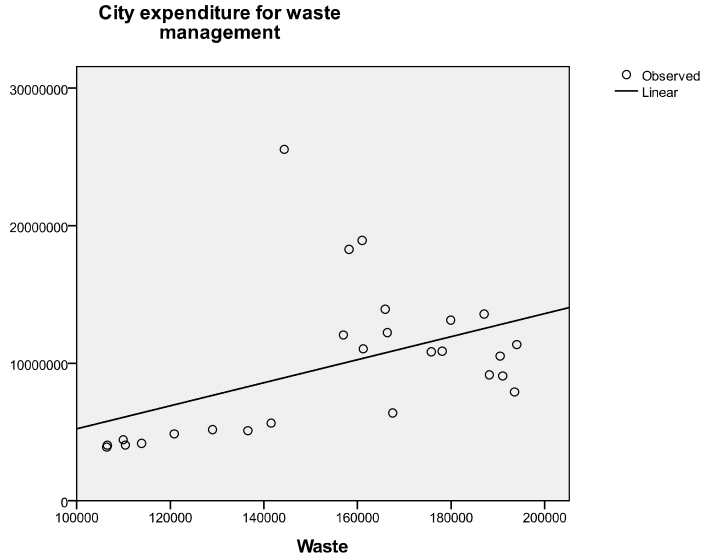


Source: Compiled by the authors.

The relationship between per capita CE and municipal solid waste was not found significant (R^2=0.22) and has been shown in figure 7. However, the t-statistics 2.58 implies the relationship between the two

variables. The evidence suggests that municipal waste generation can be explained by the city expenditure for waste management over the time periods.

Figure 7: Relationship between municipal solid waste and per capita city expenditure for waste management of Toyohashi city over the time periods 1980-2005



Source: Compiled by the author.

Highlighting the growth of Toyohashi city over time, the study expects higher generation of wastes. In contrary, the study also expects that with the advancement of tec9hnology and existence of national target, the EKC for Toyohashi city would be an N-shaped one.

5. Empirical results:

The model OLS regression analysis results are provided in table 2. The regression coefficients estimated from the panel data are statistically significant, as indicated by the *t*-statistics.

Table 2: Regression results of the study

	Municipal Waste
Constant	-14353.743
VAR1	21360.370*** (2.41)
VAR2	-1496.873** (2.69)
VAR3	6198.61 (5.04)
VAR4	-74.47 (5.17)
R^2	0.793

***. Correlation is significant at the 1% (2-tailed)
**. Correlation is significant at the 5% (2-tailed)
*. Correlation is significant at the 10% (2-tailed)
Numbers in the bracket denotes t-statistics
VAR1: Per capita EL, VAR2: Per capita EL^2, VAR3: CE, VAR4:CE^2

The results in table 2 revealed that per capita EL and per capita city expenditure for municipal solid waste management can be explained by the trend of higher municipal solid waste generation in the city. On the closer look, the effect of EKC hypothesis has been confirmed by the regression, as per capita EL^2 and CE^2 were significant. The results above are contrary to our priori expectations, and formed an inverse U-shaped EKC curve. The simulation result of the outcome is explained in figure 8 and figure 9. The figures show the EKC for the periods of 1980 -2005 for Toyohashi city.

Figure 8: The effect of growth in per capita EL based on EKC for Toyohashi city for the time periods of 1980 to 2005.

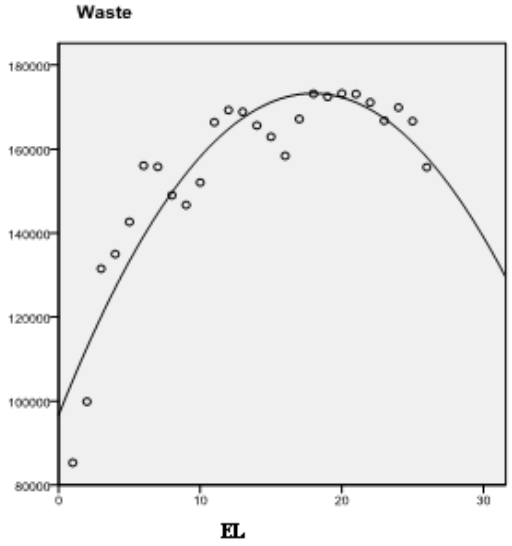
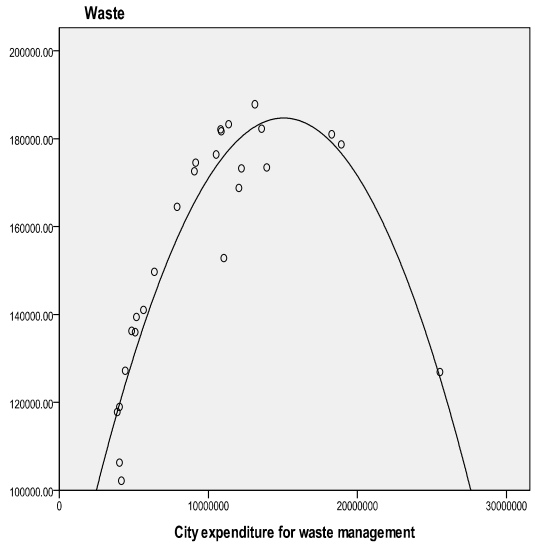


Figure 9: The result of growth in per capita city expenditure and municipal waste generation based on EKC for Toyohashi city for the time periods of 1980 to 2005.



Following the results of regression analysis in estimating relationship between municipal solid waste and per capita EL, city expenditure for waste management; the outcome satisfies our priori expectation. All the coefficients are statistically significant, the slope of the coefficients have expected signs. The R^2 value is 79.3%. The result implies that larger amount of the variation in waste generation can be explained by the explanatory variable.

6. Discussion

This study empirically examined the relation between city economic growth and municipal solid waste. Growth in economic, EL and population has increased discharge of municipal solid waste in Toyohashi city. EL is identified as a strong explanatory variable. As city grows, diversified household activities contribute in generation of various kinds of municipal wastes. Our study found that during the period of 1980 to 2005, EL as well as per capita EL of the city grew fast. Municipal solid waste of the city experienced increase in volume as a by-product of economic activities. Expansion in solid waste disposal contributed more on demand for policy and technological interventions. As a result, city expenditure on waste management increased during the same period. The city opened its high-tech waste treatment facility in 1984. The facility provides waste to heat and power generation technology (Toyohashi city, 2011) [36]. Later on, national concept of sound-material based society supports the city to initiate efficient and effective municipal waste management strategy from 2001 onward (Tachibana, et al., 2008) [33] and city expenditure for waste management started to decline. The positive coefficient of per capita EL for generation of municipal solid waste was positive. The result denotes that economic growth put upward pressure toward the municipal solid waste generation. The negative coefficient of per capita EL^2 indicates governmental initiative to manage the municipal solid waste generation in terms of regulations and/or technology. The positive coefficient of per capita city expenditure for generation of municipal solid waste was positive. The result implies that the higher the waste generated, the more the city needs to spend more for waste management. The negative coefficient of per capita CE^2 indicates the raised city expenditure to manage municipal solid waste can be overcome by introducing regulations and/or technology. The results provide theoretical and practical significance and proposition. As city grows, various sectors of the city contribute in different ways to produce municipal waste and growth in income provides space for the government to improve quality of life.

The inverse U-shape EKC for Toyohashi city proves that the relation between per capita EL, per capita city expenditure for municipal waste management, and municipal solid waste can be explained by changes in national and local level initiatives accompanied by economic development and quality of life. The results follow the EKC hypothesis (Grossman and Krueger, 1995) [10]. Interpretation of such outcome is that in Japan national level policy and legal agenda reflects in local governmental level as Toyohashi city was able to improve its citizen's quality of life by addressing environmental pollutions problems by the support of higher income and better technology. The EKC of the city demonstrate that idea of sound-material based society could play a vital role in the management of the waste. On the contrary, reduction of volume of municipal solid waste would jeopardize waste to energy technology. A better solution of the outcome could be higher usage of the facility by extending the service to the neighboring localities.

7. Conclusion

Outcome of our study suggests that in Japan national level policy and legal agenda reflects in local governmental level as Toyohashi city was able to improve its citizen's quality of life by addressing environmental pollutions problems by the support of higher income and better technology. The EKC of the city demonstrate that idea of sound-material based society could play a vital role in the management of the waste. On the contrary, reduction of volume of municipal solid waste would jeopardize waste to energy technology. A better solution of the outcome could be higher usage of the facility by extending the service to the neighboring localities. The present EKC can be viewed as the hypothesis on the interaction between economic growth, relevant spending and environmental quality. However, the shape of the relationship is not uniform across pollutant and turning points, when they exist, differ across the pollutant. In an optimistic view, the process of globalization and global economy may provide the world's development more sustainable simply by pushing the economy towards the decreasing part of the bell-shaped EKC, but the progress of research needs to learn which variable(s) have a turning point in their relation with output to draw policies to follow. Our study suggests that even a mid-sized city in Japan could play significant role in manage environmental pollutants. In achieving targets of the Kyoto Protocol, national and local governments require to play significant role (Takeuchi and Sugiyama, 2008 [32]). When a city or region grows economically;

better innovation and legal framework to secure natural environmental quality is able to improved quality of life and sustainable society. Despite of these implications, our study is not out of limitations. First, the study sample or data influence the results because of market direction. The degree of correlation differs according to the type of influencing factors of the city. Second, previous researches showed that increase in income results in inverse U-shaped EKC (Panayotou, 2001 [21]), our study followed the same path of the hypotheses. Third, factors influencing municipal solid waste generation might have different technology and direction toward the state. This study did not count the different state of affairs. Lastly, this research did not cover the impact of technological improvement and legal framework competitiveness performance. Therefore, the effect of legal intervention, technology innovation and their competitiveness is left for future task. Comprehensive research outline considering wider factors and technological cost benefit analysis toward the research problems has been kept for future scope.

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SUSTAINABILITY DIAGNOSIS OF AN AGROFORESTRY SYSTEM

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Abstract
Serra de Montemuro Site is a Natura 2000 classified area in northern Portugal, especially for its role in preserving both the landscape, environmental and cultural heritage. Based on the main features of the territory in question, as well as on the agroforestry activities developed therein, this article aims at depicting the main aspects which characterize the (un)sustainability of the afore mentioned activities, namely some of the challenges that a sustainable agroforestry development must be able to meet. The methodological procedures included several complementary processes of information gathering such as: bibliographical research, field research, interviews, participatory meetings and sectoral meetings. Two implications arise from this sustainability diagnosis: 1) the revenue isn't sufficient to maintain the agroforestry systems; 2) the conservation of this territory is imperative and the agroforestry systems are essential for this purpose.

Keywords: Agroecosystem management; environmental, economic and social dimensions; territorial features; Serra de Montemuro; sustainable development.
***JEL classification*:** Q01, Q15, Q23

1. Introduction

Sustainable development is currently the dominant paradigm that guides the development planning. Since 1987, the report from the World Commission on Environment and Development (WCED), disclosed the word sustainability. The Bruntland Report criticizes the model adopted by the developed countries and advocates a new type of development that can sustain progress across the globe. The concept of sustainable development or sustainability, which aims to meet the needs of the present without compromising the ability of future generations to meet their own needs, is established as official to correct the effects of the ecological crisis (WCED [44]).

However, still persist many difficulties to give a concrete content to sustainable development in the national and international contexts. Serious efforts have allowed a progress in defining the concept, such as those by Altieri [1] and Hansen [18]. Specifically, it cannot define the sustainability to a narrow definition of a universal nature or based on a set of indicators also universal (Masera *et al.* [30]).

In order to advance empirical studies it is necessary to accept an operational definition of sustainability as indicated by Fernandes and Woodhouse [17] The debate around sustainability brings awareness of the complexity and interaction of the different dimensions, and a need for a more integrated action between them (Altieri [1]). Also, the European Council of Stockholm (CEC [8]) and more recent documents (CEC [9] and European Commission [14]), acknowledged that, in the long-

term, environmental protection, economic growth and social cohesion must go hand in hand. The practical realization of this objective requires that economic growth supports social progress and respects the environment, that social policy underpins economic performance and that environmental policy is cost-effective.

In fact, sustainability is a dynamic concept, seeking to achieve a balance in space and time, of the environmental, economic and social dimensions - regarded as the tripod of sustainability. It is not a fixed concept, but vulnerable and influenced by other factors as productivity, resilience, adaptability, stability, reability, equity and autonomy of the system (FAO [16]; Partidário [36]; Masera *et al.* [30]; Navarro [33]; and Altieri and Nicholls [2]). The sustainability also depends of the initial starting conditions; the dynamic of the society evolution and the changing of its fundamental values; the specific social and environmental context; the temporal and spatial scales used and the objective which it will be applied (resource, production system, region or country, FAO [16]; Masera *et al.* [30]).

Based on the main features of the Serra de Montemuro (a Portuguese mountain) and of its agroforestry activities, this article focuses on the main environmental, economic and social aspects which characterize the (un)sustainability of agricultural and agroforestry production systems developed in this territory. The aim is also to identify some challenges that sustainable agroforestry development has had to meet in this classified area. Serra de Montemuro (PT CON0025) Site is one of the 60 Sites included in the Natura 2000 Network National List of Sites. It is an important classified areas in northern Portugal, not only for its territorial dimension, but especially for its role in preserving the landscape and the natural, environmental and cultural heritage of the five municipalities in it includes.

Although the geographical limitation of this article to the Serra de Montemuro Site, many of their problems are common to other mountain areas of Portugal and to other countries, no absence its agro-forestry specificities. At the sustainability point of view, the diagnosis is of extremely importance to search and develop the most suitable solutions for the maintenance and conservation of these areas, in environmental, economic and social dimensions, as actually requested by society.

This article is part of a project which aims to develop an integrated territorial management and development plan to Serra de Montemuro Site, carried out by a multidisciplinary team of UTAD researchers in which the authors are included.

The paper is organised as follows. The following section presents a brief critical analysis of the main territorial features of the study area. A third section presents the design and implementation of methodology for the exploratory survey. A fourth section presents the results and discusses the main findings resulting from the data and information collected in the several complementary processes of the information gathering. Finally, a fifth section provides some concluding remarks. References are included, as usually, at the end of the paper.

2. Territorial features of Serra de Montemuro

Serra de Montemuro Site covers an area of approximately 38.760 hectares, including part of the Portuguese municipalities of Cinfães (35%), Castro Daire (30%), Lamego (15%), Resende (17%) and Arouca (3%) (AMVDS [3]). Despite its location (Figure 1), between the coast and the inland and between the north and the centre of the country, Serra de Montemuro has been, until quite recently, a peripheral marginal area with difficult accessibility.

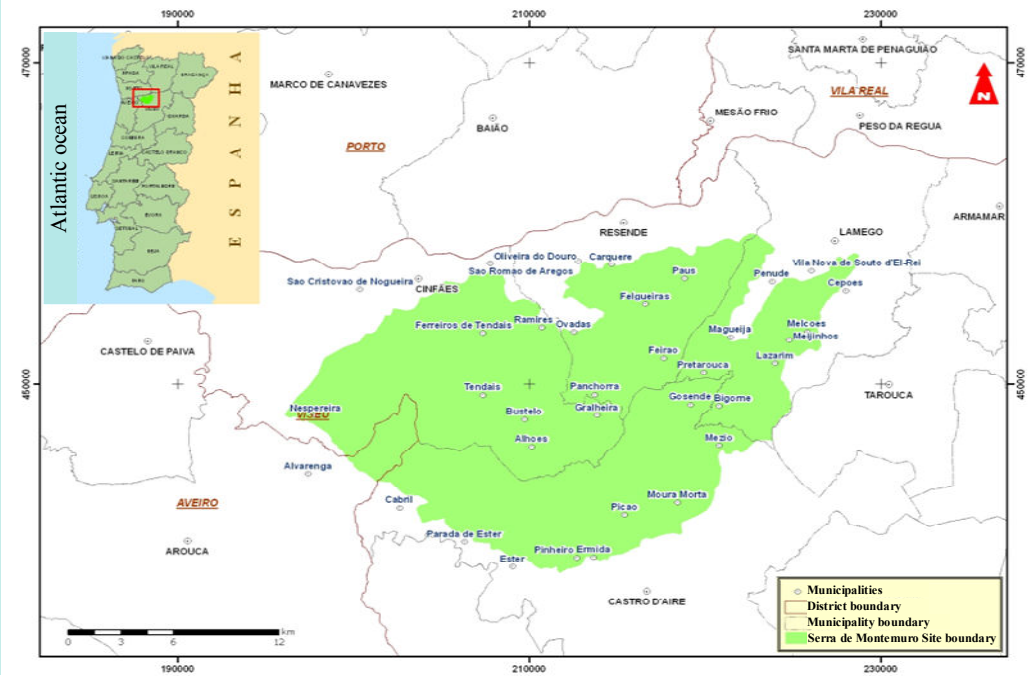

Figure 1: Localization of **SSM**
Source: Azevedo *et al.* [4]

The altitude (between 100 and 1300 metres, IA [21]) and slope, combined with its rigorous climacteric conditions[27] and its soils heterogeneity[28], are the key factors responsible for an enormous variety of habitats, agro-forestry systems and the thereof ensuring distribution of soil occupation (IA [21]). The spatial dimension of this territory makes it particularly important for the defence and preservation of several semi-natural habitats, as well as fauna and flora species[29] (ICN [22]).

It is a typical mountain territory of rugged terrain, where undergrowth areas (29%), degraded woodland[30] (16%), semi-natural spaces related agriculture[31] (14%) and mixed forest areas of coniferous and hardwood trees[32] (10%), together with sparse vegetation (8,6%), are the most frequent mosaics (DGRF [12]). The absence of forest management practices and the negative evolution of agriculture result in regular areas shattered by fires which claim for more sustainable agro-forestry systems.

The decreasing of agriculture in Serra de Montemuro Site is a fact. Both the number of farms with an Usable Agricultural Area (UAA) and the UAA itself are becoming fewer[33]. The reasons for such a decrease are well known and have to do mainly with the low income that this activity generates,

[27] Precipitation between 700-800 and 2500-3000 millimetres per year, in areas of lowest and highest altitude, respectively. Three thermal gradients: 1) low temperatures between 7,5º C and 10º C, in the highest zones; 2) average temperatures of 10º C to 12,5º C, in middle-slope zones; and 3) higher temperatures, oscillating between 12,5º C and 15º C, in the remaining zones (IA [21]).

[28] Predominance of schist and greywacke (from the Cambrian and pre-Cambrian periods) and granites, and also corneal and quartz deposits (Baptista [5]). The most representative soils are cambisols. These are thicker and more evolved soils with an horizon rich in organic matter which appear in areas of more moderate relief. Rankers associated with higher zones are located in the central zone of the Site and correspond to the highest spots in Serra de Montemuro, where granite knolls and stock masses occurred (IA [21]);

[29] Stated in annex B-I, B-II, B-IV and B-V of Decree-Law N.º 49/2005 from 24 February.

[30] The woodland is divided into three types: 1) water courses and vegetation associated with them, usually consisting of exuberant and thick hardwoods; 2) areas of oak in altitude, which, although regularly devastated by fires, still possess a remarkable regeneration potential; and 3) agro forest mosaics (DGRF [12]).

[31] 9.950 hectares of rangeland under forest regime (AMVDS [3]).

[32] Predominance of pine (Pinus pinaster) and an Exponential increase of the area occupied by eucalyptus (Eucalyptus globulus), as a result of tree planting in the nineties by cellulose manufacturing companies and individual farmers (AMVDS [3]).

[33] The agricultural productive structure lies on about 2012 familiar farms, which cultivate 8429 ha of UAA, approximately, according to data from 2009 (INE [23]).

especially in mountain areas (AMVDS [3]). In view of the zone's specific edaphoclimatic conditions, exposed before, permanent pastures occupy most of the UAA (53%) and are a source of fodder for herds (INE [23]). Only approximately 10% of the total area of Serra de Montemuro is dedicated to crops[34] (INE [23]), despite having suffered a strong decrease in recent years.

The farm size structure is dominated by small-sized farms (4,19 hectares in 2009, INE [23]), with a high level of parcelling, which constitute an handicap for the competitive evolution of agro-forest systems of Serra de Montemuro.

Livestock, the main source of income for the population living in the Site, is also decreasing fast (INE [23]). Cattle, especially bovines of the *Arouquesa* breed, and small ruminants are predominant in the area under study. The endogenous resources only allow the farming of local species and production of autochthonous breeds, due to its good adaptation to the conditions offered by this territory. Abandonment of livestock raising causes ancient practices of production systems to be endangered, like extensive herding in commons, *vezeiras* (a pastoralist practice by which cattle owners take their herds to common pastures and take turns at tending them), *regas de lima (*which consist of using water from rivers for irrigation) and the clearing of marshy land. This affects the preservation of both nature and biodiversity, since it decreases the edge effect and enhances the probability of fire propagation due to the increase of biomass.

The weak agriculture practiced in Serra de Montemuro is also due to the general loss of population[35]. Employment has been declining (AMVDS [3]) and young people tend to look for better job opportunities, education and leisure facilities in towns. The retired population usually goes back to their home villages, especially during certain periods of the year. The consequences of these two migratory flows are: 1) population decline and demographic aging of rural population; and 2) the creation of a new demographic structure, although not important enough to justify certain public services (Mafra and Amado da Silva [26]). Nowadays Serra de Montemuro[36] is a deserted old territory, like most regions in the Portuguese inland.

As regards population distribution, there is a mixed situation: in medium sized to "large" parish in the periphery of the Site and on the northern slope the population is sparse (1000 to 2000 inhabitants), whereas in the smaller parish in the interior and in higher zones it is concentrated (with less than 200 inhabitants, AMVDS [3]).

3. Methodology and data collection

In order to complete this study, the authors used several complementary processes of information gathering listed and explained as follows. Hezri and Dovers [19] underlines the challenges of disciplinary and methodological heterogeneity for sustainability indicators, which requires engagement between environmental and social sciences and methods to aggregate raw and incongruent sustainability variables.

1) *Bibliographic research and document analysis* – The amount of information previously gathered was essential for a first approach of the area to be studied and its characterization, namely in statistical terms.

In order to find valid sustainability diagnosis, that reflect a local socio-economic and ecological environment, a number of stakeholders capable to influence decisions over agroforestry management were consulted, including farmers, development agents, state-level policy makers and the community. Individuals and institutions belonging to each of the municipalities of Serra de Montemuro were

[34] Temporary meadows and forage crops (57%), cereal grains (36%), particularly corn and rye and potatoes (5%) are the most important annual crops (INE [23]). Vineyards (39%) and fruit trees (40%) are the most significant permanent crops, occupying an area of almost 1435 ha. The chestnut is one of the few crops which has had a rather positive evolution, although locally this activity has still a limited dimension (11%, INE [23]).

[35] Recent data shows that population reaches 27.000 inhabitants, approximately, distributed by 35 parish of the municipalities of Castro Daire (9), Cinfães (9), Lamego (10) and Resende (7) and part of the parish of Alvarenga in the municipality of Arouca (AMVDS [3]).

[36] For more information on the territorial features of Serra de Montemuro see AMVDS [23].

contacted. These, reflected the indicators of several soil and climatic and socio-economic conditions, able to enhance different production systems and land use, with reflection on its viability and sustainability. It was address at least one parish by municipality. This approach is based on the idea of recognising external (expert-led or top down) and internal (community-led or bottom-up) viewpoints on what constitutes sustainability in agroforestry systems (Reed *et al.* [39]). Public participation through the involvement of individuals and population groups by defining problems and identifying potential solutions may manifest itself as an important contribution for the revitalization of these areas, being them the key players.

The consultation was conducted through a variety of participatory methods listed below. The goal of these methods was to identify within the stakeholders a set of factors contributing to the sustainability of the agroforestry system, and reconciling scientific and agroforestry-management perspectives.

2) *Field visits under the motto "Percursos Conhecer o Montemuro"* (Routes to Know Montemuro) – In order to get a better knowledge of the territory, field visits were arranged (five routes). These routes were meant to allow for a better understanding of the social and economic dynamics in some of the places which form Serra de Montemuro Site, either through *on-Site* observation and with recourse to photography, or by conducting open and informal interviews to presidents of parish, local promoters (rural tourism, artisans, theatre, food and catering), representatives of several local organizations (forest, rangeland, cultural and recreational associations) as well as anonymous residents.
3) *Interviews to specific actors engaged in livestock and agroforestry related activities* – Two sets of interviews were conducted. The first set took place in the context of the previously mentioned routes, in the form of formal and structured interviews with a script to specific actors engaged in farming and agroforestry related activities. The interviews were personally conducted with the respondents. The selection of interviewees was based on a sample criterion. Parishes with the maximum number of livestock by municipality and, on the other hand, with the largest and smallest decreases in cattle by municipality were selected.
   The purpose of these interviews (11) was to quickly and efficiently gather information that might lead to an assessment of local traditional agroforestry systems' sustainability. The aim was to study the operating system and its strengths and weaknesses, using the following indicators: i) soil usage and occupation; ii) several environmental, technical and economic indicators which characterize the activities (farming system type, pasture system, inputs and outputs of the system, products commercialization, problems and difficulties, probability of fire risk); and iii) characterization of the respondent and their social relations (household, motivations for the profession, conflicts with other local social actors).
   The second set of interviews targeted key informants directly related to livestock and agroforestry sectors. Interviews were done with Health Protection Groups; Livestock Producers' Organization; Nature and Biodiversity Conservation Institute (ICNB); *Autoridade Florestal Nacional* (AFN, General Board of Forestry); and local administrative authorities in the region. These interviews were conducted in meetings with representatives of those organizations.
4) *Participatory Meetings* under the motto *"Abrir as Portas de Montemuro" (Opening the Doors of Montemuro)* – Through these participatory meetings the authors wished to identify the yearnings and interests of the social actors residing and intervening in the territory, while getting a better knowledge of the Site's main weaknesses as well as potential. Four meetings were held in four villages/places chosen among the Site's four main municipalities. Each participatory meeting had an audience of 20 to 30 participants.
5) *Work meetings with local development associations, forestry associations and rangeland associations* – one of the goals of these actions was to consolidate the knowledge about important topics (such as territory, agriculture, forest, sustainability) for the area which was being studied and to obtain the various agents' perspective on the problems that affect this territory and its development. These work meetings were conducted through presence meetings with representatives of these organizations, having been used a structured guide for each of the topics under review.

4. Critical points for agroforestry systems sustainability in Serra de Montemuro

A sustainable agriculture must be able to make the production of goods, food products and raw materials (productive function) and the providing of services (social function) compatible with the systems it is directly related to, that is, environment, economy and society (CEC [8] and [9]). The study of some aspects of agroforestry systems' (un)sustainability developed in Montemuro is done based on these three pillars of sustainability - environmental, economic and social. It is highlighted some of the benefits/potential as well as costs/threats which the performance of the systems used generally entails, based on the information gathered using the methodology exposed before. However, although the three areas presented are differentiated, the various sustainability characteristics come as a whole and are often transversal to the different scales indicated. As pointed out on FAO's document [16], if the environment is to be preserved, agriculture has to be technically adequate, economically feasible and socially acceptable.

4.1. Environmental sustainability

Agriculture is an economic activity consisting of a productive process which, although depending on nature cycles, influences them by using a vast array of elements which exist freely in the environment such as soil, water, air and genetic heritage. These resources, however, are not unlimited and are rapidly being exhausted. On the other hand, they are essential to all life-supporting systems on Earth and, therefore, vital for the balance and quality of the environment around us. Protecting them is to ensure that the agricultural activity is technically and economically viable and to provide environmental quality. The way natural resources are used in agriculture may well have a negative impact on them. Choosing production systems and cultural practices becomes then paramount to avoid resource depletion (MADRP [25]). Moreover, those choices must protect the landscape, the biodiversity and the natural resources of the rural world (Marta-Costa [27]).

Table 1 identifies the main aspects negatively and positively affecting environmental sustainability of agroforestry systems developed in Montemuro. These aspects represent the territory's strengths/potential, but also its threats/weaknesses.

Table 1: Critical points for the environmental sustainability of agroforestry ecosystems in Serra de Montemuro

Critical Points	
Positive	Negative
• Rational farming management; • Low inputs of the system; • Preservation of biodiversity, ecosystems and landscape; • Preservation of autochthonous breeds; • Use of available resources by the cattle; • Possibility of regenerating autochthonous oak forests; • Decrease of number of fires in areas with natural cleaning of woods and fallow land.	• Predominance of non-autochthonous forest species; • Villages dirty from animal excrements; • Abandoned forests; • Abandonment of marshy land areas and *cervunais* (meadows covered with mat-grass); • Increase of air biomass; • Increase of fire risk; • Difficult tracks for herding.

The adaptation of agrarian activities to the existing edaphoclimatic conditions is a first attempt to the continuously provide for the needs of both present and future generations, preserving the soil, the water and the genetic resources, as stated by a FAO's document [16]. This situation is real in Serra de Montemuro. Its agroforestry systems are based on local species' and breeds' of high level rusticity well adapted to the harsh conditions of the mountain. The inputs of the system are very low with benefits for the environment and contribute to preserving biodiversity and its ecosystems. Serra de

Montemuro has a series of natural habitats with many wild life species, as well as livestock and autochthonous breeds of cattle – *Arouquesa* (facing endangerment), sheep and goats. However, in forest terms, it is saw the predominance of non-autochthonous and rapidly growing forestry species.

The livestock use available resources of the mountain that are not used by humans, so there isn't food competition. Also, the weed control, in areas with herding, is made with less use of herbicides, and they also can help prevent fires and soil erosion as stated in a document from the European Parliament [15].

Its mountain villages, which lie further from urban centres, also have a particular type of landscape, heritage and rural traditions, which has been constructed with agroforestry systems. Villages dirty from animal excrements are a main negative point related to environmental aspects.

However, agroforestry systems have been abandoned with harmful consequences for the territory in question at environmental and socioeconomic level. Along valleys and water courses (rivers and streams) there are agricultural areas. Half way up on the hillside it can be found chestnut groves (*Castanea sativa*), some oak regeneration (*Quercus pyrenaica* and *Quercus robur*) and also high shrubs which are sometimes covered with ferns and Portuguese broom (*Cytisus striatus*), a clear sign of abandonment. The progressive abandonment of agriculture, herding and forests causes marshy land and tilled areas to be neglected and high shrubs to take over. These lead to an homogeneous soil occupation, loss of biodiversity and increase of vulnerability to fire, an opinion also shared by the stakeholders in the "*Abrir as Portas de Montemuro*" participatory meetings and identified in documents of Rego [40], Moore and Smith [32], European Parliament [15] and Loepfe *et al.* [24]. Hubert [20] claims that, due to abandonment, some areas which have always been maintained by herding are presently dense and closed and of a limited diversity. Indeed, on the upper portion of the Serra de Montemuro, there is much undergrowth and some signs of burned areas. The shepherds that were interviewed account for the situation claiming that "in the old days there were a lot more cattle which kept the mountain clean and, whenever there was a fire, it was a small fire. Now there are not enough cattle, shrubs grow too rapidly and, when there is a fire, it all burns down…"

There are evidenced high maintenance costs resulting from population declining and abandonment of agricultural activities. For example, difficult tracks for herding are a fact always referred by these shepherds.

4.2. Economic sustainability

The economic dimension of sustainability is important because it influences the activity's survival and farmers' permanence in rural areas, which is essential for protecting the environment and preserving both the landscape and its natural resources (Marta-Costa [28]). To achieve these goals, agricultural production must meet food demand and promote suitable revenues for the family/farm, minimizing risk aversion and the use of external factors of production, such as fertilizers and pesticides, favouring instead a more efficient use of available resources. This way it is possible to move forward to more self-sufficient and viable systems in the long run (Marta-Costa [27]; [28]).

The main critical points which economically affect agroforestry systems' sustainability in Serra de Montemuro are listed on Table 2.

Table 2: Critical points for the economic sustainability of agroforestry systems in Serra de Montemuro

Critical Points	
Positive	Negative
• Small initial investment per animal; • Low production costs per animal; • Little dependence on production factors external to the farm; • Reduced number of losses caused by diseases; • Final products are the families' main sources of income; • Obtaining food products for families' self-consumption; • High quality of sales products; • The existence of a Group of Producers for the *Arouquesa* meat; • A system backed up by European measures.	• Low revenue of agroforestry systems; • Low income/ productivity/ production efficiency; • Reduced number of livestock per farm; • Difficulties in disposing of animal products, namely of sheep and goat origin; • Subsidy-depending systems; • Delay on subsidy payment; • Lack of a monthly fixed wage; • Lack of organization as regards production chains; • Lack of accounting records.

The main positive economic aspects identified before, where based on the low costs of investment and production of the agroforestry system of Serra de Montemuro. This is due to many reasons, as cattle rusticity, which is responsible for the reduced number of animal losses caused by diseases, low input of the system – buildings, equipments, feeding, labour, veterinary, and others. For example, the raising of local autochthonous breeds is in an extensive regime, where the livestock is most, of the year, kept in herding on the mountain. They feed mainly on sub-spontaneous vegetation. There is little dependence on production factors external to the farm. So, this animal production is an economic surplus as it was considered in other works (Marta-Costa and Costa [29]). Esquivel [13] also argues that the economic viability of agrarian systems can be obtained by using suitable low-cost technologies; increasing product quality; using more efficient energy, land and work technologies; using species adapted to local environment; in other words, by building more integrated and integrating systems which will remain more stable in the face of external pressures.

Agroforestry systems are economically valued by the final product - beef, sheep and goat meat - with high quality and based on food products produced on the farm. They are also used as food products for families' self-consumption, which positively contributes to the maintenance of the agroforestry system. These products are the main source of income for the population residing in the Site or, in other cases, they are a source of supplementary income, as support mechanisms are. The calves from the *Arouquesa* breed (through qualification), between six and nine months old and with a carcass weight between 70 to 135 kg, are usually sold by the *Arouquesa* Meat Group of Producers. This product has a Protected Designation of Origin (PDO) and producer price is therefore increased (5 Euro per kg of carcass weight). If these animals are transacted through direct sale to the consumer, to livestock tradesmen or other middlemen, prices can go down to less than 4,50 Euro. Other bovine breeds sold in this area may even reach a producer price of 4,00 Euro. The existence of this organization makes possible to release the products onto the market in the best hygienic and health conditions, according to food safety regulations.

Goat and sheep offspring usually pose greater problems when it comes to releasing them onto the market and are usually sold directly to the consumers or livestock tradesmen. There aren't organizations as regards production chains. Demand for these animals usually increases around Christmas and Easter and the same happens with prices: 10 Euros per kilo (kid goats) and 5 Euros per kilo (lambs). In the rest of year, prices go down to 8 and 4 Euros, respectively. These animals are usually sold without being weighted, based on the buyer's appraisal by just looking at them, after which a sum is offered for the whole living animal. Goat milk is, in some cases, turned into fresh cheese, resulting in a major source of supplementary income.

Nevertheless, the gains from selling agricultural products are scarce. The productivity of the system is very low and the number of livestock per farm, converted than in number of products, is reduced too. The economic results are imperative to the systems, farms, families and territory sustainability as showed in many documents cited in this paper (Masera *et al.* [30]; CEC [8]; Fernandes and Woodhouse [17]; Marta-Costa [28]; Marta-Costa and Costa [29]). Without economic

revenue it isn't possible to survive and to reproduce the system. The monetary support of the system by European measures is view as positive, because it brings more money for the farms, but a subsidy-depending system can prevent the demand for more sustainable systems. The delay on subsidy payments and the lack of a monthly fixed wage are negative economic points, essentially when compared with other alternative activities.

At least, the lack of accounting records, verified with almost of the farmers of the Serra de Montemuro, is very negative for a correct management of the farm. It is necessary a rational use of the available resources in order to reach the efficiency of the system adopted, that can be correctly analysed and planned using the accounting as a support tool.

4.3. Social sustainability

The social aspects of a sustainable agriculture are mostly related to an even distribution of revenues, of the access to resources and information, and of an active participation of stakeholders in research and decision making processes. Sustainable agriculture must: i) reflect social values; ii) be concurrent with institutions and traditional cultures; and iii) generate high levels of autonomy (Esquivel [13]). It is not only a mere problem of production and of physical productivity but rather a way of life for many families, and the need to preserve stable rural communities (Pinheiro [38]). The social dimension of sustainability implies creating equal conditions in a society oriented towards improving the populations' quality of life (Marta-Costa [27]).

Table 3 synthesises the main social critical points of the agroforestry systems. It is showed that negative points are in much more number than the positive. However, they are also a result of the environmental and economic factors detached in the last sections and they are a clear reflection of the farmer and his family feelings.

The lack of competitiveness of products is due also to the deficient farm size structure, labour demands, hard work in to steep slopes and degraded or inaccessible trails for the herding, an aging population and without qualifications, as similar statement in the document of the European Parliament [15], have contributed to the population decline and to further emphasise the situation of the abandonment of traditional agricultural systems. It is evident the lack of motivation of the farmer to pursue the activity and that this is not part of the children's projects for the future. Also children do not wish to continue their parents' way of life because the low social status of the farming activity.

Table 3: Critical points for the social sustainability of agroforestry systems in Serra de Montemuro

Critical Points	
Positive	Negative
• Creation of self-employment; • Lack of alternatives to the agrarian activity. • Production of foodstuff for self-consumption; • Production of safe high quality animal products; • Consumer's confidence on the final product; • Avoids abandoned areas.	• High level of abandonment of the activity; • Deficient farm size structure; • Lack of labour force; • Hard work due to steep slopes and inaccessible trails; • High level of aging population; • Low levels of education; • Lack of motivation to pursue the activity; • Agrarian activity is not part of the children's projects; • Low social status of the farming activity; • Poor housing conditions.

Therefore, according to Telles [43] "the greatest challenge mountain agriculture has to face is not that of production but creating the necessary living conditions for people to reside in the area". So far this has not been done, yet. As a rule mountain villages do not have good accessibility. Settlements are concentrated and the streets narrow. Orography is hard, the climate harsh and lodgings have poor housing conditions. These characteristics point to the poverty intrinsic to mountain areas, shown by

the populations' low standards of quality of life and their poor incomes (Miranda [31]). Montemuro is by no means an exception.

However, there are positive points too. The agroforestry systems still exist. The lack of alternatives to the agrarian activity, due to the absence of occupation in Serra de Montemuro push people to create their self-employment based in farming activities. As consequence of the system, they consume safe foodstuffs, based on their own production. They are more autonomous to get vegetable and animal products. And, as species and breeds are local and with high rusticity, there aren't need chemicals and toxics inputs, which imply higher level of consumer's confidence on the final product. Despite of little farming developed in Serra de Montemuro, this activity is fundamental to the maintenance of people in territory, and to avoid more abandoned areas.

5. Challenges to sustainable agroforestry development

Departing from the characterization of Serra de Montemuro and some aspects of its (un)sustainability, it can be concluded that many of the negative critical points of the agroforestry systems of Serra de Montemuro derive not from the used system itself, but from its abandonment or degradation. Sustainable development in this territory must be able to enhance the strong points of its economic system and the ones which make it unique, favouring agroforestry activities, especially the breeding of local autochthonous breeds in an extensive regime and improving the quality of local products. This way it will be possible to dignify the activity while making it less hard. In this sense, bovine, ovine and caprine cattle rearing, based on local breeds must be encouraged in Montemuro for the following reasons, as has been advocated by other similar works in mountain areas (Marta-Costa [27]; [28]; Marta-Costa and Costa [29]):

- The rusticity of these breeds, which makes them fit to adapt to the edaphoclimatic and agroecological conditions, and prepares them to make the most of the existing grazing conditions;
- The comparatively low cost of rearing these animals since most of the year they are kept herding on the mountain and they feed mainly on sub-spontaneous vegetation, which is beneficial for nature conservation and landscape preservation. The use of comercial concentrates is null or almost insignificant and administered in small quantities only to calves and sometimes to lactating cows. Thus it is possible to obtain high quality products, some of them bearing a PDO;
- The low cost of these systems and the selling of offspring as an important revenue source and an economic surplus value;
- Self-employment (the opportunity costs of labour are, in most cases, null), self-consumption (milk and meat) and the use of manure and animal traction are other ways of families and farms benefiting from the system.

Despite the above mentioned advantages, it is necessary to identify how agroforestry activities in Montemuro can become environmentally, economically and socially sustainable. From the viewpoint of economic viability and land use management, maintaining agroforestry activities is very important for the territory. Their sustainability implies taking specific measures to develop production and commercialization chains, for example, or to develop other complement ways of income. In the participatory meetings carried out under the motto "Opening the Doors of Montemuro", Montemuro residents referred how relevant production chains are for keeping agroforestry systems sustainable. As reported by Esquivel [13], the economic viability of an agrarian system does not depend solely on the efficient use of resources, given that it is closely linked with the markets and political compromises. Therefore it is necessary to create mechanisms that will help overcome external pressure. To that purpose some policies must be set and actions undertaken, namely:

- Adapting the farming activity to nature conservation polices that help preserve both fauna and flora species as well as recover autochthonous oak groves. The latter should guarantee that forest areas are kept clean so as to prevent fires and enhance such activities as, herding, hunting, beekeeping, processing mushrooms and aromatic herbs, recreation and leisure;

- More forest management practices. European agroforestry areas have been evolving under natural disturbance regimes to which they adapt. Understanding the dynamics of these natural disturbances and the way they relate to other disturbances of human origin, such as management and intervention practices, are essential to preserve and manage biodiversity in humanized ecosystems of current European agroforestry areas (Bengtsson *et al*. [6]). In fact, vast areas of forest have been consumed by fire, which forced public authorities with responsibility in forest management to change their attitudes towards fire use and control and policies regarding herding systems in forests (Rubino [41]). Accordingly Rego [40], Moore and Smith [32] and Loepfe *et al.* [24] suggest that management of forest areas must reintroduce traditional practices like controlled fires, cutting down trees and/or herding which help reduce biomass, while allowing the formation of vegetation mosaics alternating with arboreal formations with clearings dominated by herbaceous communities. Svenning [42], argues that the promotion of autochthonous herbivores[37] and of controlled fire regimes should be a top priority of any conservation policy. The region can directly benefit with fire prevention that can carry some indirect economic advantages, because it involves lower costs than fire fighting;
- Preserving traditional farming activities like "vezeira" and extensive herding on rangelands, resulting in nature and land conservation and the reduction of fire risks;
- Increasing the average number of livestock, particularly of small ruminants. It is essential that the size of herds and flocks be increased so us to make up for the time spent on conducting and herding the livestock, with a particular emphasis on small ruminants whose number is limited and does not provide the families with the necessary income. Reducing working hours by increasing the range of activities - which can be done by promoting the "vezeira" system - may well be a good solution;
- Creating the necessary conditions to transform animal products locally and promoting commercial appraisal and development of agricultural and agri-food products. A possible socio-economic development strategy might be retaining value added obtained through transforming animal products; additionally, the integrated trade of a group of products bearing a territory associated label should be implemented, thus reflecting and advertising the territory's environment, its rural features, the nature surrounding it, the mountains, its quality, in a nut shell, the very essence of Serra de Montemuro Site;
- Transforming agricultural micro productions for self-consumption into market oriented products. Local transformation of traditional agricultural and agri-food products is not particularly developed in Montemuro, where there is no such thing as local agri-food production chains;
- Developing a market for local products while facilitating relationships between producers, distributers, food and catering operators, rural tourism units and consumers;
- Promoting full integration of local products into the gastronomy and contributing to advertising both the products and the territory producing them;
- Regulating and reducing delays in compensation or premium payments, since they economically impair agroforestry activities;
- Developing the tourist and socio-economic features of the hunting activity, particularly relevant in social terms for it fosters relationships within the local community besides representing a surplus value which adds to agroforestry activities;
- Attaching importance to herdsmen's social function, e.g. reinventing their role as managers of an area that needs preserving – shrubs need to be clean, fuel loads reduced, agroforestry systems looked after. But herdsmen can also act as tourism promoters, selling their quality products and turning herding tracks into itineraries for tourists and visitors.

[37] The work carried out in Parque Natural do Alvão (Alvão Natural Park) shows a decrease of the red-billed chough (*Pyrrhocorax Pyrrhocorax*) population due to herding having been abandoned and the thereof ensuing diversity loss (Pereira [37]).

6. Final remarks

Serra de Montemuro Site is a fragile rural mountain territory with a landscape and environmental diversity particularly relevant for nature protection and conservation. It has an aged population scattered by small villages. Some of these villages show clear signs of abandonment, with young people leaving for bigger urban centres. Agroecological conditions are not particularly suitable for the practice of agriculture which is facing a serious decrease. Farming is the main source of income but it is also decreasing and there is still room for improvement as regards making good use of agricultural and agri-food products. Traditional agroforestry systems are undergoing some changes, with negative impacts on the typical landscape and on the environment.

Two key policy implications arise from the analysis of the sustainability diagnosis of agroforestry systems for Serra de Montemuro. The first concerns the relatively low profit of these systems. Besides the low costs of production, the revenue isn't sufficient to maintain the agroforestry systems and, consequently, the landscape and the population in the Serra de Montemuro.

The second policy implication arises from the important role that natural and social capital play in this region, and its relation with agroforestry systems. Serra de Montemuro is one of the most important classified areas in northern Portugal, especially for its role in preserving both the landscape and the natural, environmental and cultural heritage. The conservation of this territory is imperative and the agroforestry systems can be essential for these purpose.

Enhancing the development of Serra de Montemuro Site, while respecting its natural space, its history and culture poses a challenge that has to be won. In order to preserve this type of territory, there must be an intervention at various levels considered essential to its revitalization. One of those levels should be creating the necessary conditions to attract the young population, which can be done through employment and revenue generating activities, renewal of the agroforestry sector and the promotion and improvement of people's living standards (Miranda [31]).

Information, awareness and involvement of the populations at different levels of the development process are also important requirements for the success, sustainability and compatibility of agroforestry activities that can lead to nature conservation.

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THE EUROPEAN RAILWAYS IN THE TEN CONTEXT: FROM PLANNING TO IMPLEMENTATION

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Abstract
Railway systems consist of a mode with many advantages such as environmentally friendly transport services, rational energy consumption- non-oil based- as well as much spare capacity available.
The European Commission promotes a range of measures to maintain the efficiency and competitiveness of the European transport sector. Their final goal is to change the traffic share of the various transport modes in order to face among others the lack of additional capacity of the road system, the environmental impacts resulting from the over-use of the road systems etc. In this context, the revitalisation of the railway system is of real importance.
The railway system consists of a valuable European asset that may contribute substantially towards the ratification of the entire transport system. Strengthening of the railway sector implies both modernisation of the infrastructure as well as improvement of the efficiency of the operations.
In the framework of the Common Transport Policy - as a result of the Maastricht Treaty- the European Parliament and the Council issued the decision No 1692/96/EC on the guidelines for the development of the Trans-European Network (TEN).
In such a framework the railway system consists of an integral part of the TEN. For the efficient implementation of the rail TEN the Commission is proposing to focus on the construction of the missing links as well as on the upgrading of the rail infrastructure providing great potential for shifting freight transport from roads to railways.
Along these lines there has already been identified a group of railway projects which guarantee the efficient development of infrastructure in critical routes all over the continent. These priorities were agreed during the 1994 Essen European Council, and provide a basis for the EU co-financing of the TEN. The focus of this paper is on the role of the railways in the context of the TEN planning and implementation. More precisely, in chapter one some useful information on the advantages of the railways will be presented. Chapter two will present the development of the European railways, before the establishment of the TEN. Chapter three will present the vision of an integrated European rail network in the context of the TEN. In chapter four, the extension of the railway network in the framework of the revision of the TEN will be presented. Finally in chapter five, conclusions and recommendations will be drawn.
Keywords: Trans-European Network (TEN), Common Transport Policy, European railway system
JEL, **classification** R10, R40, R30

1. Introduction

The present railway systems are the result of a long development that started in the first half of the 19th century with the construction of the first railway link in England. Since then, railways have evolved into the complex rail system, of today[38]. As railways played a crucial role in the development

[38]Mainly consisting of the infrastructure, the traffic control systems, the rolling stock and the operations

of national economies, the solutions adopted for the technological and organizational problems, which arose over the years, primarily met national requirements. This has lead to a sector marked by a number of technical variations in its standards –often non-compatible to each other- despite the many common features among the various rail systems. This situation of the European railway systems and rail markets usually reminds of a patchwork of poorly interconnected national systems.

In Europe, various gauge widths can be found, together with different systems for the supply of electricity, different maximum permitted axle loads for wagons and locomotives, different clearances (gabarit), etc. Furthermore, the European rail market is characterised by major differences in the organization of the rail traffic management systems, differences in the requirements for staff and so on. As a result, rail/ services from one country to another face significant delays at border crossings, due to the above differences, which lead to additional costs making thus railways less competitive than other transport means (e.g. road).

The low level of efficiency of the railway system, together with the rather inflexible structure of the European railway companies (state enterprises most of them), were among the main causes responsible for the severe problems of the railway market after the 70s. In fact, rail transport in Europe has experienced a sharp decline for almost thirty years, especially in the area of freight. In 1970 the railways carried 21 % of all freight in the fifteen countries of the European Union. By 2000 this figure went down to 8.1 % while for the same period the proportion of the freight going by road rose from 30.8 % to 43.8%. During the period 1970 to 2000 the tonne-kilometre performance of railway freight also fell by 12% and that was the only mode of transport exhibiting a drop where all the other competitive modes were increasing their performance. Amazingly so, during the same period, the volume of tonne-kilometres carried by road has tripled! The share of railways in the area of passenger transport also declined, although less dramatically, from a percentage of 10.2% of total in 1970, rail transport fell to 6.3% in 2000. **(1)**

The upcoming developments in the TEN and revised TEN context are opening new perspectives for the sector which need to be explored. Therefore the focus of this paper is to examine and present the role of the railways in the context of the European TEN[39] planning and construction. More precisely, the **second part** of the paper provides some useful information on the advantages of the railways as a transport mode. The **third part** comments on the development of the European railways, in the context of the TEN. **Part four** examines the rail priority projects, as these were decided in the Essen summit. In **part five**, the paper tackles the extension of the railway network in the framework of the revision of the TEN, focussing on the new priorities, as these have been defined in the context of the Van Miert approach. In **part six**, the paper gives some information regarding the on going restructuring of the rail sector in the European Union; finally, some summarizing conclusions on the prospects of the European railways are drawn.

2.The Role of Railways

This part of the paper provides some information on the importance of the railways as a transport mode, together with a range of problems, which have led in the sharp decline of the railway traffic the last decades.

Railways are a mode with unique advantages. An attractive railway system can provide environmentally friendly transport services, with low energy consumption, not based on oil, and with much of spare capacity available. Its ability to serve the required modal shift in freight traffic can be shown by the fact that one single train set can carry the equivalent load of up to 50-60 trucks. In addition, the existing railways' infrastructure is dense, and is in

[39] Trans-European Network

general in a good state. However, it seems that the railways face sharp difficulties to match the modern requirements of the market.

Railway traffic is generally more energy efficient and has lower emissions than other modes of transport. Since there is a strong relation between energy and transport policies, this advantage has played a particular role in the whole effort to promote railways. The transport sector is responsible for 25-30 % of the total energy consumption, and policy initiatives have been introduced to promote passenger and freight transfer from road (and air) to rail and intermodal freight transport. A transfer from road to rail is contributing towards diminishing polluting emissions, limiting CO2 emissions, and also minimising the use of natural resources like oil. **(2)**

It should be noted that important energy savings can be achieved in the short-term, on the basis of available technology. It has been estimated that the completion of the European high-speed railway network will lead to an increase in electricity consumption of the rail mode, but this will be more than compensated by a drop in the energy consumption of the other transport modes. As a result, introduction of high-speed trains across Europe will translate into energy saving of some 4% and this for higher mobility and speed levels. It has been estimated that when the high-speed network will be completed (2010)[40], the relevant annual savings would amount 4181 million litres of fuel. **(3)**

Moreover, an electrified rail system provides a transport grid that can be operated with energy produced by various resources, including renewable sources complying with the future energy policy expressed in the Commission's Green Paper. **(2)**

The following Table 1 shows the energy consumption of the various transport modes:

Table 1. Consumption of the various transport modes.

Passengers transport	**Year: 2000**
Unit consumption bus-passengers in goe (grams oil equivalent) per pkm	22
Unit consumption car-passengers in goe (grams oil equivalent) per pkm	38
Unit consumption train-passengers in goe (grams oil equivalent) per pkm	19
Unit consumption airplane-passengers in goe (grams oil equivalent) per pkm	160
Freight transport	**Year: 2000**
Unit consumption truck freight in goe (grams oil equivalent) per tkm	72
Unit consumption train freight in goe (grams oil equivalent) per tkm	7

Source: European Commission/ DG TREN: Report "Transport and energy", 2001

The Table shows that railways have the half of the average unit consumption of the passengers cars (19 vs. 38 goe respectively); for freight transport, the railways have on average, one tenth of the respective unit consumption of trucks (7 vs. 72 goe).

[40] the forecast show that the railways would then transport 143 bio more passenger-kilometers

3. The Development of the European Railways in the TEN Context

This part of the paper examines the development of the rail mode, as part of the Trans-European Network (TEN), as well as the relevant investments that have been devoted on its infrastructure during the last years.

An important moment for the implementation of the common transport policy, the Maastricht Treaty introduced the concept of the trans-European network (TEN), which has gradually arisen as one of the driving forces for the achievement of growth, competitiveness and employment in the EU territory. The result of this process was the Community guidelines for the development of the trans-European transport network (TEN). **(4)**

The significance of these guidelines lied in the fact that they were the first attempt to describe a vision of how an integrated network in the Union's territory should develop in the 2010 horizon.

The TEN accounts for almost half of the total goods and passenger traffic in the EU. It can be seen as a planning instrument enabling established links to countries bordering the EU to be improved.

The Community guidelines involve investments by 2010 estimated at that time around Euros 400,000 million. A number of financial instruments have been set up by both the Community and the European Investment Bank in order to implement this particular policy, namely the budget for the funding of the trans-European network. However, so far, only 20 % of the work has been completed, and much remains to be done. At the present rate, and without additional financing, a further 20 years will be needed just to complete the work planned for 2010. If the necessary infrastructure is not completed, there is the danger that the Common Transport policy goals will not be achieved. **(5)**

Especially large investments have been devoted for railways, where 88.5 billion Euros, between 1996 and 2001, were spent on railway infrastructures. The highest amounts spent are exhibited, so far in Italy, UK, Germany, France and Spain. From 2002 onwards, 118 billion Euros are planned to be invested for the entire TEN-T railway network.

Three types of railway lines were distinguished in the TEN guidelines: high speed lines, upgraded high-speed lines and conventional. Between 1996 and 2001, n the 15 Member States, of the time, expenditure on high-speed lines accounted for 48% of the total, 30% was allocated to upgraded high-speed lines and approximately one fifth was spent on conventional lines. For the period up to 2006 the share for high-speed lines increases slightly, with the highest expenditure being in France, Italy, Spain and Germany. Investments in conventional lines add up to 17.5 billion Euros from 1996 until 2001 and another 23.1 billion will be spent from 2002 onwards. **(6)**
In the new member countries, 2.9 billion Euros were invested between 1996 and 2001. As it has been reported during the TINA[41] process, the total investments in railway infrastructure in the TEN (at the time) candidate countries, has been estimated to 37,119 Million Euros between 1999-2015. Poland and Romania have the lion's share in the railways investments. It is noticed that no investments in high-speed lines were reported. **(7)**

In the territory of the enlarged Union, the railway network was distinguished in the basic (backbone network[42]) and the additional railway components, as reported by the countries themselves.

Tables 2, 3 and 4 give interesting information on the situation.

[41] Transport Infrastructure Needs Assessment
[42] identical with the sections of the ten Pan-European Corridors of Helsinki in the candidate countries

More precisely, Italy Germany and France appear to realise investment programs of 39,780 mil., 36,175 mil. and 26,972 mil. Euros respectively, during the period 1996-2010. On the other side, Poland and Romania realise investment programs of 14,612 mil. and 5,192 mil. Euros respectively, during the period 1999-2015. In total, the "old" EU countries have programs of investments in rail infrastructure amounting to about Euros 220 bil, in the horizon of 2010. The relevant investments in the "new" EU countries are about Euros 37.5 bil. in the horizon of 2015.

Table 2. Investments in the TEN Rail infrastructure

All sums in Million euros

	Investments in TEN Rail infrastructure						
	1996/1997	**1998/1999**	**2000/2001**	**2002/2003**	**2004/2005**	**2006/2010**	**Total**
EU of 15							
Austria	669	984	285	433	311	622	**3303**
Belgium	575	967	539	1136	1088	2934	**7240**
Denmark	1291	3055	420	5	0	0	**4772**
Finland	188	265	236	552	431	497	**2169**
France	1730	4402	4599	4636	4810	6732	**26972**
Germany	5371	5033	4270	6824	5033	9644	**36175**
Greece	380	475	569	945	941	984	**4295**
Ireland	46	104	60	87	87	121	**505**
Italy	1730	7822	8292	8845	6112	6977	**39780**
Luxembourg	31	11	7	3	3	7	**62**
Netherlands	625	1429	5724	6342	6364	3153	**23638**
Portugal	127	580	422	422	329	118	**1998**
Spain	755	1743	2794	4144	4516	10540	**24494**
Sweden	935	697	383	1303	1209	1511	**6038**
UK	569	4690	6431	8358	8697	9563	**38307**
Total	**15025**	**32257**	**35033**	**44035**	**39392**	**53466**	**219749**

***Source**: T E N - I n v e s t/: PLANCO Consulting GmbH, 2003*

Table 3. Investemnts in the TINA Rail infrastructure

	Investments in the TINA Network 1999-2015		
	Backbone Network	**Additional Components**	**Total**
Bulgaria	1930	200	2130
Czech Rep.	1904	1807	3711
Hungary	2915	1115	4030
Latvia	510	432	942
Lithuania	1268	49	1317
Estonia	183	76	259
Poland	9718	4894	14612
Romania	3651	1541	5192
Slovakia	1728	187	1915
Slovenia	3011	0	3011
Total	**26818**	**10301**	**37119**

***Source**: TINA Final Report. November 1999*

Table 4. Comparison of the TINA Network with the TEN

	TOTAL TINA	**EUROPEAN UNION**	**Ratio CEEC/EC**
Surface Area In km²	1,087,617	2,238,700	48.6%
Population in mil. Inhabitants	105.9	372.1	28.5%
Length of Rail in km	20,924	73,900	28.3%
Km per 000 sq. km	19.24	33.01	58.3%
Km per 000,000 inhabitants	197.58	198.60	99.5%
Construction Cost to complete the Railway Network	37,119 *	219,749 **	16.9%

* in the period 1999-2015

** in the period 1996-2010

Source: TINA Final Report. November 1999: Main indices for the TINA Network versus TENs. Elaboration of figures

Regarding the type of railways the situation in the Member States in 1996 was not so much different than that in the Candidate Countries. In the former, the Trans-European Transport network comprised approximately 90% of conventional lines. Only 10% of the length of the railway links was upgraded high-speed lines or high-speed lines. In the Candidate Countries, almost 100% was conventional lines. However, it can be assumed that there were differences as to the operational characteristics of the conventional lines in the Candidate Countries.

Up to the year 2001, the share of up-graded high-speed lines and high-speed lines increased to almost 15 % in the Member States, whereas in the Candidate Countries no significant developments took place. In addition, for the same period, the share of up-graded high-speed lines and high-speed lines increased up to almost 15 % in the Member States, whereas no significant developments took place in the Candidate Countries.

Further developments until 2015 and 2020 are difficult to capture although, it can be said that the recent enlargement (1st May 2004) will have significant consequences on the overall picture of the railway infrastructure in Europe. The high-speed network will certainly be further developed, not only in the territory of the "old" Union, but also in the "new" Member States. The limited public and private capital available, needs to be coupled with innovative policies related to charging for infrastructure use. In addition public funding must be more selective and focused on the necessary major projects increasing the territorial cohesion of the "expanded" Union, optimising thus infrastructure capacity and contributing towards the removal of bottlenecks.

4. Rail priority Projects, as defined at Essex

The European Council, in the Essen meeting 1994, identified a number of major priority projects, which were subsequently incorporated into outline plans adopted by the Parliament and the Council, which provided a basis for EU co-financing of the trans-European transport network.

This method of building up the trans-European network, as introduced by the Maastricht Treaty, has yet to yield all its fruits. Some major projects have now been completed or have reached their final construction stages, such as the two basic railway priority projects (as defined in the Essen list), mentioned herewith:

- ***High-speed train PBKAL***:

It envisages the construction of a new railway network that will soon provide a high-speed alternative to air travel for passengers crossing the heart of Europe. Linking a number of capitals and other major cities, Europe's first cross-border high-speed rail project was launched in 1989 with the signature of an agreement between France, Belgium, Germany, the Netherlands and the United Kingdom.

- ***High-speed train East***:

European citizens from west and east alike will benefit from a new high-speed railway link between Germany and France. The project envisages the construction of the new 320 km an hour line between Paris, Metz-Luxembourg, Saarbrücken-Mannheim and Strasbourg/Kehl. The project is designed to connect the extensive high-speed rail networks that already exist in France and Germany.

In addition, common transport policy promoted the development of the most modern techniques within a European framework of interoperability. Projects launched at the end of the 1980s are now bearing fruits, as can be seen in the trans-European high-speed rail network and the GALILEO satellite navigation programme.

If a number of missing strategic links have to be built, a more effective use of the existing network becomes crucial. Only the proper use of modern technologies and the innovative cooperation between public authorities and the private sector will be able to integrate the logistic chains crossing Europe and to achieve more integrated and more efficient traffic management.

5. The Revision of the TEN: The Rail Extension

In the context of the EU enlargement, and together with the revision of the TEN, new priorities should be defined, including now projects in the new –enlarged- territory of the Union. This part of the paper focuses on the new railway priority projects[43], after the extension of the TEN.

The TEN guidelines were not meant to be rigid, nor eternal and so, they were revised in the light of new transport data, traffic forecasts and changing economic, political and financial circumstances.
The European Commission submitted at the end of 2003, a new proposal to further reform the trans-European network policy[44]. The scope of this proposal is to connect the networks in the whole territory

[43] from the "Essen prioroties" to the "Van Miert priorities"
[44] already approved in May 2004

of Union –including the new Members States- and increase the concentration on selected real European priorities such as cross-border projects and the key land and sea routes needed for continent-wide cohesion and an expanded internal market. **(8)**

This re-focusing of efforts in the Trans-European Transport Network leads to a shift of emphasis and concentration on the networks, which connect the new Member States. A high-level Group, chaired by the former Commissioner Van Miert and supported by senior transport experts from all 25 member States studied the new needs.

Particular attention was paid to a number of important issues such as:
- Halting or slowing down present trends of modal shift
- The possibility of integrated rail freight corridor management in line with the Railways Policy
- The perennial problems of technical harmonization and interoperability in rail transport
- The need to fully integrate harmonized management systems in the Trans-European network, taking advantage of advanced technical tools such as GALILEO

In view of the expected increase in traffic on the major axes, and the need to incorporate the new Member States, the Commission identified the new priorities to facilitate transnational exchanges in a single internal market, by promoting intermodality and rebalancing of the territory of the enlarged Union. These new priorities[45], have a high European value added and are realistic, concerning financing constraints. However, the eligibility of each project depends on the financial instruments and has to be assessed on a case by case basis.

The countries agreed to begin the commencement of works on all the sections of these projects at the latest in 2010 or to make them operational at the latest in 2020.

The majority of these projects aims at building new, or upgraded existing railway lines. The new geography of transport flows in Europe together with the technological advancements of the transport sector, particularly in the railway sector, require going beyond the traditional design of infrastructure.
Technological projects are also adopted aiming towards improving the interoperability, as well as the overall transport management of the rail network of the rail network based on the European Galileo system of radionavigation by satellite.
From the adopted 30 priority projects, the following nine are of special interest for the European railways development: **(9)**

- ✓ **Railway line Berlin – Verona/Milano – Bologna – Napoli - Messina**

Ongoing improvements to one of Europe's major rail axes will enable both people and goods to travel much faster between Northern Europe and Italy. The construction of a new rail basis tunnel under the Brenner pass will encourage the development of intermodal transport in the Alps. Besides the bridge over the Strait of Messina will connect the second most populated island of Europe (5 millions inhabitants) to the rest of Europe.

The project consists of 3 sections:
- Munchen – Kufstein;
- Kufstein – Innsbruck;
- Brenner Tunnel

- ✓ **High speed railway lines of South-West Europe**

The additional capacity and higher quality of service ensured by this project will improve the connection of Portugal, Spain and the South of France to North and Central Europe, contributing to a better accessibility of the Iberian Peninsula through the natural barrier of Pyrenees. Journey times

[45] Referring to the time period 2007-2020

within the areas will be dramatically reduced. Additional capacity and improved quality of services will make a significant contribution to sustainable development by shifting road traffic to rail. Improved transport links will also provide a substantial boost to economic development in the regions served. The extension of the European standard gauge to the Spanish and Portuguese network will smooth international trade by removing the interoperability barrier at the Spanish- French border.

- ✓ **Railway line Lyon – Trieste/Koper – Ljubljana – Budapest – Ukrainan border**

The construction of this new rail line will encourage the development of intermodal freight transport in the Alpine Valleys suffering from high traffic densities and serious pollution. Its extension eastward will improve the connections to new Member States while reinforcing the access to the Adriatic Sea.

- ✓ **Nordic triangle railway line/road**

The Nordic triangle transport scheme aims at upgrading road and rail in Sweden and Finland to improve freight and passenger transport between the Nordic countries and Central Europe. It will contribute to overcome the remoteness of Sweden and Finland from the centre of European continent and help to integrate these outlying regions into the European Union.
The project is a combined railway and road investment program for the Nordic Triangle in Sweden, connecting the cities Copenhagen, Stockholm, Oslo and Helsinki. Concerning the section to be upgraded some works have to be done in the railway sector and some others in the road sector.

- ✓ **Freight railway line Sines – Madrid - Paris**

This project consists of the construction of a new high capacity rail link across the Pyrenees on a route that is still to be defined amongst several options under consideration. This link, dedicated mainly to freight, should include European gauge lines and would require the construction of a long distance tunnel, (expected length between 33 and 47 km) approximately 50% in Spanish territory. The expected capacity is 20 ton/year. Up to now some preliminary studies concerning the rail tracks have been carried out but still remains a great part to be completed. Design and interoperability standards will comply with EU and UN/ECE standards.

- ✓ **Railway line (Paris) – Strasbourg – Stuttgard – Wien - Bratislava**

This project comprises the construction of new and upgraded high speed lines all the way from Paris to Wien and the upgrading of existing lines between Wien and Bratislava. More precisely it includes, the construction of a second track on the Kehl bridge over the Rhine to interconnect the French and German networks. It includes upgrading of the existing lines, which will be used for freight. The project will provide a continuous rail axis for both passengers and freight from Paris to Bratislava. The development of this axis will contribute to a successful EU enlargement by connecting the new Member States and providing an alternative to roads for inter – Member States traffic. The project will improve access to and from the many conurbations along its route.

- ✓ **Railway line (Athens) -Thessaloniki – Sofia – Budapest – Wien – Praha – Nurnberg/Dresden**

The project is the backbone of the railway network of Eastern Europe, connecting the ports of Athens, Thessaloniki and Constanza to the enlarged Union. The selected sections will complete an axis on which future Member States have already invested through the ISPA[46] programme that will enable a better level of connectivity of networks on the basis of the common standards such as TER and ERMTS, double track, electrified, with maximum speed from 160 to 200 km/h. This line will foster traffic and trade within a big part of Europe. It will also provide the Greek network with an important hinterland.

- ✓ **Railway line Gdansk-Warszawa-Brno/Bratislava-Wien**

The modernisation of this rail line will allow faster journeys for both passengers and freight transport services. The development of attractive rail service from the Baltic Sea along a North - South axis

[46] ISPA: Instrument for structural Programmes for pre-Accession

constitutes a unique opportunity for providing an alternative to the existing saturated North - South axes from the North Sea. The project's route has a particular interest from a European point of view since it carries a high share of international transport (48 million tonnes of international traffic in transit 2000). Besides, the project contributes to a wider strategy to attract new economic activities along the axis, and to promote a modal shift on long distance traffic, whileat the same time serving the mobility needs of regional passengers.

- ✓ **Railway line Lyon-Genova-Basel-Duisburg-Rotterdam-Antwerpen**

Developing a rail axis, from the North Sea to the Mediterranean will contribute towards rebalancing the modal split on one of the most populated and industrial areas in Europe. While establishing a direct connection from the Iberian Peninsula to Germany for passengers, the ultimate goal is to develop a rail freight corridor with dedicated rail freight lines. Works comprise the construction of the new high speed lines in France (South and East branches of the "TGV Rhin – Rhone"), in Germany (between Karlsruhe and Basel and from the Frankfurt airport to Manheim), upgrading of existing lines to enhance their freight capacity and the construction of a dedicated freight line (the "Iron-Rhine") from Antwerp to the German network.

The priorities as were identified in the Essen Summit were proved effective measures for viable investments on transport infrastructure. Especially for the railways, the Essen priorities gave a clear message on the will of the European Governments to revitalise the railways, through investment measuers of high scales.

6. Restructuring of the railway sector

This part of the paper briefly describes the institutional and legislative part of the problem, which – together with the infrastructure- consists a top priority for efficient railways.

The whole process for revitalising the railways –following the provisions of the Common Transport Policy- has been so far efficiently canalised. It is expected that soon all these efforts will give concrete and positive results. Railway is a mode with many advantages that should be properly utilized. The current trends are very positive. If this effort to revitalise the railways fails and railways continue to lose their market position, it would be very difficult to find other opportunities in the near future.

Even if the ambitious investment programme for modernisation of the European railway infrastructure is generally achieved, there would always exist the question of efficient rail operations. There cannot be an efficient railway system without efficient and economically viable rail enterprises.
The European Commission's first White Paper on the development of the Common Transport Policy was published in December 1992, and the guiding principle of this document was the opening-up of the transport market. Over the last 10 years or so, this objective has been generally achieved, except in the rail sector.

The European Parliament took in December 2000 a historic decision to open up completely the rail freight market by 2008.

The arrival of new railway undertakings could help to bolster competition in this sector and should be accompanied by measures to encourage company restructuring that takes account of social aspects and work conditions. The priority is to open up the markets, not only for international services, as decided in December 2000, but also for cabotage on the national markets (to avoid trains running empty) and for international passenger services. This opening-up of the markets should be accompanied by further harmonisation in the fields of interoperability and safety. Starting from March 2003, the member states should implement a package of measures, which should restore the credibility, in terms of regularity and punctuality, of this mode in the eyes of operators, particularly for freight.
This is the so called "*Rail First Infrastructure Package*", which consists of three Directives, i.e. 2001/12, 2001/13 and 2001/14:
Directive 2001/12, refers to the access rights of railway enterprises

Directive 2001/13, refers to the licences of the railway enterprises
Directive 2001/14, refers to the allocation of capacity of the railway infrastructure

According to this framework, from March 2003 the Member States must:

- Open up international freight services on the trans-European Network (and on the entire network in 2008)
- Give managers independent of the railway companies responsibility for decision-making to ensure equitable access to infrastructure and set up regulatory bodies
- Create a transparent framework for allocation of capacity and for charging for the use of infrastructure

The first package is completed with the new Interoperability Directive 2001/16 for conventional railways.

The European Commission has adopted on 23 January 2002 a new package ("second package") of measures to revitalise the railways by rapidly building an integrated European railway area. The five measures are based on the guidelines set out in the 2001 White Paper on transport and aim at greater safety, interoperability and opening of the rail freight market. To give strong impetus to this process, the Commission has also decided the establishment of a European Railway Agency to steer the technical work on safety and interoperability

Finally, The European Commission adopted on 3 March 2004 its third railway package containing measures to give additional impetus to the European railways. The package consists of a Communication, four legislative measures and a Working Document on an extended impact assessment for the gradual opening up of the market for international passenger services.

7. Prospects

Revitalising the railways is thus an imperative. It is a top priority in the European Union's Common Transport Policy. Far from wishing to "fragment" the railways the European Union is anxious, in line with its transport policy, to create conditions in which rail transport can once again be efficient and competitive, both for freight and passengers.

With the "Third railway package", the Commission is proposing to continue the reform of the railway sector by opening up international passenger services to competition within the European Union. It seeks thus to complete the integration of the European railway area and stimulate a mode of transport which is needed more than ever. The Commission is also proposing to improve the rights of passengers using international services, establish a certification system for locomotive drivers and step up the quality of freight services. "*In 2010, the high-speed trans-European network will be connected and new services will be able to develop on the basis of competition. Pressure from low-cost airlines is already a reality for international rail passenger services: they will have to evolve into new models and this is without any doubt the right time to free up initiatives*" stated Loyola de Palacio, Vice-President of the European Commission responsible for transport and energy. "*This proposal is both ambitious and realistic: with the 2010 deadline, we are establishing a clear timeframe for all operators so that they can prepare*" **(10)**

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THE GREEK EEZ: PRINCIPLES OF A GEOPOLITICAL ANALYSIS[47]

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Abstract
This paper comprises three parts. The first part presents and substantiates Greece's legal position with regard to the process of unilaterally establishing an EEZ and analyses the basic concepts, the terms and conditions of this process before resorting to the International Court of the Law of the Sea (International Court of Hamburg). The second part presents the various scenarios, based on the Voronoi chartographic method, with regard to the delineation of the Greek-Turkish-Cypriot EEZ, with or without the complex of island Megisti-Strongyli and Ro. Moreover, Greece's losses in methane hydrates are presented in relation to the sumbarine mountains of Anaximenes, Anaxagoras and Anaximander, for both cases. The third part includes our geopolitical conclusions, through an analysis of Turkey's political behaviour, depending on its geo-strategic aims.
Keywords: Greek EEZ, Davutoğlu, Cyprus-Turkey EEZ, Geopolitics, Strategic Depth, Kastelorizo, Megisti-Strogyli-Ro, Aegean Sea, hydrocarbons.
JEL classification R10, R40, R30

1. Introduction

The latest developments in the geopolitical complex of the Eastern Mediterranean, and more in particular in the dipole of Greece and Turkey, correspond to the implementation stage for Turkey's geo-strategic goals. This is witnessed, inter alia, by the declarations of the Turkish Foreign Minister, A. Davutoğlu, during his latest visit in Greece, in March 2011. The sincerity of these declarations should be taken for granted, and should have been expected by the Greek diplomacy. Needless to remind, that Davutoğlu's positions had appeared already in the 2001 first edition of his book, Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları (İstanbul 2004). The book has already been reprinted... 18 times, in Turkey only48. The author presents, inter alia, his known theory of "zero friction with Turkey's neighbours". However, he rejects his theory with regard to Greece, and refers to the so-called strategic chock point of transport and defence-related flows in the Dardanelles, as well as to the strategic importance of Thrace and of Phanari (tr, Fener)!
In other words, he posits that:
(a) At this geopolitical and geographical point of Turkish geo-strategic influence on the Balkan Peninsula and the Aegean Sea, Turkey is faced with two, geo-strategically competitive, poles of power: Greece and Russia. It also sees the "Patriarchate of Phanari" (sic) as a geopolitical catalyst of Greece's geo-strategic goals in this chock point and considers that the Patriarchate, together with "the small Rum [Greek] community aims to acquire an ecumenical character (sic!)┐ ". With regard to Russia and its claims on the Straits, Turkey's officials posit that Russia "tries to exercise influence on

47 First published in Greek: Η Ελληνική ΑΟΖ και το Καστελόριζο. Αρχές μιας Γεωπολιτικής Ανάλυσης. Επίκαιρα (Epikera, special edition), 2011 Translated into English by Ioannis E. Saridakis.

48 The book has been published also in Greek: *Το Στρατηγικό Βάθος και η Διεθνής Θέση της Τουρκίας* [Strategic Depth and Turkey's International Position], Athens, 2010.

the Orthodox Slavs in the region of the Balkans and of Caucasus"49.
(b) Thrace is the extension portal for Turkey's neo-Ottoman influence in the Balkans. He considers that it is part of a "security zone created in Eastern Thrace during the Cold War", which must be "expanded further to the West, based on multilateral and bilateral agreements that will be concluded on the level of the Balkans"50. Moreover, he posits that this expansion is highly competitive vis-a-vis Russia, in absolute Cold War terms, as a necessary element for the creation of "security aegises in the periphery or outside it, aiming to counterbalance the Russian factor in the region and mainly to prepare a master plan to guarantee the internal security and the territorial integrity of Albania, of Bosnia and of Macedonia (sic!)"51.
On the Dardanelles-Aegean Sea trade corridor, however, it is reasonable for the Turkish Foreign Minister to include the Greek Dodecanese and to posit, clearly and unreservedly, that "at this point, the geopolitical and military reality must be aligned with the economic and political reality. **In the same way, it is necessary to increase the dependence of the Dodecanese on the continental plate of Asia Minor...** (NB: the author refers to Turkey and provides also a geopolitical dimension, which he aims to utilise so as to disallow Kastelorizo from claiming an EEZ or a continental shelf, even though the geopolitical dimension is currently absent from the 1982 Convention on the Law of the Sea"52.
Three questions arise from the text of Davutoğlu:
1. What constitutes the danger for internal security and integrity of these three nation-state entities?
2. Which is Turkey's influence on the non-completion of the Russia-Burgas (Bulgaria)-Alexandroupolis (Greece, Thrace) pipeline?
3. To what extent does Davutoğlu think that the designation of FYROM as "Macedonia" reducs the friction between his country and Greece?
It is of course reasonable, in the context of the said geo-strategic Turkish framework, for Ankara to invest in naval bases in Albania, since it insists on being involved as a "protective power" for the interests of Bosnia, and because it has recognised FYROM with its constitutional name "Macedonia".
However, and in order to fully explicate the intentions and the meaning of Mr. Davutoğlu's text, when referring to "zero friction with Greece", it is worth noting his remark that "effort is being put so that Turkey familiarises itself with tensions in its relations with Greece and Syria: this corresponds to the training of a heavyweight wrestling athlete to face a mid-weight athlete (sic!)53. This results in the country not being able to utilise its full potential. Turkey is now obliged to upgrade itself, so as to treat its relations with these countries from a higher level, and only exercise policies from above towards them (sic!)"54.
However, in the geo-complex of the SE Mediterranean, the Turkish Foreign Minister is right to include also Cyprus. It is where Davutoğlu's cynicism is clear in adopting the harshest possible classical principles of "Geopolitik".
Citing from the FM's text:
1. "The latest developments have shown that] the US, by creating a dynamic relation between their Eastern European and Middle Eastern policies, aim to control Europe's Hinterland and to fill the gap in the geopolitical field that emerged after the dissolution of Soviet Union. The Aegean Sea and Cyprus are two important elements, both on the Eastern Europe - Middle East axis, in terms of land connection, and on the Adriatic Sea - Eastern Mediterranean - Gulf axis, in terms of sea connection55.
2. "(...) Within this strategic planning, the Cyprus issue will come to the foreground in a more drastic manner. (...) Nowadays, a field of a highly dynamic interaction is formed between Eastern Europe, the Balkan Peninsula, the Adriatic, the Aegean, Eastern Mediterranean, Middle East and the Gulf. (...) On this line, unifying the Balkans and the Middle East, the development of new onsets will be

49 A. Davutoğlu, op. cit.
50 A. Davutoğlu, op. cit., p. 202.
51 A. Davutoğlu, op. cit., p. 202.
52 Op. cit. p. 235.
53 NB: What a..."delicate" and "peaceful" approach!
54 A. Davutoğlu, op. cit., p. 235.
55 *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, 18th edition, 1st edition 2001, p. 174.

unavoidable".
3. "[chapter section title] 'The strategic Gordian knot of Turkey: Cyprus"
"Cyprus, having a central position within the global continent, and being located at an almost equal distance from Europe, Asia and Africa, is located together with Crete on a line traversing the maritime corridors. Cyprus holds a location between the Straits separating Europe and Asia, the Suez Canal, separating Asia and Africa, while it also acts as a stable base and an aircraft carrier catching the pulse of the sea corridors of Aden and Ormuz, together with the basins of the Gulf and the Caspian Sea, i.e. the most important routes connecting Eurasia with Africa"56.
4. "A country ignoring Cyprus cannot be active in world and peripheral politics. In world politics, it cannot be active, since this small island occupies a position that (can) influence(s) directly the strategic connections between Asia - Africa, Europe - Africa and Europe - Asia. In peripheral politics, it cannot be active, because Cyprus, with its Eastern nose, stands as an arrow turned to the Middle East, while with its Eastern back, it is the cornerstone of the strategic balances existing in the Eastern Mediterranean, in the Balkans and in Northern Africa"57.
5. "Turkey, affected because of its location by a multitude of balances, is obliged to evaluate its policy on Cyprus, withdrawing it from the equation of Turkish - Greek relations. Cyprus is increasingly becoming a matter of Eurasia and Middle East - Balkans (Western Asia - Eastern Europe). Turkey's policy on Cyprus must be placed in a new strategic framework, and in a manner compatible with this new strategic framework. On the Cyprus issue, and from Turkey's point of view, emphasis can be put on two main axes. One of these axes is human value, and is oriented towards safeguarding the security of the Muslim community, as a result of Turkey's historic responsibility. (...)"58.
6. "A possible incompetence of Turkey which will [eventually] become prominent as pertains to safeguarding and protecting the Turkish minority of Cyprus could expand as a wave in Western Thrace and in Bulgaria, and indeed also in Azerbaijan and Bosnia. The second important axis of the Cyprus issue is the importance of this island from a geo-strategic point of view. (...) Even if there were no Muslim Turks on Cyprus, Turkey would be obliged to have a Cyprus issue. No country can be indifferent vis-a-vis such an island, located at the heart of its own vital space. (...)"59.
7. This geo-strategic importance has two dimensions. One of these has a major strategic importance and relates to the balances between Turkey and Greece, and TRNC and Greek Territories (sic!) in the Eastern Mediterranean. The second dimension of the geo-strategic importance is major and relates to position of the island within the world and peripheral strategies"60.
8. No peripheral or world power having strategic prospects in the Middle East, the Eastern Mediterranean, the Aegean Sea, Suez, the Red Sea and the Gulf can ignore Cyprus. Cyprus is located at an ideal distance from all those regions and acts as a parameter that can influence each and every one of them. Turkey should exploit the strategic advantage it gained in the 1970s on this parameter, not as an element of defensive Cyprus policy aimed to safeguard the status quo, but as a fundamental support of an aggressive sea strategy of a diplomatic nature"61.
During his visit to Greece, the Foreign Minister's statements went no further than his academic publications. Therefore, there is no room for surprise in Athens. And the criticism by the mass media and Greek diplomatic commentators should not relate to his... bourgeois politeness and his... good manners! Any criticism should relate to the level of geopolitical and geo-strategic perception of the System of SE Mediterranean. It would be better to have no criticism at all, than to have this kind of criticism. One of the issues that must be taken seriously into consideration by Turkey, in response to the theories of Ahmet Hodja, is its proper position with regard to the demarcation of a Greek EEZ, which should not be delayed, given that the intents of Turkey have now been made clear, and are posited by officials, even in scientific contexts... In other words, in the context of the greater geopolitical game and the geopolitical reforms developing in the Eastern Mediterranean and the oil-bearing Muslim world, both on and beyond the Mediterranean coastline, three are the main focal

56 Op. cit.
57 Op. cit., *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, p. 176.
58 Op. cit., *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, p. 178.
59 Op. cit., *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, p. 179.
60 Op. cit., *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, p. 179.
61 Op. cit., *Stratejik Derinlik. Türkiye'nin Uluslararası Konumu, Küre Yayınları,* İstanbul 2004, p. 180.

points for demarcating a Greek EEZ:
(a) Greece's significant relations with Israel and the important political support that is openly offered by Jerusalem to Athens is a major political trust, which should not be consumed without a reason or be limited to the exchange of official visits between the two states. Greece's current state of economy urges in this direction, while waiting and navel-gazing are no aid at all. On the contrary, they diminish the level of trust shown by Jerusalem to Athens.
(b) The discovery of natural gas reserves in Israel's EEZ should be channelled to the European market, as soon as possible, particularly amidst the energy instability caused by the explosion of national social formations in Tunisia (natural gas), Libya (natural gas and high quality crude oil) and Egypt (new natural gas reserves in the Nile Delta region and in the submarine areas north of the Delta, within the Egyptian EEZ). Consequently, the axis of flow of non Arab-Muslim and non-Russian hydrocarbons towards the EU is the one defined by the Israel - Cyprus - Greece (Kastelorizo - Crete - Ionian Sea) - EU route.
(c) Recent geophysical explorations in Cyprus would lead, mathematically and within the next 5 to 10 years, to corresponding processes also in the Greek space, both on land and on sea, either willingly by Athens and with the corresponding benefits for the stalling Greek economy, either unwillingly and without such benefits62!
The said 5 to 10 year period is defined as the time necessary for the commencement of the exploitation of the Leviathan reserve in the Israeli EEZ, given that the Noble Energy & Delek (Israel) consortium is currently preparing a storage facility for LNG derived from this reserve, as well as a storage facility for carbon monoxide produced from the completion of the drilling. However, achieving this target requires the demarcation of the Greek EEZ, properly timed and in consultation with the Cypriot and the Israeli authorities. However, any timing on the part of Greece should take into consideration the developments in the region and make proper use of them, together with the said 5 to 10- year period, within which any legal arrangements before international judicial bodies (Hamburg) must be finalised. Moreover, Greece resorting to international adjudications for the final settlement of the boundaries between the Greek and the Turkish EEZs, even if this would mean partly waiving Greece's EEZ, e.g. about 25% of its total area, would be preferable to waiving its rights over the entire area, together with the corresponding prospective methane hydrate deposits of the Anaximander Mountains63. In this paper, our effort is to exemplify the evolution of the geopolitical game, in the context of delineating Greece's EEZ by applying the 1982 Convention on the Law of the Sea.

2. Current Situation: Measures and Estimations for the Greek EEZ

Before discussing the size and the geopolitical importance of the EEZ, it is necessary to give an account of the most important elements of its legal definition, so as to avoid doubts and misinterpretations. We shall refer to the new Convention of the Law of the Sea, i.e. the 1982 Montego Bay Convention64.
1. Article 55. “The exclusive economic zone is an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention [Montego Bay, 1982]”.
2. Article 56. “In the exclusive economic zone, the coastal State has: (a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or

62 On the condition, of course, that there will be a government body for the exploitation of these deposits in Greece.
63 As pertains to methane hydrates, see our publication in *Epikera*, 26 (15-21 April 2010).
64 The 1982 UN Convention of the Law of the Sea (UNCLOS) includes precise definitions of the Territorial Sea, the Contiguous Zone, and the Exclusive Economic Zone (EEZ). UNCLOS was signed in Montego Bay of Jamaica and its implementation started on 16 November 1994, replacing four precedent international treaties. In a vote that took place on 30 April 1982 in New York on the ratification of the new convention, 130 states voted for, 4 voted against and 17 abstained. Turkey was one of the states that voted against the convention. By the end of 2008, UNCLOS had been ratified by 157 states, including Cyprus (12 December 1988) and Greece (21 July 1005).

non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds; (b) jurisdiction as provided for in the relevant provisions of this Convention with regard to: (i) the establishment and use of artificial islands, installations and structures; (ii) marine scientific research; (iii) the protection and preservation of the marine environment; (c) other rights and duties provided for in this Convention"65.

3. Article 57. "The exclusive economic zone shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured"66.

An example from the Greek case is the following: Breadth of the territorial sea + width of the EEZ = 200 nm. In the present. In the current state of affairs, i.e. of the Greek territorial sea extending to 6 nm, this equation reads as follows: 6 nm + 194 nm = 200 nm = EEZ!

"This means that the notion of the EEZ currently includes both the traditional sovereign rights which the coastal state exercised on the continental shelf, i.e. on the natural resources of the seabed and the subsoil of its adjacent marine areas, and the new sovereign rights related to research, exploitation and preservation of the natural resources of the overlying waters, i.e. mainly of fish catches. Moreover, additional jurisdictions were given to the coastal state (i.e. exclusive authorisations) with regard to installing and using artificial islands and other constructions, to conducting scientific research and to protecting the marine environment from pollution. There was no consequence for the traditional freedoms of international communication of he other states within the limits (navigation, overflights, and placement of cables and pipelines). This new institution, that was already applied extensively in the practice of states, even before its contractual establishment, constitutes already part of the customary international law"67.

However, as pertains to the continental shelf, the formulations are quite clear and are indeed reinforced by the 1982 Montego Bay Convention. On the basis of this Convention68, one of the most vexed issues of the Law of the Sea was resolved: an agreement was reached on the breadth of the territorial sea, which can no reach a limit of 12 nautical miles (nm). Indeed, this rule has also become customary, owing to its extensive use. Moreover, in view of delineating overlapping territorial seas, the median line principle was adopted, with very few exceptions (article 15). This principle can cover fully the case of Greece and Turkey.

Moreover, it should be mentioned that the rights exercised by the coastal state having the said continental shelf are exercised in the form of "sovereign rights": in other words, no other state can lay claim to such rights, even if the coastal state in question fails to exercise such rights in practice. Also, it should be stressed that, based on a resolution of the International Court of Justice in Hague (North Sea Continental Shelf case69), such rights exist in favour of the coastal state, ipso jure and ab initio, without this state having to take any legal action in this respect70.

Let us make, however, one more clarification with regard to the continental shelf: the continental shelf and its regime, as is currently defined in the International Law, is ceded to the coastal state, for both practical and political reasons. How is this notion distinguished from its geological definition? Based on the 1982 Montego Bay Convention on the Law of the Sea, the continental shelf of a coastal state comprises basically the seabed, within a distance of 200 nautical miles from the coast. This principle applies regardless of the geological formation of the seabed. However, in case the continental margin (continental shelf, continental slope and continental rise) extends beyond 200 miles from the baseline, the continental shelf is deemed to extend either up to 350 nm, or up to 100 nm beyond the 2,500 metre

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65 Β. Καρακωστάνογλου, *Η Αποκλειστική Οικονομική Ζώνη στο Νέο Δίκαιο της Θάλασσας*, Σάκκουλας, Θεσσαλονίκη [in Greek; V. Karakostanoglou, *The Exclusive Economic Zone in the New Law of the Sea*, Sakoulas publications, Thessaloniki], 2001, pp. 54 , 559, (Section V, Provisions of the 1982 Convention on the EEZ; source: Act no. 2321 (Greek Government Gazette A136/23.6.1995).

66 V. Karakostanoglou, op. cit., p. 54.

67 V. Karakostanoglou, op. cit., p. 53-54.

68 V. Karakostanoglou, op. cit., p. 53-54.

69 See *ICJ Reports* (1969), par. 19 in: V. Karakostanoglou, op. cit., p. 42.

70 See K. Οικονομίδης, Βασικές Ρυθμίσεις του Νέου Δικαίου της Θάλασσας, *Δίκαιο και Πολιτική*, Παρατηρητής, [in Greek: K. Economides, Main Privisions of the New Law of the Sea, *Dikeo ke Politiki* (*Law and Politics*), Paratiritis publications], vol. 9., 1985, p. 176-177. In: V. Karakostanoglou, op. cit., p. 42.

isobath, or up to 60 nm from the base of the continental rise71 72.
Until today, all mentions of the Exclusive Economic Zone have as their point of reference the database of the Flanders Marine Institute, which is to date used widely in all publications in the press that relate to the issue of the EEZ. However, as mentioned by the Flanders Marine Institute, the construction of the EEZ is theoretical. In practice, this implies that a scientifically accepted method has indeed been adopted, albeit without accuracy or safeguards for the detailed demarcation of the EEZ.
It is however obvious that Greece has to date relied on the map published by the said institute (seaaroundus.org). It is worth mentioning, however, that this post includes the following:
1. "Disclaimer: Maritime limits and boundaries depicted on Sea Around Us Project maps are not to be considered as an authority on the delimitation of international maritime boundaries. These maps are drawn on the basis of the best information available to us. Where no maritime boundary has been agreed, theoretical equidistant lines have been constructed. Where a boundary is in dispute, we attempt to show the claims of the respective parties where these are known to us and show areas of overlapping claims. In areas where a maritime boundary has yet to be agreed, it should be emphasized that our maps are not to be taken as the endorsement of one claim over another ".
2. With regard to the accuracy of demarcation: "The EEZ boundaries we use in our database were adapted from the public domain "Maritime Boundaries Geodatabase" available from the Flanders Marine Institute (VLIZ, Belgium), overlaid onto the ½ degree x ½ degree spatial cells GIS system of our database. Given the ½ x ½ degree nature of our GIS system, area measurements of EEZs based on our data may differ slightly from those of other systems, and should be considered approximations. Note also that we deal with major disputed areas and unsettled boundary disputes by presenting the areas as non-country specific 'disputed areas' with reference to those countries involved in the claim. Also note (1) that some countries (e.g., around the Mediterranean) have not declared EEZ, in which case we defined EEZ boundaries for these countries based on data and the general methods used by the Flanders Marine Institute, as if these countries were to apply the UNCLOS rules to their definitions, (2) that some countries (notably European Union member states) do not use EEZ for fisheries management. Surface areas are expressed in km² and were obtained by overlaying a global 2-minute cell ESRI GRID of surface area values with a matching ESRI GRID of EEZs (based on General Dynamics Advanced Information Systems database, see above). For each EEZ the intersecting surface area based on the 2-minute raster was extracted and summed. The area of each 'EEZ shelf' was prepared in a similar way but was truncated at 200 m depth, i.e., at the shelf edge, based on the United States National Geophysical Data Center's ETOPOS GLOBAL 2' ELEVATION data ".
The general conclusion drawn from these paragraphs is as follows:
The maps have been drawn using the best information available, without reference to the degree of accuracy of such information. For this reason, any reference to this database is without legal documentation. In spite of this fact, data gathered from official Internet sources leads to the conclusion that the delimitation of the EEZ, even in the context performed by the Flanders Marine Institute, have been derived from a database created by a pertinent European research programme focused on the erosion of coasts73. In the said database, Turkey's coastline is generic, to such an extent so as not to follow the geomorphology of the Turkish coastline with accuracy. However, there is a specific delimitation of baselines by Turkey (see Figs. 2 and 3). The Flanders Marine Institute does not clarify if this form of the Turkish coastline was used for calculating the median line or the baselines.
As pertains to the accuracy of the demarcation of the EEZ, there is no clear conclusion to be drawn from the information provided on the said website (searoundus.org). However, as regards the Greek insular coastline in particular, as well as the coastline of Turkey, which is characterised by a clearly notched geomorphology, it is obvious that more accuracy cision is indispensable, so as to specify both

71 Unofficially, it has been argued that in the case of Greece, e.g. south of Crete, where the physiography an the steep bathymetry exceed 2,500 m., the extension of the continental shelf reaches only 100 nm. This is of course a misunderstanding. Based on the definition of this paragraph, the 100 nm extension is possible only beyond the 200 nm line. The authors hope they have aided in the resolution of this ambiguity.
72 See Εμμανουήλ Ρούκουνας, *Διεθνές Δίκαιο, τεύχος ΙΙ* (*Το κράτος και το έδαφος - Το Δίκαιο της Θάλασσας*) [in Greek: E. Roukounas, *International Law. vol.2: The State and the Territory. The Law of the Sea*], Athens, Sakoulas publications, 2005.
73 Erosion GIS Database, http://www.eea.europa.eu/data-and-maps/data/maritime-boundaries.

the points and the drawing lines.
Consequently, there is no guarantee for Greece that the map proposed by the above-mentioned institute is a sound legal basis, that could be used by the Greek authorities to safeguard national sovereignty (sea borders between Greece and Turkey, Greece and Albania, Greece and Libya, Greece and Cyprus, Greece and Egypt). For reasons of scientific method, the authors have considered that the same procedure should be applied, with the required accuracy and by necessarily taking into consideration the legal clauses that govern the geometrical drawing. This method proves that there should be no room for complacency on the Greek side, while also providing the Greek authorities with examples of geometrical drawings, which Greece would probably have to confront, if and when it resorts, without prior preparation, to the international judicial fora or if it relies on its common arguments about the continental shelf or the EEZ (an issue that is, surprisingly, stressful for Greek politics). For example, in the maps below (Figs. 4, 5), the deviations are clear between the sea borders that are drawn using the Voronoi diagram method and by respecting the said accuracy of geometrical drawing, on the one hand, and the non-accurate borders proposed by the Flanders Marine Institute, subject to the said reservations, on the other.

3. Demarcation of an EEZ between Greece and Turkey. Requirements and limitations subject to the 1982 International Law of the Sea

In view of demarcating the EEZ between Greece and Turkey, we have taken into consideration all of the international rules emanating from the said Articles 55 and 56 of the Law of the Sea. Besides, the process is based also on corresponding cases of application of the Law of the Sea, in delineating the EEZ of other countries as well, particularly in cases where the "median line"74 method was implemented. In particular, and given that this is a geographical process75, the following rules and limitations were taken into consideration:
(a) For Greece: Points of the physical coastline were taken into consideration, on the bases of which straight lines were drawn according to the definitions derived from the Law of the Sea. Therefore, the basic level of information is the list of points that make up the line segments of the baselines.
(b) For purely technical reasons, we performed also an analysis of the Turkish baselines. Where possible, we increased the number of points of Turkey's physical coastline, particularly at areas where the distance between the two coastlines is very small. In other words, we increased the number of points, so as to increase the accuracy of the baseline calculation. Using special mapping software, we georeferenced the map depicted in Fig. 3. The endpoints of the baseline segments are the second basic level of information.

74 Cosquer, G., Hangouët, J.- F. (2003). *Delimitation of Land and Sea Boundaries: Geodetic and Geometric Bases*. FIG Working Week 2003, Paris, France, April 13-17, 2003. This article refers to the separation of the EEZs between Qatar and S. Arabia in 1999, using Voronoi transformations. See also: Christensen, A.H.J., A Fully Automated Sea Boundary Delineator, *Proceedings of FIG XXII International Congress*, Washington, D.C. USA, 19-26 April 2002", Session JS12 Marine Cadastre [www.fig.net/figtree/pub/fig_2002/ Js12/JS12_christensen.pdf].

75 This is distinguished from Topography or any other measurement method, since Geography examines the solution of the problem in its entirety, and in the most comprehensive way, both topographically and from a legal and historical viewpoint.

(c) The information below is addressed to readers who are unfamiliar with the notion of baselines. According to the Law of the Sea76, there are two types of baselines:

i. Normal baselines, calculated from the low-waterline (Article 5);
ii. Straight baselines, in cases where the coastline presents an irregular geomorphology (Article 7), for example if it is notched. The method of calculation used with regard to baselines in cases of rivers, bays, ports and generally of any other geomorphological irregularities depending, for example, by the tidal, wave or wind regime, is defined in Articles 8 to 15 of the Law of the Sea. Based on the above, every state can define its baselines in order to delineate its territorial sea and, by extension, the EEZ.

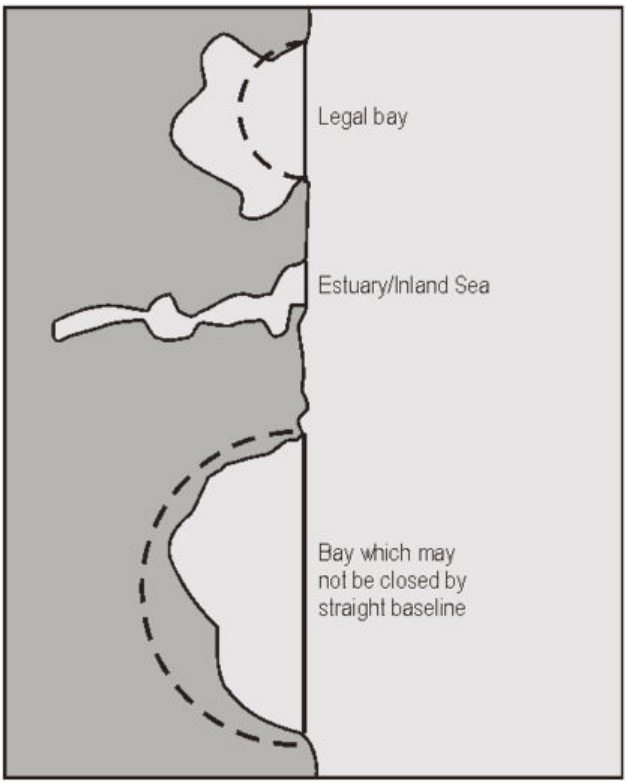

Fig. 1. Depiction of the baseline drawing method, according to the UNCLOS. Source: Harold D. Palmer, H., Pruett, L., (1999) GIS Applications In Maritime Boundary Delimitation [http://proceedings.esri.com/library/userconf/proc99/proceed/papers/pap938/p938.htm].

76 Articles 5 and 7 of the UNCLOS refer to the preconditions for drawing the baselines, as follows: "**Normal baseline** . Except where otherwise provided in this Convention, the normal baseline for measuring the breadth of the territorial sea is the low- water line along the coast as marked on large-scale charts officially recognized by the coastal State. **Straight baseline .** In localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity, the method of straight baselines joining appropriate points may be employed in drawing the baseline from which the breadth of the territorial sea is measured. Where because of the presence of a delta and other natural conditions the coastline is highly unstable, the appropriate points may be selected along the furthest seaward extent of the low-water line and, notwithstanding subsequent regression of the low-water line, the straight baselines shall remain effective until changed by the coastal State in accordance with this Convention. The drawing of straight baselines must not depart to any appreciable extent from the general direction of the coast, and the sea areas lying within the lines must be sufficiently closely linked to the land domain to be subject to the regime of internal waters. Straight baselines shall not be drawn to and from low-tide elevations, unless lighthouses or similar installations which are permanently above sea level have been built on them or except in instances where the drawing of baselines to and from such elevations has received general international recognition. Where the method of straight baselines is applicable under paragraph 1, account may be taken, in determining particular baselines, of economic interests peculiar to the region concerned, the reality and the importance of which are clearly evidenced by long usage. The system of straight baselines may not be applied by a State in such a manner as to cut off the territorial sea of another State from the high seas or an exclusive economic zone.

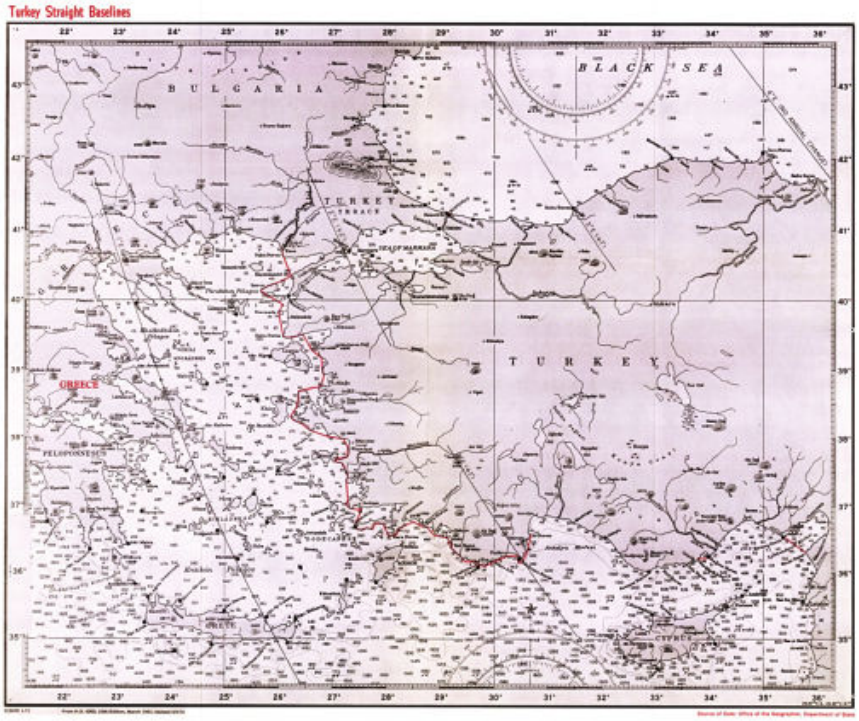

Fig. 2. The Turkish Baselines (marked in red). Source: Office of the Geographer, US Department of State.

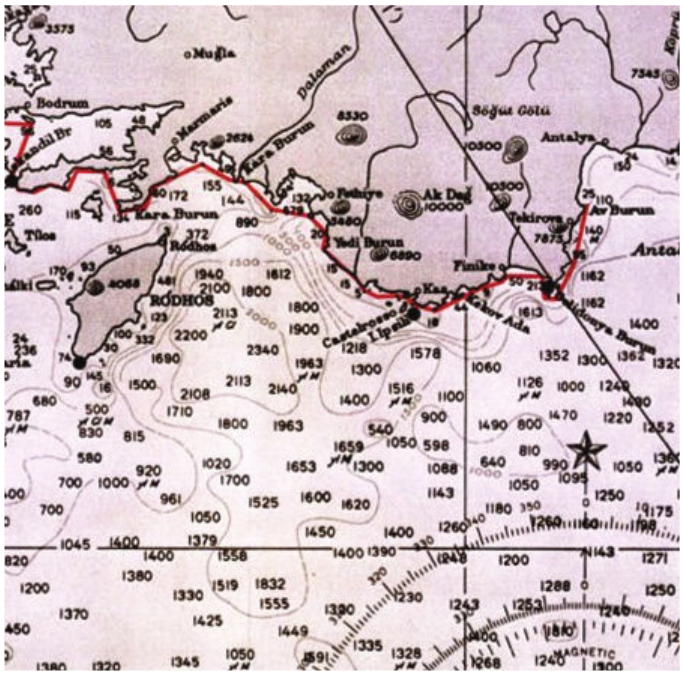

Fig. 3. The Turkish Baselines (detail; marked in red). Source: Office of the Geographer, US Department of State.

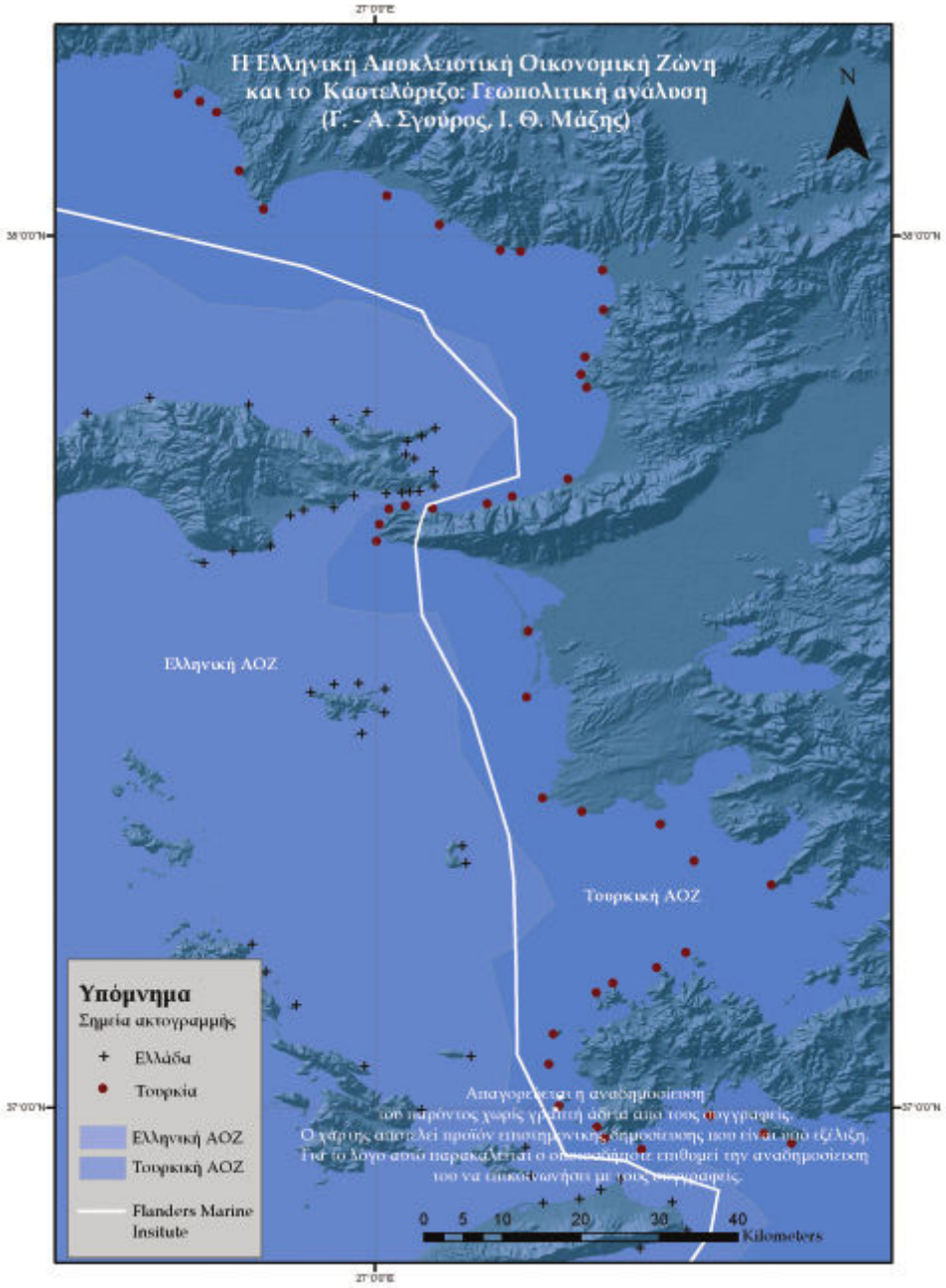

Fig. 4. The white dotted line represents the median line of the EEZ, as calculated by the Flanders Marine Institute. The mistakes are obvious, since this median line coincides with land, within the Turkish territory!. The second drawing was performed by the authors, based on points of the physical coastline and using Voronoi transformations.

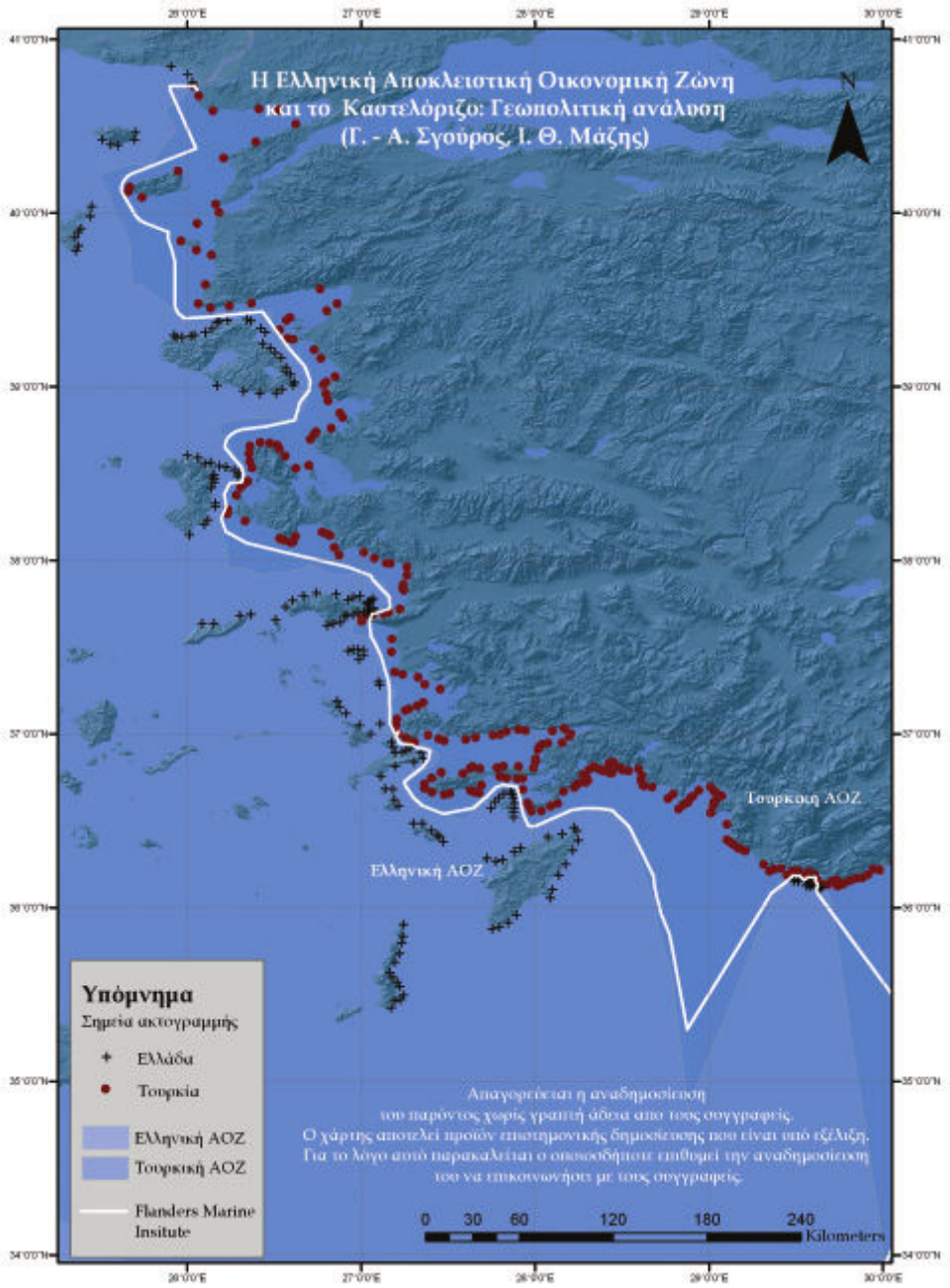

Fig. 5. The limits of the Greek EEZ using the Voronoi method, in the Eastern Aegean, from the Dardanelles to Kastelorizo, based on the already drawn baselines of the Turkish coastline (see Fig. 2), as compared to the (admittedly inaccurate) proposition of the Flanders Marine Institute (searoundus. org). The differences are all but insignificant.

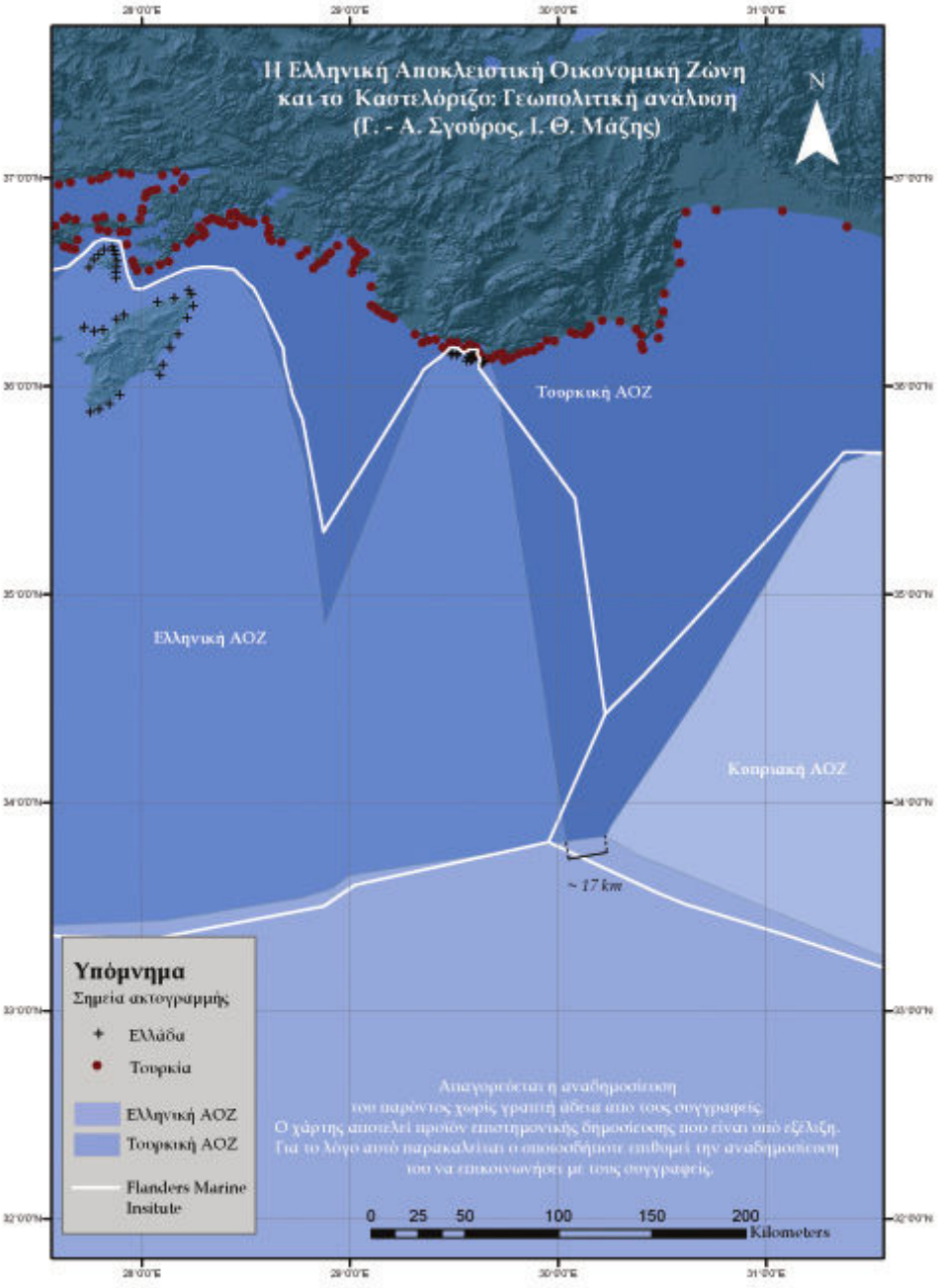

Fig. 6. Using the baselines of the Turkish coastline, it can be seen that Turkey's EEZ contacts the EEZ of Egypt, at a length of 10 nautical miles approximately.

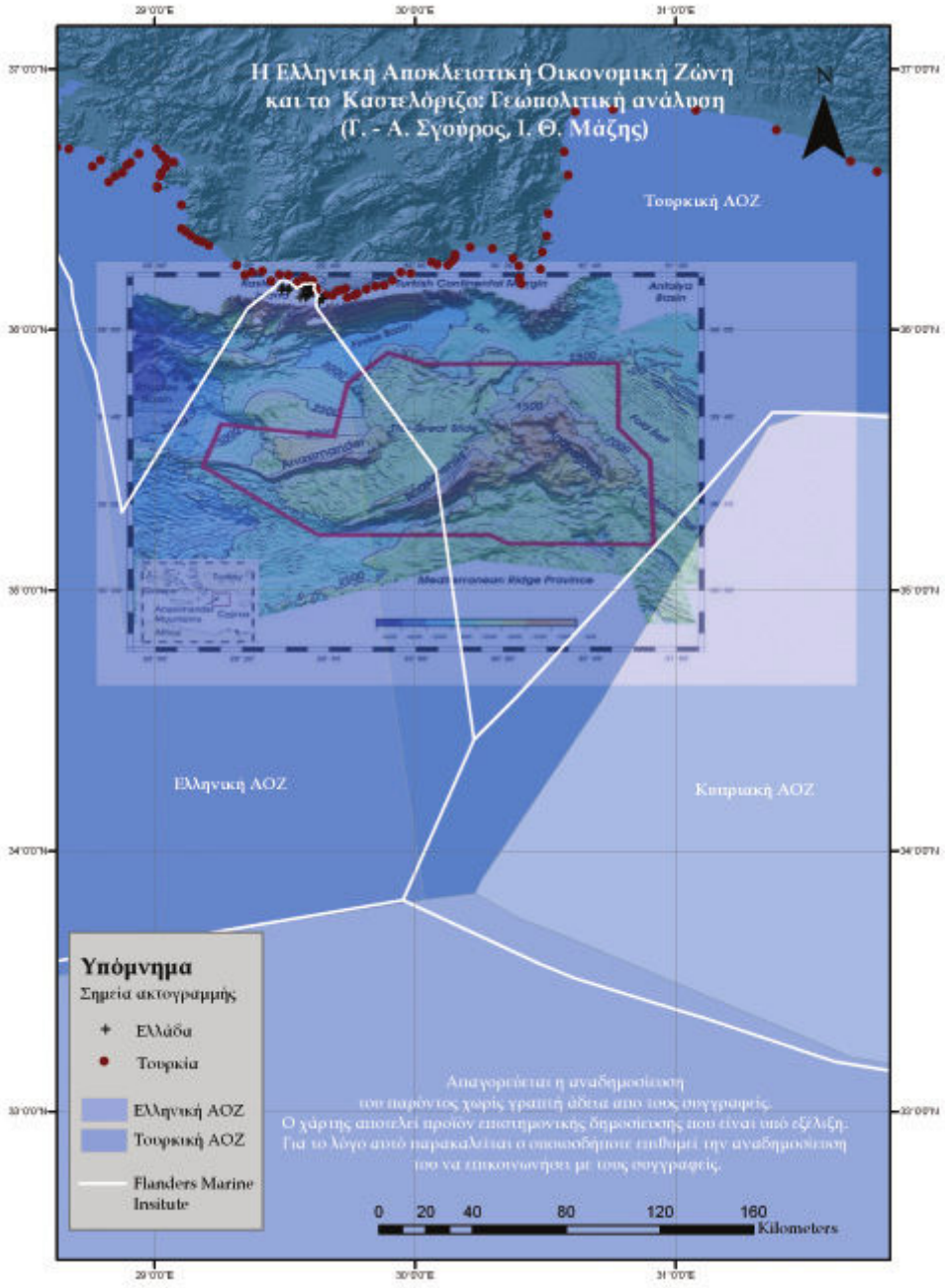

Fig. 7. Distribution of methane hydrates by EEZ (Georeference and overlay of a map included in Lykoussis et al., 200977).

77 Lykousis et al. (2009) Mud Volcanoes and Gas Hydrates in the Anaximander mountains (Eastern Mediterranean Sea), *Marine and Petroleum Geology*, 26.6, 854-872.

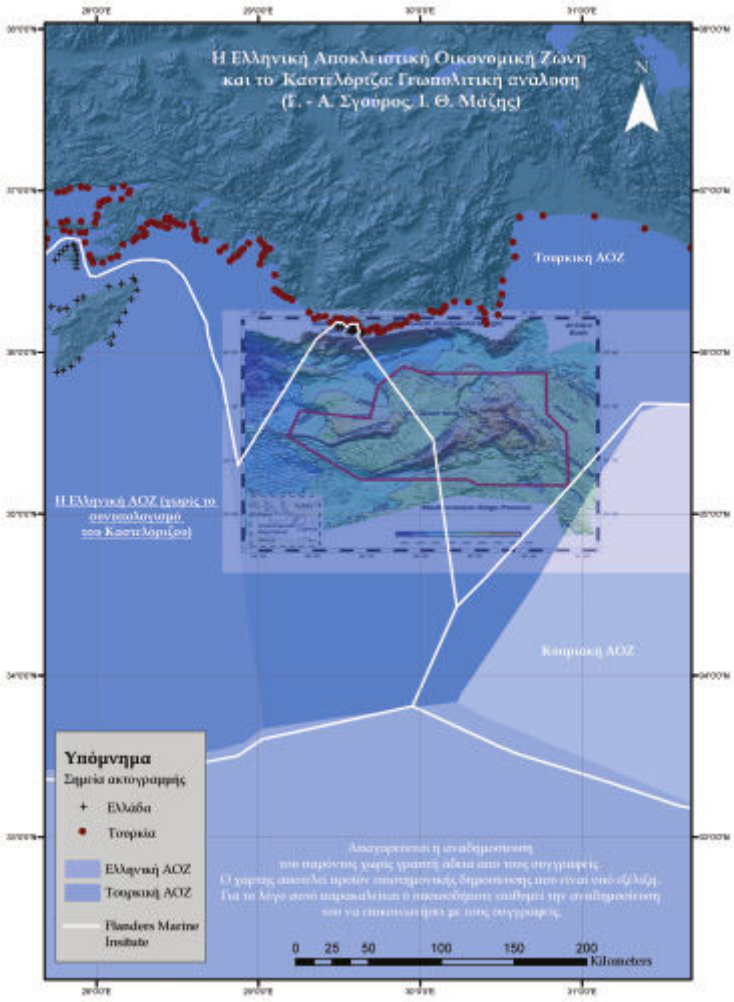

Fig. 8. Distribution of methane hydrates by EEZ without Kastelorizo (Georeference and overlay of a map included in Lykoussis et al., 2009). There are clear differences, compared to Fig. 7.

4. Turkey defines in advance, and without official statements, the limits of the EEZ using its own baselines and its own specification of points on its physical coastline, using the same calculation principle: Obstructing the OGS Explora

The incident that took place with the obstruction of the sailing of the OGS Explora research vessel is an indication that Turkey's competent authorities have already adopted the same method, in view of demarcating their own EEZ. The ship was performing mapping works for the deployment of a submarine cable from Haifa (Israel) to Italy. The incident was reported extensively also in the Greek Press.

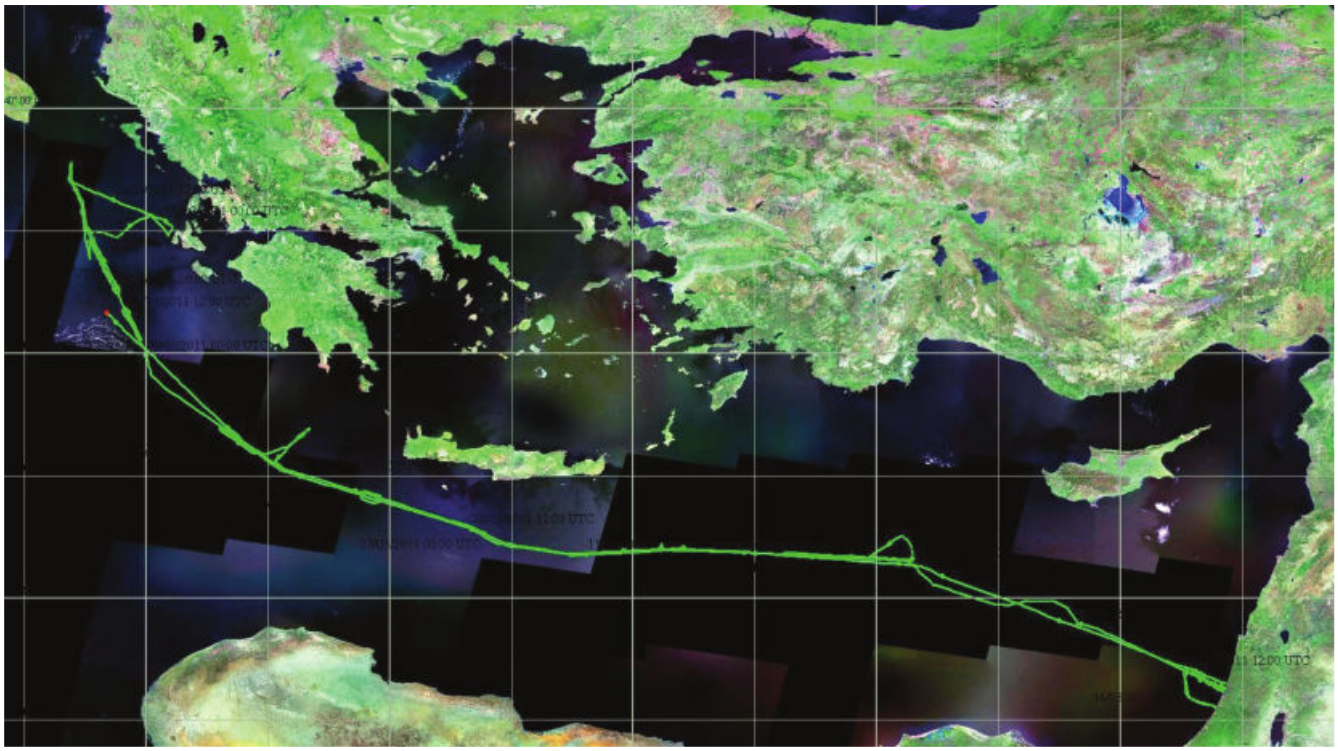

Fig. 9. The mapping course of OGS Explora.

Longitude	Latitude	Date	Time (UTC)
19.54864394	38.75627636	01/03/2011	12:00
34.31461988	32.30308265	16/03/2011	12:00
20.27412338	38.45941995	02/03/2011	00:00
34.69361293	32.10351989	17/03/2011	00:00
19.77606556	38.39994236	02/03/2011	12:00
34.70406405	32.09263813	17/03/2011	12:00
19.23230545	38.18801132	03/03/2011	00:00
34.52614056	32.1893837	18/03/2011	00:00
19.12773265	38.58146818	03/03/2011	12:00
34.74941083	32.09853237	18/03/2011	12:00
19.04123693	38.8907598	04/03/2011	00:00
34.55671241	32.16473256	19/03/2011	00:00
19.26997176	38.19838734	04/03/2011	12:00
34.4409488	32.24399508	19/03/2011	12:00
19.39012291	37.89053869	05/03/2011	00:00
34.46278109	32.22730121	20/03/2011	00:00
19.42593935	37.91982608	05/03/2011	12:00
34.43521931	32.21398326	20/03/2011	12:00
19.56320639	37.53244746	06/03/2011	00:00
34.58121474	32.1616878	21/03/2011	00:00
19.75520449	37.22816118	06/03/2011	12:00
34.69105333	32.10570531	21/03/2011	12:00
19.9995163	36.62879841	07/03/2011	00:00
34.73302836	32.09076871	22/03/2011	00:00

Longitude	Latitude	Date	Time (UTC)
21.25258041	35.51248901	07/03/2011	12:00
34.36973676	32.34036047	22/03/2011	12:00
21.26920029	35.44261358	08/03/2011	00:00
32.50170482	33.02431731	23/03/2011	00:00
21.81561196	35.25304177	08/03/2011	12:00
30.90700531	33.6232053	23/03/2011	12:00
22.13413998	35.55149759	09/03/2011	00:00
30.4880118	33.86267863	24/03/2011	00:00
22.10950901	34.99135279	09/03/2011	12:00
30.18569885	34.07618242	24/03/2011	12:00
22.94419274	34.7589153	10/03/2011	00:00
29.65354848	33.88726912	25/03/2011	00:00
24.45665888	34.26915552	10/03/2011	12:00
29.12024033	33.89065352	25/03/2011	12:00
26.03069533	33.91794011	11/03/2011	00:00
28.33604448	33.9402963	26/03/2011	00:00
27.35336309	34.01424628	11/03/2011	12:00
26.54837781	33.97491121	26/03/2011	12:00
27.05243441	34.02014483	12/03/2011	00:00
24.63182485	34.20557862	27/03/2011	00:00
28.1903392	33.94621999	12/03/2011	12:00
22.86361943	34.79581268	27/03/2011	12:00
30.30942259	33.79252871	13/03/2011	00:00
21.11747214	35.65420847	28/03/2011	00:00
32.79504948	32.97828961	14/03/2011	00:00
19.58844488	37.09085205	28/03/2011	12:00
34.24536097	32.33772488	14/03/2011	12:00
19.45998169	37.21148163	28/03/2011	13:00
34.66414467	32.12105508	16/03/2011	00:00

However, what is not obvious to date, is that this obstruction took place exactly along the EEZ demarcation limits, as detailed in this paper (see Fig. 9).
Let us examine the incident in geographical detail: the said map depicts that the course of the Italian research vessel (Explora) extends tangentially with respect to the demarcation proposed by the authors, i.e. through the narrowest point of contact between the EEZs of Turkey and Cyprus. The course of the steep and unreasonably diverging curve that is marked between points [1. 24/03/2011 00:00 UTC; 2. 24/03/2011 12:00 UTC; and 3. 25/03/2011 00:00 UTC] is, remarkably, located within the EEZ that has been demarcated by the authors using the Voronoi method, which Turkey considers to be its own EEZ. It is for this reason that Turkey annoyed the Italian vessel while it was still within the Cypriot EEZ and before it entered into what Turkey considers to be its own EEZ. Obviously, it is for this reason that the Italian vessel was forced to request a second transit passage permission from the Turkish authorities.
This fact proves that Turkey tries to preoccupy the international community to accept the limits of the EEZ which this country will claim to be its own, if Greece insists on its initial official statements and does not concede to the irrational Turkish claim that the islands of Kastelorizo, Stroggyli and Ro have no EEZ. Of course, this should be taken into serious consideration by Greece, so as to make the appropriate moves and to support its own arguments in a manner analogous to Turkey and thus raise the level of negotiation, if it aims to achieve a final result, better than the one depicted on the above map. In short, the Archipelagic-type baselines in the Aegean insular complex should not be rejected in principle as irrational. They are simply a response to Turkey's legal irrational and arbitrary claim that "the islands of the Aegean have no continental shelf" and that "Kastelorizo is part of the Mediterranean". Let us think clearly: what will we waive before an international court of justice, so as to make Turkey waive such legal nonsense?

5. Geopolitical Conclusions

1. Based on the above, is is concluded that, on the one hand, the EEZ which must be demarcated for its drawing to apply, is an indispensable part of both the conventional and the customary Law of the Sea, which is applicable internationally and, on the other, that it is an unalienable and unique right of the coastal state concerned, to proceed to such a demarcation.
2. Besides, it should be made clear that the European and, mainly, the Anglo-Saxon geostrategic direction have changed. These two international poles of power (the EU and the US-UK [special relationship]) purport to be independent from the Russian, Iranian and Arab-Islamic energy reserves. Also, in the light of this explanation, the Anglo-Saxons of the said special relationship have no positive outlook for a future dependence of the EU on Russia's natural gas, the retailer and distributor of which will be Germany in the EU. This is their chance to avoid this scenario: the deposits of Israel and Cyprus, together with the natural gas deposits of Greece (south of Crete, and in the Ionian Sea and up to the Adriatic) are an ideal solution. Consequently, anyone raising obstacles to this geostrategic development (which in our case is, arguably, Turkey only) would have to face the harsh response of the so-called "West", i.e. of the EU and of the London-Washington Special Relationship. Naturally, the Israeli factor, which is able to influence the Special Relationship, will clearly contribute to the same direction! It should be stressed, however, that Greece should proceed to a tripartite arrangement of its EEZs with Egypt and the Republic of Cyprus, without any further delay, so as to safeguard the contact between the Greek and the Cypriot EEZ. If it fails to do so, Turkey will intervene to render this contact impossible, using the method of the non-calculation of the insular complex of Megisti, Stroggyli and Ro. Moreover, in this way it will be in a position to lay claims on the methane hydrates of the area south and south-east of this insular triangle (see: Ι.-Θ. Μάζης - Γ.-Α. Σγούρος, Κοιτάσματα στην Ανατολική Μεσόγειο, Επίκαιρα, 26, 15-21/4/2010), like in the western side of the EEZ of Cyprus and the eastern side of the EEZ of Crete, at the region of the Herodotus basin, where there is a Greek portion of natural gas deposits of about 1 trillion cubic meters, based on data published already (in the US, in France and in Norway). From a legal standpoint, however, an interfering Turkish EEZ would not obstruct the passage of LNG tankers or the deployment of cables and pipelines through the seabed of the EEZ, even if "political manipulations" end up in this area being considered Turkish subsoil. However, Turkey's behaviour is no guarantee that it will ultimately respect the international rule of law. In this sense, it is imperative to eliminate such an eventuality, through a direct tripartite settlement.

Consequently, there is no excuse for phobic syndromes in Athens, with regard to decisive and targeted actions in the SE Mediterranean.

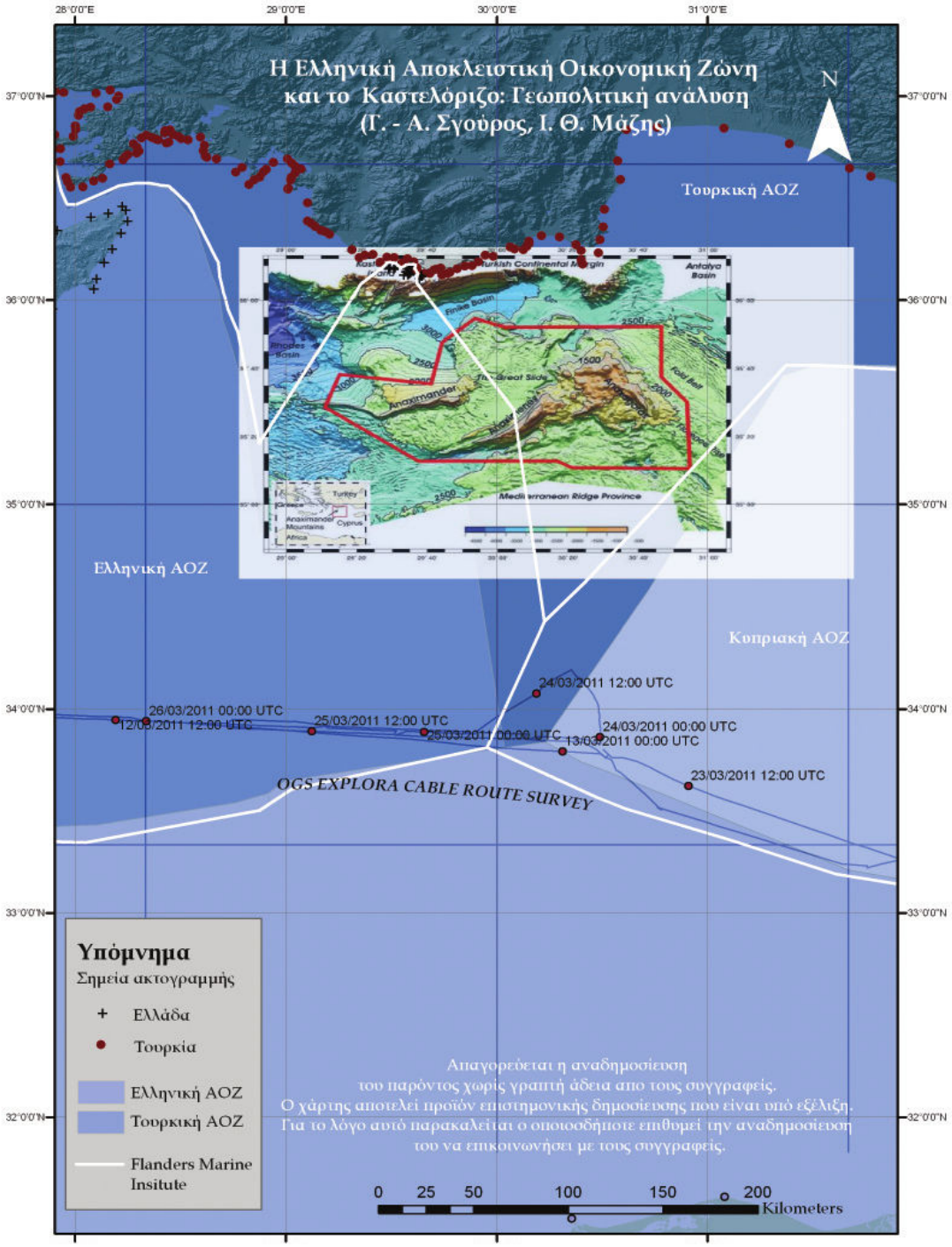

Fig. 10. It is noted that the course of OGS Explora extends tangentially to the drawing presented in this paper, i.e. through the narrowest point of contact of the Cypriot and the Turkish EEZ. The course of the steep curve between points [1. 24/03/2011 00:00 UTC; 2. 24/03/2011 12:00 UTC; and 3. 25/03/2011 00:00 UTC] is, remarkably, located within the EEZ that has been demarcated by the authors using the Voronoi method, which Turkey considers to be its own EEZ.

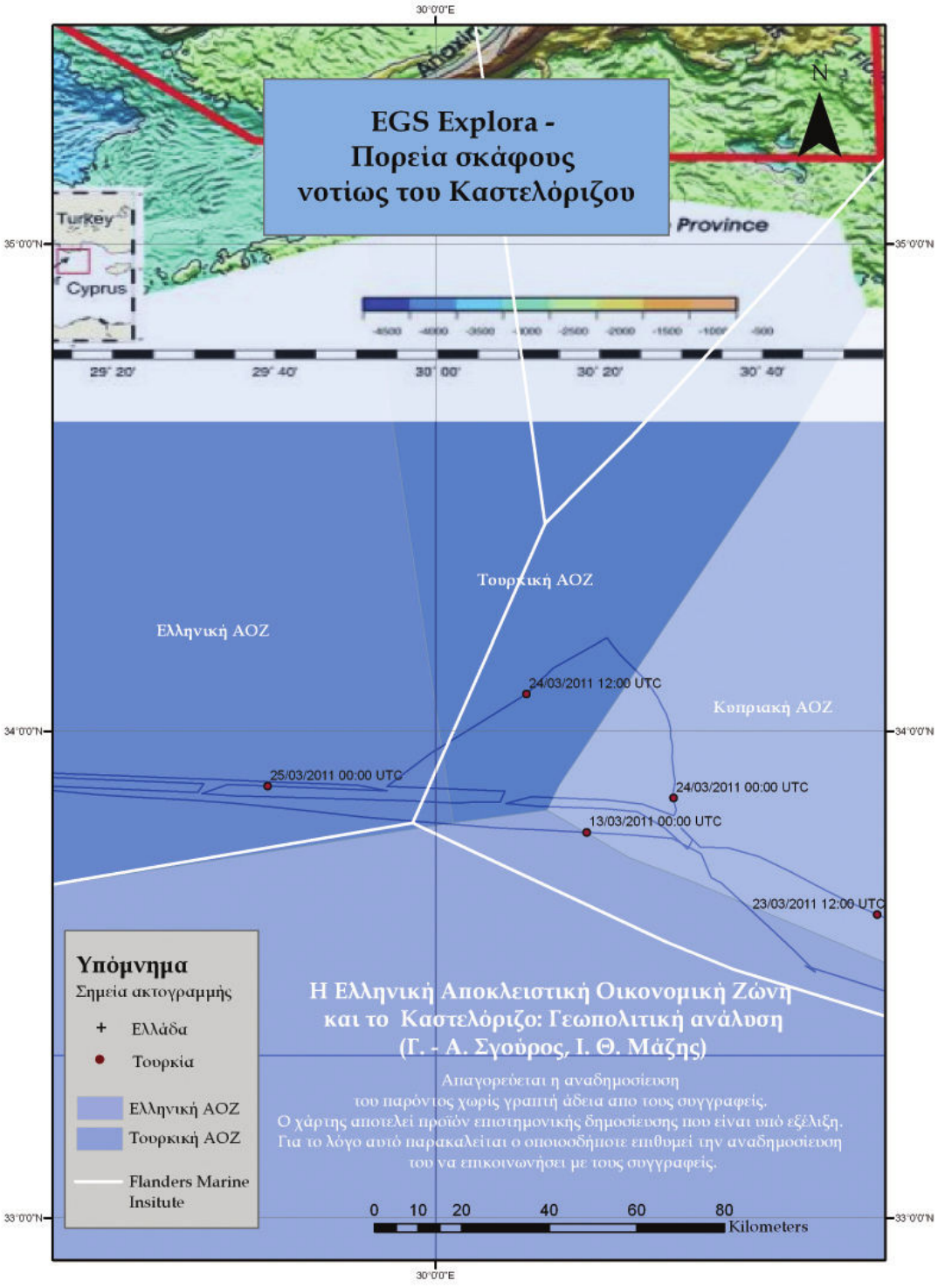

Fig. 11. Detail of Fig. 9. The course of OGS Explora and the location of the said annoyance and deviation from the predefined course (in rectangular frame). Below, the same location with respect to the Turkish perception of the limits of the Turkey-Egypt, Greece-Turkey, Greece-Cyprus and Cyprus-Turkey EEZs.

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A COMPARATIVE ANALYSIS OF ICT DEVELOPMENTS IN DEVELOPING AND DEVELOPED COUNTRIES

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Abstract

The most exposed advancement in this era of globalization has been the Information and Communication Technology (ICT) influx. It has turned the world into a global village with boundless connectively, interactive organizations, information sharing and infinite accesses across the globe. It is a cross-cutting issue as well as an indispensable instrument for social and economic development. For decades ICT has been playing an important role in creating employment, hovering work skills and production. The adoption of ICT can dramatically reduce corruption from a society, thus can bring forward-looking governance in the country. The life and livelihood of a large number of populations, especially those living in rural areas, cannot be developed without utilizing the ICT scope for them. However, Bangladesh, a developing country, with huge potential, despite many problems still far away from using ICT, when the whole world is getting developed with the blessings of ICT. Malaysia, another developing country, was once seen as potential high-tech hub that is downplaying its role now and has focused on developing its own infrastructure. On the other hand, Japan as a developed country and one of the top industrialized countries in the world, has been able to exploit the all-out paybacks from ICT till date.

In this paper, we provide a comprehensive empirical analysis on Information and Communication in developing and developed countries where Bangladesh, Malaysia and Japan are the study regions. We also provide a comparative analysis, raise some future challenges and describe the steps taken forward for the ICT development in these regions before providing a set of recommendations for these nations which also can be adopted by other developing countries.

Keywords: Information and Communication Technology (ICT), Internet, Fixed Line, Cellular Phone, E-Governance.
JEL, **classification** R10, R40, R30

1. Introduction

In recent years, Information and Communication Technology (ICT) is playing one of the key roles in advancement of a nation. It covers the vast area of information, communication and the telecommunication technologies. ICT categorically processes information and ensures connectivity. In this modern era, without the development of ICT sector the dream of a digitization of a country would be a distant dream. However, ICT is only a technology, a technology or a machine could not be functional without human where humans are the driving force in establishing an idea in to society and state. Indeed, Information and Communication Technology is a combination of physical backbone and

the skilled human capital behind the backbone. Physical backbone could be the hardware and accessories e.g., computers, network devices and connectivity and software.

In the era of globalization, ICT is a cross-cutting issue as well as an essential tool for economic development. It can play an important role in creating employment, raising work skills and production. The adoption of ICT can lead to corruption-free, citizen-centric and forward-looking governance in the country. The life and livelihood of a large number of populations, especially people living in the rural areas, can be developed by facilitating ICT equipment. As a whole it can ensure transparency, accountability and answerability at all levels of society and state.

In this paper, we provide an empirical analysis of ICT sectors in developing and developed countries where we choose Bangladesh, Malaysia and Japan as study regions. The two main reasons of choosing these countries are: i) Research area of interest and ii) Accessibility of Information. It is to be noted that Bangladesh and Malaysia fall under developing countries, whereas Japan is a developed country. The main objective of this paper is to study the ICT sector development of these countries. Make a comparative analysis of these countries and to point out the ICT gaps between developing and developed countries. Finally, to make some recommendation to tire downs the gaps to lead the developing countries towards the developed world through ICT. We believe that the study will benefit the developing countries to understand their limitations that will ultimately help the decision makers to plan well towards digitize their vision 2020.

With a population of more than 150 million and a total land of 147,570 km^2, Bangladesh, located in the south Asia (see Figure 1), is considered as one of the most densely populated countries in the world. As a developing country, Bangladesh needs the blessing of ICT for the development of the country. To materialize the idea of digital Bangladesh, development of countrywide backbone and expected number of human recourses are the basic needs. However, availability, accessibility and affordability must be ensured.

Moving down to south east of Bangladesh as shown in Figure 1, Malaysia was once seen as potential high-tech hub that is downplaying its role now and has focused on developing its own infrastructure. However, Malaysia had successfully developed "one of the most advanced telecom environments in the developing world". Indeed with a population of little more than 28 million and a total area of 329,847 Km^2, Malaysia is one of the top developing countries that have done a huge improvement in the ICT sector in the past few years. Malaysia's telecom industry is consolidating but still expanding as mobile growth soars to 90% of its 28 million populations using mobile services. Wired telecommunication though is a more matured market, the usage is seen declining [1].

Besides Bangladesh and Malaysia the other country that is studied is Japan. Japan is one of the developed nations in Asia, which fully utilizes ICT almost in every sphere of its economy. Japan, an island nation located in the Pacific Ocean which lies at the east of the Sea of Japan, China, North Korea, South Korea and Russia, stretching from the Sea of Okhotsk in the north to the East China Sea and Taiwan in the south as shown in Figure 1. It has the world's tenth-largest population, with 127.3 million people and area of 377,944 km^2, Japan is considered as one of the super powers of current time as it has the world's third-largest economy by nominal GDP and fourth-largest economy by purchasing power parity. Japan is also world's fourth-largest exporter and importer.

In reality, the home fibre connectivity gives Japan a huge boost in the country's ICT sector. High Definition (HD) Image Technology, Home Network, and Mobile Equipment Technology are the main areas where Japan has made a big improvement. In the areas like Optical Transmission Technologies such as WDM (Wavelength Division Multiplexing) and PON (Passive Optical Network), Japan has achieved a big improvement. Audio technologies, AV terminal/imaging terminal technologies, Integrated/Process technologies are some other sectors where Japan gets a lot of world's attention.

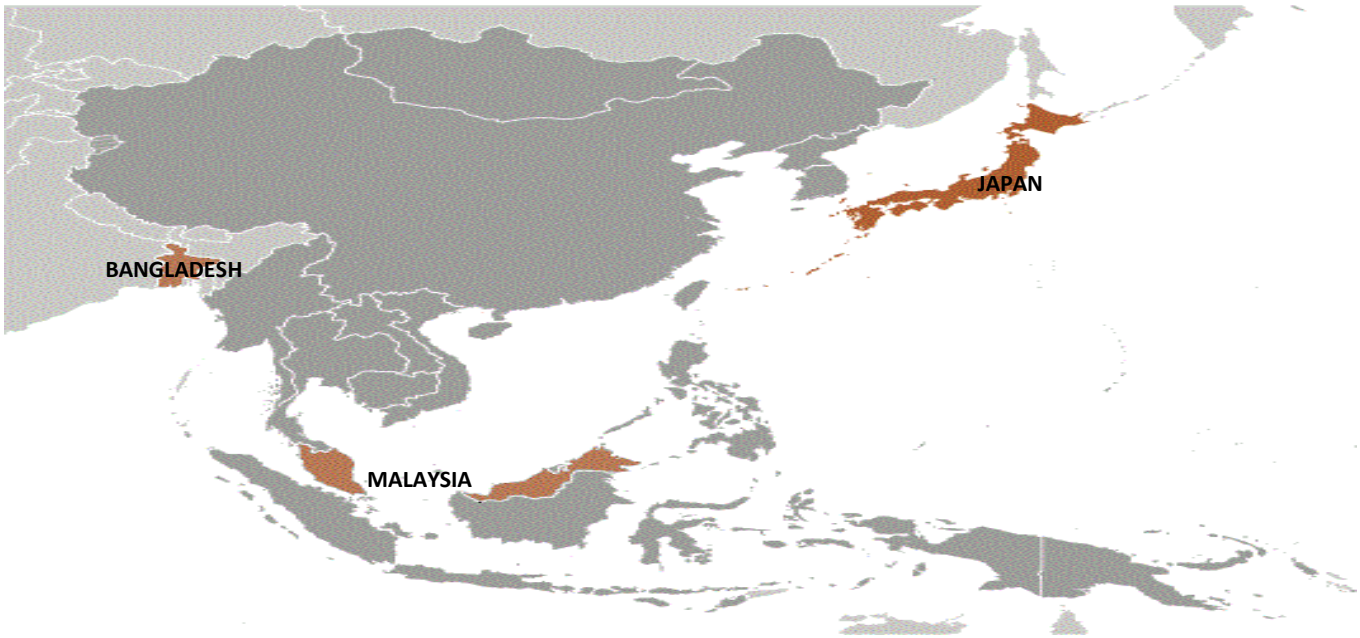


Figure 43: Geographical Location of Bangladesh, Malaysia and Japan

Figure 1 illustrates the geographical location of Bangladesh, Malaysia and Japan. These three countries are in the Asia continent. Bangladesh and Malaysia are two economically developing countries in this continent where as Japan in the most economically developed country in the region.

In this paper, we study the ICT sector of these countries in depth. We analysis their strength and weekness that facilitate to boost up the countries economy. Based on the study we make some recommendation to faciliate their ICT sectors.

The rest of the paper is organized as follows. In Sections 2, 3 and 4, ICT sector of Bangladesh, Malaysia and Japan is demonstrated, respectively. In Section 5, the steps that have been taken forward for their ICT developments are presented. Later in Section 6, a comparative analysis of ICT sector between Bangladesh, Malaysia and Japan is delivered whereas in Section 7, we raise some issues and future challenge. Subsequently in Section 8, a set of recommendations is suggested that could be adopted by the developing countries for the development of their nations by maximising the usage of ICT and finally in Section 9 we present the concluding remarks.

2. ICT in Bangladesh

The ICT sector in Bangladesh has started its journey when the Atomic Energy Centre, Dhaka and some universities have taken place in using computers back in 1964 [2]. However, the formal education in computers was first introduced in 1984 with the foundation of Computer Science and Engineering Department in the Bangladesh University of Engineering and Technology (BUET). Nowadays, a thousand number of ICT related graduate every year Bangladesh is producing from around 35 Public and 51 Private Universities.

In the year 1998, the government has decided to withdraw all import duties and VAT from all computer hardware and software which has brought computers close to the middle income households. Later, in October 2002, the Government of Bangladesh issued its National Information and Communication Technology (ICT) Policy stating the importance of this sector and referring to the designation granted by the Prime Minister as a thrust sector. As a result, now the total number of computer user is about 20 Million. Over 3000 Bangladeshi NRB (Non Resident Bangladeshi) IT professionals employed only in North America.

The Internet came in 1993 to Bangladesh. The government has decided to allow private companies to act as Internet Services Providers (ISPs) using VSATs in mid-1996. More than 180 ISPs are now operating in Bangladesh. As of 2011, the total number of internet user in Bangladesh is over 1 Million which is only about 1% of the total population. Though broadband internet access is available it charges high for high speed connection than other south Asian countries, though this is rapidly changing.

The telecommunications and information technology sectors in Bangladesh are still very poor. In Bangladesh, the total number of PSTN Phone Subscribers has reached 1.03 million at the end of May 2010**,** whereas the total number of Mobile Phone Active Subscribers has reached 82.442 million at the end of October 2011 [4]. The mobile sector in Bangladesh contributed a total of BDT 260 billion to the economy in 2007. The number of Internet subscribers in Bangladesh is expected to reach 18.3 million by the year 2020– translating to a 32 percent household Internet penetration at around the same time. This increased internet penetration would resulted in 2.6 per cent contribution to the country's GDP by 2020 while creating 129 thousand more jobs by the same year.

In Bangladesh, Broadband internet and e-commerce is slowly progressing. WiMAX service is now available from some internet service providers. However, Broadband is legally defined as 128/128 kbit/s, which is not in line with (International Telecommunication Union) ITU. Therefore, most of the Broadband internet services and also subscribers are using bandwidth that may not be considered a broadband in other countries and may not be broadband in international standards [3].

3. ICT Sector in Malaysia

In Malaysia the first computer system is implemented in 1966. The first Smart School was launched in July 1997. Subsequently, the government has introduced various initiatives to facilitate the greater adoption and diffusion of ICT to improve capacities in every field of business, industry, education, and life in general. Malaysia has a long-term vision usually referred to as "Vision 2020" which calls for sustained, productivity-driven growth, which it believes could be achieved only with a technology literature, critically thinking workforce prepared to participate fully in the global economy of the 21st century [5].

Technological advancement is a key success factor in this industry. Currently, the industry is saturated with wired and wireless telecommunication technology. Malaysia presently has an adequate copper analogue system that is being replaced and expanded upon by a new digital fibre optic cable network as demand for capacity increases. This allows the introduction of advanced telecommunications services in the country. Currently only fibre-trunks constitute the backbone of the major telecommunications exchanges [6]. The optical fibre trunk implemented by Telekom Malaysia Berhad is the largest integrated solutions provider in Malaysia, and one of Asia's leading communications companies. Wireless technology is another option to provide wider broadband access solutions. Initially, wireless networks were considered as a solution for providing telecommunication facilities to rural areas and lightly populated areas where it was difficult to provide conventional wire-line networks as the cost of wireless networks were competitively higher.

Technological developments in the wireless facility during the last one decade have completely changed the telecommunication scenario in Malaysia. On account of reduction in the cost of the equipment, ease of installation, operation and maintenance, flexibility for service providers and convenience to end users mobile services have taken over the fixed line network. Wherever the penetration of copper loops is not widely spread, the laying of new copper cables and optical fibre cables is an expensive option due to high operational cost. Therefore, wireless based access is an ideal solution for widespread coverage through a combination of different technologies like WIMAX and Wi-Fi. These technologies have the added advantage of interoperability and economy of scale due to international standardization. However, the deployment of any wireless technology requires suitable and sufficient spectrum availability and efficient utilization.

Wireless data communication technology that has deployed in Malaysia includes 3G (International Mobile Telecommunications-2000) services, WIMAX (Worldwide Interoperability for Microwave Access) and Wi-Fi [7].

The year 1995 was considered the beginning of the Internet age in Malaysia. The growth in the number of Internet hosts in Malaysia began around 1996. According to the first Malaysian Internet survey conducted from October to November 1995 by MIMOS and Beta Interactive Services, one out of every thousand Malaysians had access to the Internet (20,000 Internet users out of a population of 20 million) (Beta Interactive Services, 1996). In 1998, this number grew to 2.6% of the population [8].

Broadband penetration in Malaysia is gaining more attention as the citizens are shifting towards knowledge-based nation. The surge of bloggers in Malaysia, fuelled by the local bloggers community helps to boost the broadband adoption among Malaysians. As the society advances towards the era of High Definition digital distribution of contents, consumers demand greater bandwidth capacity for their internet connectivity. It is apparent that there is a booming demand for higher bandwidth broadband packages. Malaysians in general are pessimistic towards the services provided by the telecommunication providers in Malaysia. There has been a plague of poor services provided by the major telecommunication providers on their internet connections, causing consumers to complaint about slow internet connections and not getting the amount of bandwidth as advertised. Most of these are because of poorly-maintained last-mile copper connections and network congestions.

4. ICT Sector in Japan

The rapid development of information communication technology (ICT) has underpinned Japan's economic growth for the last few decades. Japan, one of the top industrialized countries, has been able to exploit the all-out paybacks from ICT till date. Japanese companies, the main actors in encouraging ICT investment, have been benefitted most from ICT. With the introduction of 'IT New Reform Strategy' and 'U-Japan' [9], Japanese government has been able to put the country to sit in the group of the front-runners in IT these days.

Japan has made sequential national ICT policies since around 2000, with the aim of fostering an advanced ICT network society. The Information Technology Basic Law was enacted in November of 2000. In 1999, Japanese Internet penetration rate was just 13.4 percent, lagging behind that of Northern Europe and North American countries. Also, in April 2001 the number of broadband subscribers in Japan was 737,000, behind the United States and Korea. At the time, introducing ICT into corporate management in Japan meant simply installing information technology devices and systems. The law was established because of a sense of urgency on the part of the government about Japan's slow start in the ICT revolution [10].

The 'IT Strategy Headquarters' was established in 2001 under the leadership of former Japanese Prime Minister Junichiro Koizumi to implement a new national strategy called 'E-Japan' for IT-driven growth. E-Japan attached high priority to developing infrastructure and making the most effective use of available IT resources. In 2006, the IT Strategy Headquarters created 'IT New Reform Strategy' for the next step after 'E-Japan'. Its ultimate goal was to realize a self-sustaining 'ubiquitous network society' by 2010.

The speedy improvement of information communication technology (ICT) has highlighted the economic growth of a developed country for past few years. This economic growth can be attained through productivity gains and companies' efforts in the wide application of ICT. Out of the total GDP growth in Japan, ICT has contributed near about 40% [11].

In the mid of 1980s, Internet was introduced in Japan. Similar to the others, it was initially developed as an experimental network project, named JUNET, among computer scientists to share their computer resources as well as information, knowledge and ideas.

In 1992, AT&T JENS, a small subsidiary of US giant telecommunications company in Japan started to provide leased line Internet connection service in Japan. And through this AT&T's service, a small start-up company called IIKK became the first ISP in Japan that provided Internet connectivity service to individual and corporate users on commercial basis including TWICS [12].

In 2000, the number of Internet user was 47 million that was 37.1% of the total population. But in 2010, this number had gone up to 78.2 % [13]. This number is a growing day by day as in 2012; the total number of internet users in japan is near about 101 million, which is 80 % of the total population and 4.4% of the world internet user [14].
In the field of wireless technologies, Japan is sitting on a very high position. Advanced Wireless technology such as mobile communication technologies and applications, Japan has made an enormous development. Japan is also a front-runner in NGN technologies. Parts in mobile phones, contents of animation and games, good service and support for users are the some other parts of ICT where Japan has made a big improvement.
Japanese ICT sector has strengths in FTTH (Fibre to the Home), high definition image technology, home network, and mobile equipment technology. Japanese competitive advantage is derived from its forte in optics and imaging, components for mobile telephones and TV, and advanced visual content. Japan has obtained a large share of the world's ICT market in other areas.
Now days, Japan is mainly focusing on MPU technologies, OS technologies, software development technologies. Comparing with other developed countries; Japan is a bit slow gaining the full blessings of ICT because of strategic channels for sales, grasping overseas trends and lack of engineers with high skills of communication in foreign languages. Japan is also putting a lot of attention on Green ICT and expending a lot of money on the Research and Development (R&D) of green ICT.

5. Recent Steps Forward

5.1. eGovernance in Bangladesh

In Bangladesh, eGovernance is a vibrant topic and it is needed not only for establishing a democratic and transparent government but also for fighting against poverty of the country. Through the bidirectional information flow of eGovernance, the voice of the poor and disadvantaged groups can be heard by the government and which can contribute to policy building and implementation. Unlike most developed countries, government is the key provider of citizen services and public information in Bangladesh. It is therefore the government's prime responsibility to guarantee the flawless delivery of these services effectively and efficiently to every part of the society. Leverage of ICT enables government to provide these services to the grass root level of the society. Following are a few of the recent examples of public services, which are being delivered using ICTs in the country.
At the early stage of the present government, a joint coordination, of the Prime Minister' Office, the centre of bureaucracy and the Ministry of Establishment, ensures each of the 53 Secretaries of the Government of Bangladesh should provide at least one service electronically. These initiatives, collectively called the eGovernance 'Quick Wins' [3], were meant to quickly showcase the impact of the newly engineered service delivery mechanism to the citizens, receive their feedback and allow government the necessary preparation time for nationwide implementation. 17 of these quick wins have already been launched while the rest are in progress. Below are a few examples of those Quick-Wins [3].
Modernise TAX and Land Record Management - Recently, the ministry of Law has taken an initiative to digitize its land record system in the sub-register level of the country. Initially, it has taken place only in Dhaka. However, eventually the record system is expected to be implemented in the whole country. Moreover, the government has already signed an agreement with ADB that aims to introduce the online filing of tax returns and digitised management of land records in order to improve transparency and government service delivery.
Union Information and Service Centres - Supported by a fund of UNDP, a pilot "Community Electronic Centre (CeC)" project [4], Union Parishads, the lowest unit of Local Government, provide Union Information and basic IT Service to the rural citizens.
Utility Bill Payment - Now a days, citizens can pay gas, electricity and land phone bills through mobile phones. Customers can go to thousands of private sector outlets or bill-pay centres to pay their utility bills and receive SMS acknowledgement instantly. This reduces the cost, time and hassle for citizens and increases revenue for the public sector by ensuring timely bill payment.
Dhaka City Corporation Call Centre - The DCC Call Centre [5] is not only able to answer citizens' critical questions but also take down their complaints. The call centre can be accessed by citizens

through mobile phones, SMS, email and web sites.

Personal Data Sheet - Government officers now use the software personal data sheet (PDS) to access personnel information from anywhere in the country over the web established by the Ministry of Establishment. This allows 90% of the officers who are not located in the capital city to access vital professional information. In future, this system will have performance-based information to which they currently have access only through physical visits to concerned government departments. This system should signify a marked change in the way confidential information is handled within the government.

National Web Portal - The National Web Portal (www.bangladesh.gov.bd) is a citizen-centric gateway for all government information and services that can be accessed electronically. The website is positioned as the online one-stop shop for all government eServices and is providing information on the most popular citizen services, the basic information of the structure of Bangladesh Government, current news, upcoming events and other important information and links to all government ministries, divisions and departments.

Single Website with Downloadable Forms - This website (www.forms.gov.bd) reduces time and cost to access forms from many different organs of the government. Various government and non-government organizations are already using this site from around the country.

Web-enabled Personal Management System - This system, initially developed for the Ministry of Establishment, is gaining momentum for adoption in several other ministries and directorates including the Cabinet Division, Ministry of Education, Planning Commission, among other.

5.2 Agro-Informatics in Bangladesh

'e-Krishi', globally known as 'e-Agriculture' is an emerging field where Information and Communication technologies or ICTs (Radio, TV, Cell Phone, PDAs, PCs) are playing a vital and catalytic role in addressing key hindrances to the growth of Agriculture such as mismanagement of inputs, inaccessibility to rural finance, ineffective and inadequate extension service, lack of awareness about agro-processing, and insufficient preparedness for natural calamities, among others. In many developing countries, ICTs in Agriculture have proven to have helped farmers boost productivity by giving them access to vital information, such as weather forecasts, crop advice and market pricing, empower them by establishing linkages with policy makers and so on [15]. Some of the eKrishi initiatives taken in Bangladesh are below.

Agricultural Radio and TV Shows - The government-owned Bangladesh Television has been telecasting an agricultural TV show called "Mati-o-Manush" for over 30 years now. This is the oldest form of information dissemination through an electronic means. This is one of the most watched shows by the rural farmers and has recently been replicated by private TV channels. Currently, there is a Radio show called "Krishi Dibanishi" in which the farmers call in to have their agriculture related questions answered. This shows has also gained a lot of popularity.

Department of Agriculture Marketing Website - The Department of Agriculture Marketing (DAM) website provides commodity price information with the aim to involve all agriculture stakeholders, especially farmers in the decision making process. The database provides wholesale and retail prices of around 200 commodities from 30 of the 64 districts. The price information is collected daily and sent to the DAM headquarters in Dhaka through email.

Soil and Land Resource Information System - SOLARIS [16] under Sugarcane Research and Development Institute is a 2 GB data repository that stores soil data using primary information from Upazila Nirdeshika from 460 districts. A customized GIS software SOLARIS-GIS maps soil data based on classification (Soil Texture, Landtype, Landform, Drainage, Slope, Surface Water Recession) and condition (Crop Suitability, Land Zoning, Nutrient Status and Fertilizer Recommendation).

Department of Agricultural Extension Website - In order to develop and strengthen the ICT department of DAE, the government has initiated a project called "The ICT Development of DAE". The DAE website is one of the key components of the project. This website stores and disseminates field level information from and through extension workers.

Agriculture Information and Communication Centre - Ten of the Agriculture Information and Communication Centres (AICCs) are being set up leveraging the existing infrastructure of farmers' field schools, farmers clubs and other community centres. These centres are functioning as one-stop

shops for farmers for all agriculture related information and services including market information, soil testing, crop diagnostic services, etc.

Fisheries Information and Communication Centre - These centres will be very similar to the AICCs, but more focused on fulfilling the farmers' fisheries related information needs. The Department of Fisheries holds a wealth of information related to fish culture, their diseases and remedies, etc. The existing field workers are hardly enough for disseminating the information efficiently.

Krishi Alaponi - Krishi alaponi is a call-in TV show for farmers in which they are able to call directly to have their agriculture related questions answered and/or participate in agricultural policy debates, budget discussions etc. This is done in collaboration with Ministry of Agriculture and a private mobile operator in Bangladesh.

5.3 ICT in Health Sector in Bangladesh

The use of ICTs in health sector helps in maximum utilization of communication channels and enhancing the existing services within the present resource allocation. This flow of information will help to remove the misconceptions of health consumers, those who are now mostly in the dark due to the unavailability of adequate information and communication with the service providers. Some of the notable eHealth initiatives are below.

ORT - Oral Rehydration Therapy (ORT) started a "Labon gur Sharbat"(a home remedy for diarrhea) campaign through mass media, which was carried out extensively by BRAC, the largest NGO in Bangladesh. Mass media campaign also plays a crucial role in popularizing this cheap and effective home remedy. Special initiatives like School ORT program are also carried out.

Tele Counselling - Social Marketing Company (SMC) initiated a tele-counselling program named "Tele-Jiggasha" on reproductive health, family planning and STI/HIV/AIDS in the year 2001. It started with a mission of increasing access to information and personal counselling through telephone hotline with assurance of confidentiality.

Health Line and Telemedicine - Health Line, the medical advice and consultation service of GrameenPhone [17] was launched in October 2007. Apart from the core medical consultation services, the caller of '789' [17]through GrameenPhone are also able to get additional medical information services; they can avail doctor and medical facility information, drug information, interpretation of laboratory test reports and data, and emergency support information as supplementary services. Currently, there are other mobile operators who have also started offering telemedicine services.

Internet Connectivity at Upazilla Health Complex - All upazilla health complexes of Bangladesh have recently been connected to the Internet. This enables them to communicate with the central offices at ease and provide services to the patients more efficiently. The physicians of these upazilla health complexes are also equipped with cell phones for remote consultations. Some of these centres also have tele-conferencing facility with which, they are able to communicate with the highest authorities.

Health Alert through ICT - The government of Bangladesh has effectively used ICT during the outbreak of Bird flu in the recent times. People were informed about the situation and advised what to do. Steps taken by the Government to prevent the spread were shown on the electronic media. This is an excellent example of handling emergency efficiently through the use of ICT. Other seasonal health alerts and messages on preventive measures are also sent to customers of mobile phones through SMS. Some of these messages are sent in Bangla for the non-English speaking customers.

5.4 ICT in Education Sector in Bangladesh

To address the challenges of the 22nd century, a country's education system must re-invent itself to produce the skills and confidence. The curriculum must incorporate material to develop the requisite skills; the teaching methods must embrace collaboration and creative problem solving for the locality; the system of assessment must measure whether the children are growing up to be good citizens and how much they can really contribute to nation building; and, most importantly, the educational governance must make sure the curriculum, teaching, and assessment deliver results that move the nation forward. Not only the developed countries, but also the developing nations including

Bangladesh are making increasing use of ICT to offer better services to the people and to ensure accountability and transparency. The use of ICT in all of its conceivable and readily available forms can enable the country to achieve successes in the area of education.

Electronic Publication of Exam Results - The two major state certification exam results (SSC and HSC) are now published electronically. Previously, the procedure of viewing a student's result was rather cumbersome which involved standing in long lines and flocking at the schools. With the new system, the students can receive their exam results through email or can view it via web or mobile.

GIS-Based Education Planning - This Geographic Information System (GIS) map-based software by BANBEIS is a powerful planning tool for the policy makers. It quickly helps identify areas for intervention based on priority criteria such as underserved status, poor teacher training, lacking or disaster-affected infrastructure, and other critical educational issues.

Digital Content for Education - In now days, Bangladesh has started producing audio-visual content for teacher training and students. Although in its infancy at the moment, the digital content for education is being planned as a significant thrust area of the country at the moment with many public-private partnership efforts developing. Thousands of schools are being equipped with modest computers laboratories, internet connection is spreading quickly to secondary educational institutions and digital content is increasingly being used to improve the quality of science, mathematics and English education in secondary schools.

eLearning - With the increasing number of students, most to the higher educational institutes of Bangladesh, have started the eLearning program. These programs include virtual classroom, online library management system, online registration and so on.

Introduction of Bangla keypad - The government has decided that all mobile phone sets bought in the country must have Bangla keypad from February 2012. The Mobile-phone operators will not be able to import handsets directly, however, they'll will be able to bring in handsets through local importers, following a similar approach in Malaysia to protect the local entrepreneurs. The operators may be allowed to import high-end sets with superior technology. It is to be mentioned that currently there are six mobile-phone operators in Bangladesh: Grameenphone, Robi, Citycell, Airtel, Banglalink and state-owned Teletalk.

5.5 eCommerce in Bangladesh

eBanking - eBanking satisfied customer demand in banking activities electronically throughout the world. At present, several private commercial banks (PCBs) and foreign commercial banks (FCBs) in Bangladesh offered limited services of tele banking, internet banking, and online banking facilities working within the branches of individual bank in a closed network environment.

Online Shopping Facilities - Early this year, BRAC Bank Ltd. has launched Bangladesh's first e-commerce platform in alliance with Visa. This has opened the opportunity for Bangladeshi citizens to use Visa cards for online shopping e.g., online ticket booking, purchasing gifts, etc. BRAC Bank online shopping is open for 24 hours making it possible for retail products, companies and stores to keep earning long after shopping hour is over.

5.6 Infrastructural Growth in Bangladesh

3G Mobile Service Facilities - Bangladesh Telecommunications Regulatory Commission (BTRC) has decided to commence third-generation mobile telecommunications technology (3G Mobile) in Bangladesh. BTRC had earlier announced that Teletalk, a Government Owned operator would get to do a six-month trial run of 3G. Post-test run, the 3G spectrum is expected to be auctioned in June 2012. It is announced that 700 base transceiver stations, or cell sites, are especially designed for 3G, and 500 transmission receiver equipment are being already placed.

Once 3G mobile technologies is launched it would make mobile telephony much more efficient, with high-speed data transfer affording users to watch mobile TV, make video calls, use navigation equipment and access many other services.

Terrestrial cable licences - Recently, the government of Bangladesh has decided to issue licenses to private entrepreneurs for setting up, maintenance and running two submarine cables and three terrestrial fibre links in the country in a bid to make telecommunication and internet facilities easier. Under the licence, the companies will be able to connect with the neighbouring countries through terrestrial fibre-optic cables.
The cables are expected to provide better and more efficient internet access by building redundancy to the submarine cable. The decision has been made apprehending the necessity of alternative submarine cable since the total telecommunication and internet system collapses when the country's lone submarine cable is cut off. The two submarine cables are expected to be set up under the sea, having landing stations at Kuakata, Patuakhali, Barisal and Chittagong. Terrestrial fibre link has to be established between Dhaka and the landing stations. The new submarine cables are also expected to bring an end to illegal Voice over Internet Protocol (VoIP) operations in the country.

5.7 Advanced Services in Malaysia

Due to the paradigm change from infrastructure and access to applications and content, Malaysia is strengthening its advanced services particularly on creative content creation, payments and electronic commerce and connectivity applications [18].

In the effort of improving its advanced services, the domestic creative content creation, services and distribution and broadcasting sectors are developed extensively, with the optimism of transforming Malaysia into a regional hub for digital content. The deployment of a unified mobile and online payments system to a large user base at reduced cost is also encouraged. In addition, the deployed system ensures complete interoperability between existing platforms and by utilising mobile phones. Furthermore, the Malaysian government plays a pertinent role in driving the development and adoption of value-added communication services and applications for business, household and the government bodies as well.

5.8 Shifting to Knowledge-based Economy in Malaysia

Attentions to shift to knowledge-based economy, particularly in E-Learning, E-Healthcare and E-Government are taken by coordinating efforts to provide access, devices, applications and content [18].

E-learning for students and professional trainings on a common knowledge platform has been introduced. Several E-Healthcare launches are done nationwide to increase the awareness and to transform the perception of the public in order to achieve the goal of knowledge-based economy in Malaysia. The e-healthcare is made attractive to the public by enabling remote scheduling, remote monitoring, and facilitating personal record keeping and streamlining payments and reducing wait times. This initiative is extended to the government sector as well, to improve the convenience, efficiency and transparency of Government services to the public and for trade facilitation.

5.9 E-Governance in Malaysia

The E-Government is one of the leading applications launched in Malaysia under Multimedia Super Corridor (MSC) to improve social conditions and provide economic benefits. The objective of this flagship application is to initiate and accelerate the growth of MSC and to enhance the national competitiveness. These flagship applications plays a vital role even in the creation of high value jobs and export growth, thus reducing the digital divide and making MSC a regional hub and test bed.
E-Government is acronym for electronic government. *E-Government* is a digital interaction between the Malaysian government and citizens (G2C), the government and businesses/Commerce (G2B), government and employees (G2E), and also between the Malaysian government and other governments or agencies (G2G). The main focus of this application is G2C where it is aimed to improve transparency and responsiveness of the government to the public (19).

In e-government application, seven main projects are identified to be the core e-government application.

- Generic Office Environment (GOE)
- Electronic Procurement (eP)
- Human Resource Management Information System (HRMIS)
- Project Monitoring System (PMS)
- Electronic Services Delivery (eServices)
- Electronic Labour Exchange (ELX)
- E-Syariah

Besides these main projects, there are supporting projects such as EG*Net (Government Virtual Private Network (VPN)), EG IT Standards, Integration projects among flagships and legacy, PKI and digital signature and shared services outfit (SSO).

Several policies and laws have been also introduced to support these flagships such as Communication and Multimedia Act 1998, Digital Signature Act 1997, Telemedicine Act 1997, Personal Data Protection 2004, Electronic Transactions Act and E-Government Activities Act.

Since the use of information technology enables improvement in mass processing tasks and public administration operations, e-government improves the efficiency of the operations of the government. Similarly, e-government also provides efficient data sharing between government agencies. Thus e-government is able to generate savings on data collection and transmission.

The e-government applications are developed based on best understanding of citizens' requirements as the main element in reforming government operations is to adopt a customer-focused approach. These applications will provide seamless online services thus improving the traditional government services. Another benefit is that e-government is able to achieve specific outcomes. The internet can help stakeholders share information and ideas and contribute to specific policy outcomes. For instance, online information can boost training programmes; sharing health information can improve resource use and patient care.

E-government contributes in reducing government expenditure through more effective and efficient programmes, improving business productivity through administrative simplification and promoting the information society and ICT industry. E-government acts as a factor for reform in government. Most governments nowadays are facing the issue of public management modernization and reform such as globalization, changing society and increasing customer expectation increases the compulsion towards e-government application.

Malaysia is yet to reach full potential due to limited number of transactions available online as well as issues in infrastructure, change management and integration of legacy systems. The government agencies such as MEWC, MAMPU can ensure that implementation of e-Government applications are successful. The success of e-government in Malaysia is the key to determine Malaysia's progress towards achieving vision 2020.

J. MYKAD

The next flagship is the introduction of MyKad to the public. The objective of this project is to provide a secure ID platform for private and Government transactions and processes. This project has attracted many private applications to-date but acceptance of public applications, e.g. driver's license, has been minimal.

This project faces problems in terms of accessing to infrastructure, e.g. card readers, lack of buy-in from other agencies and poor public perception of security. These issues have limited the public usage of other applications on MyKad.

MyKad can bring some social impact through reduction of fraud and paperwork if it is fully utilies. The full potential of MyKad application can be achieved with the cooperation of multiple agencies such as NRD, MAMPU, Pos Malaysia and NITC.

K. SMART SCHOOL

Smart school is a flagship designed to promote ICT literacy and encourage creativity and self-learning in the younger generation. This flagship has been enhanced based on knowledge from pilot projects

that has been introduced since 1998. Smart school is able to provide productivity and social gains from improved administration of schools and reduction of paperwork.
The key challenges of this application are the exam-oriented curriculum, lack of technical support and change management of teachers. The government initiatives through this application include PPSMI, computer lab at school and SchoolNet that is the e-learning website. However, engagement and communication between different stakeholders within MOE could be improved to speed up full roll-out of smart school.

L. TELE-HEALTH

Tele-health is a project launched by the government to improve the overall standard of healthcare and provide more information to enable the public to better manage their health. Through this project several projects have been launched such as Tele-consultation, My-Health portal and Continuous Professional Development to provide services to the users. However, poor access to infrastructure and under-developed critical enablers limiting the use of Tele-health projects. The success of the implementation of Tele-health can be achieved with the cooperation between different stakeholders with MOH and MICC.

5.10 Next Generation Infrastructure in Malaysia

The next generation infrastructure prospects and the maturity of the existing infrastructure are able to support the future growth of Malaysia, focusing on coverage, affordability and quality of access [18].
In order to resolve access gaps mostly in rural areas, initiative to mandate broadband for all is proposed. This initiative ensures the increase ICT usage and proficiency. Importance of having access to broadband is considered similarly as to water and electricity utilities. All new residences will have ready access to content and communication services; which not only address the access gap issues but it will also enable an infrastructure transformation in sub-urban and rural areas through shared infrastructure in order to reduce costs and accelerate roll-out.

Initiatives to offer smart network to reveal quality and affordability of services is provided, through differentiated broadband packages based on priority of service, usage gaps and application-specific enhancements. Additional international submarine cable capacity will be laid and data centres will be built to host content locally in Malaysia [19].

5.11 E-Governance in Japan

The Waseda University Institute of e-Government has released the 2012 Waseda University World e-Government Ranking, where Japan lies at the eighth position of the world countries in terms of eGovernment [20].
The e-Japan Strategy specifies three priority policy areas such as “establishment of an ultra-high-speed network infrastructure and competition policies,” “facilitation of electronic commerce,” and “realization of an electronic government.” [21].
The establishment of an electronic government system has been continuing for nine years in Japan. As a result, now almost all types of applications to the government can be made electronically. There are two factors in the electronic government in Japan where one is making administrative transactions among government offices online and the other is making transactions between governments and citizens online.

5.12 E-Learning in Japan

The emergence of the Internet and electronic broadcasting has significantly increased the flow of information available and information has gone from hardcopies to digital media. A revolution is currently happening and Japan's education system needs to evolve as well and harness the power of ICT in education. Thus, new initiatives shown below have been launched:

- Setting up training schemes for people to better understand and process information and

- facilitate/promote lifelong learning
- Enhancing environments for easier accessibility to the Internet and reducing/eliminating any possible learning curve in using the Internet
- Enforcing a database of learning opportunities and useful educational information
- Making this database widely available (to ordinary people) in the same way the Massachusetts Institute of Technology (M.I.T.) opened a free online course website

5.13 Internet and Technology in Japan

The ISPs in Japan offer very attractive packages termed "triple play" (Internet, Television, Telephone) or more recently "quadruple play" (Internet, Television, Telephone, and Mobile Access). The result of these marketing tactics is that many Japanese will have Internet access. Even someone not interested in using the Internet will have to sign up for it because of the bundled services. In Japan, Internet access is considered affordable with respect to the high transfer rate offered.
Regarding to a study published by the Yano institute in March 2013 the number of fibre subscribers will reach 30 million while the number of ADSL subscribers will decrease to 7 million. The attractiveness of fibre comes from that fact that it offers very high transfer rates. For example the classic download rate offers by the fibre is about 100MB/s. However KDDI has just launched a new offer with fibre that allows a theoretical transfer rate of 1GB/s of download and upload. This offer is only available for some prefectures. But note that download rate of 1GB/s means that it is possible to download a DivX movie in 1 second and a Blue Ray DVD in 5 minutes.

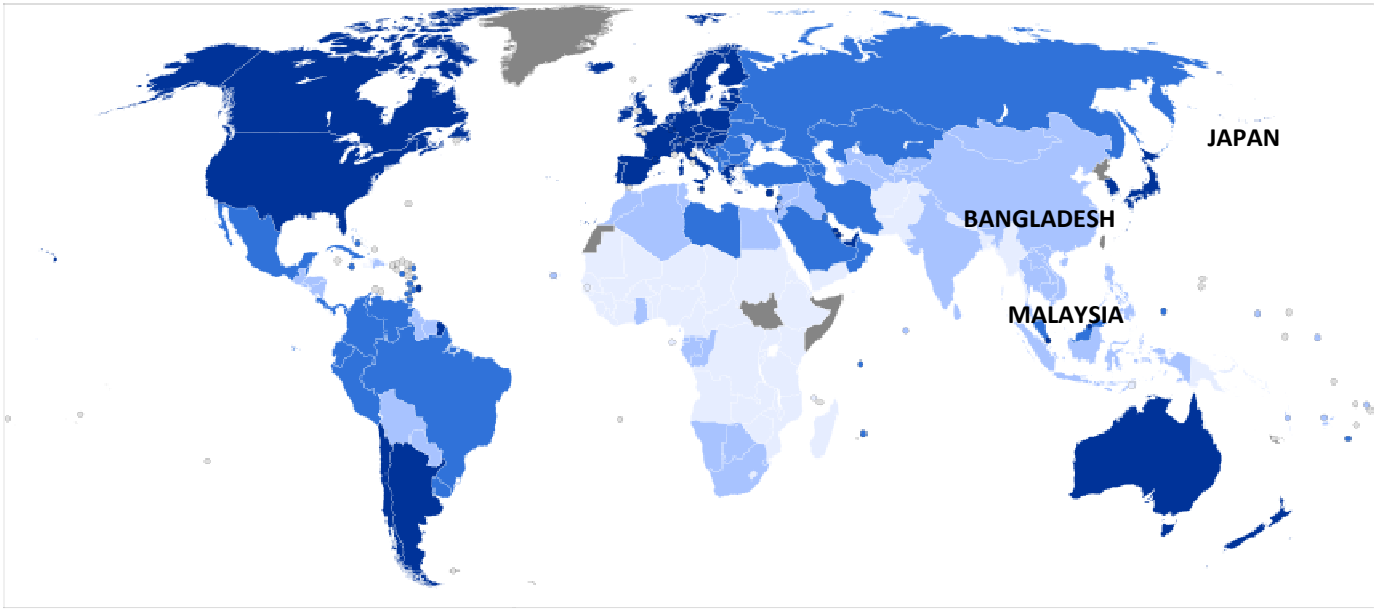
6. Comparative Analysis between Bangladesh, Malaysia and Japan

Upon analysing the history and the progress of ICT sectors in Bangladesh, Malaysia and Japan based on a wide variety of sources stemming from previous researches which is illustrated in Table 1 below, a comparative analysis of the difference between the ICT trend in developed country and developing countries is derived. The goal of providing this analysis is with a believe that is allows a better understanding of what have been achieved so far in both developed and developing countries. Then this comparison is used as a basis to provide proper recommendations for the developing countries to head towards becoming a developed country in the near future.

Table 5: Summary of ICT in Bangladesh, Malaysia and Japan

Description	Bangladesh	Malaysia	Japan
Population (July 2011 est.)	158,570,535	28,728,607	126,475,664
Urban Population (2010)	28% of total population	72% of total population	67% of total population
Literacy (2001 est.)	48%	89%	99%
GDP Composition (2010 est.)	• Agriculture: 18.6% • Industry: 28.5% • Services: 53%	• Agriculture: 10.5% • Industry: 41.4% • Services: 48.2%	• Agriculture: 1.4% • Industry: 24.9% • Services: 73.8%
ICT Initialization	1964	1966	1956
Beginning of formal Education	1994	1997	1994
Total Internet Users (2009 est)	617,300	15,355,000	99,182,000
Government Type	Parliamentary Democracy	Constitutional monarchy	Parliamentary government with a constitutional monarchy
Government role to enhance ICT Sector	• Withdraw all import duties and VAT from all computer hardware and software • Issuing of National Information and Communication Technology (ICT) Policy • e-Governance • E- Government • E-Health • Agro-Informatics • E-Commerce	• E-Government • Smart School • MyKad • Tele Health • E-Commerce • E-Learning	• E-Japan • IT New Reform Strategy • U-Japan • E-Government • E-Learning

Based on table 1 we can see that the ICT sector in Bangladesh, Malaysia and Japan is almost having a similar pattern. The initiatives taken to enhance this sector, is practically similar where all three countries have moved forward to transform most traditional practices by introducing E-Government, E-Health, E-Education and E-Commerce. Though Bangladesh, Malaysia and Japan have similar practices, the contribution of ICT sector on the development of these countries varies. We can say that by exploiting ICT to the fullest Japan has brought itself on par with other developed countries in the world as illustrated in Figure 2 below. In figure 2, Japan is one of the Asian countries that has been indicated as very high development rate, in other words Japan is also categorized as one of the advanced economy country. As for Bangladesh, it is indicated as medium developed and as for Malaysia it is indicated as highly developed. So what is the real factor behind this variation in development?



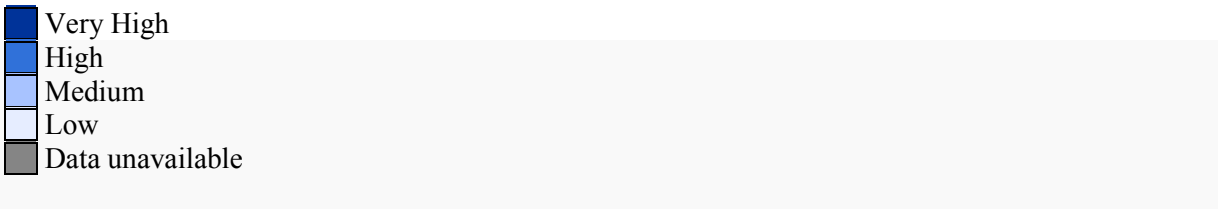


Figure 44: World Map [22]

As mentioned earlier, the delivery of the conventional development goals (in health, education and business), has clear potential of being enhanced by the ICT applications, regardless of the effect of the ICT sector on national economic performance. In the economic growth perspective, the achievement of these development goals is likely to be easier because the relationship between the two is dualistic. Economic growth is also more likely to be achieved in societies that are healthier and better-educated, where individuals and communities have the skills and capacity to fulfil their potential and to develop new business opportunities. ICTs can thus play a part in improving both national economic performance and mainstream social development, a dual potential which should be better understood by policy-makers in both ICT and economic development.

ICT production sectors are mainly done by either middle-income countries that comprises transition economies in central and Eastern Europe or countries in Asia and Latin America with established industrial and manufacturing sectors. The ICT production is also practised by very large countries, such as India and China whose size gives them substantial domestic markets and skilled workforces requiring wages at levels well below of other countries. Much of the investment in ICT manufacturing in developing countries derives from foreign sources rather than from local capital markets, for example, while most of the resulting production leads to improved efficiency in the countries to which products is exported rather than enriching local manufacturing and services. Much the same is probably true of the export-oriented service sectors undertaking software development, data entry or back-office functions which have become established in some smaller developing countries with appropriately skilled workforces.

Least Developed Country (LDCs) such as Bangladesh has limited ICT production or export-oriented ICT service sectors. ICT manufacturing sectors in developing countries also seem likely to have fewer backward and forward linkages into the national economy than ICT production sectors in the OECD area [23]. Much of the investment in ICT manufacturing in developing countries derives from foreign sources rather than from local capital markets, for example, while most of the resulting production leads to improved efficiency in the countries to which products is exported rather than enriching local manufacturing and services. Much the same is probably true of the export-oriented service sectors undertaking software development, data entry or back-office functions which have become established in India and some smaller developing countries with appropriately skilled workforces. Second, many developing-country economies, particularly LDCs, are still dominated by commodity production and (often subsistence) agriculture, in which ICT investment obviously has much more limited value. The scale of ICT investment will therefore be much lower as a proportion of national output than in industrialised countries and the benefits for national growth will be slower to materialise.

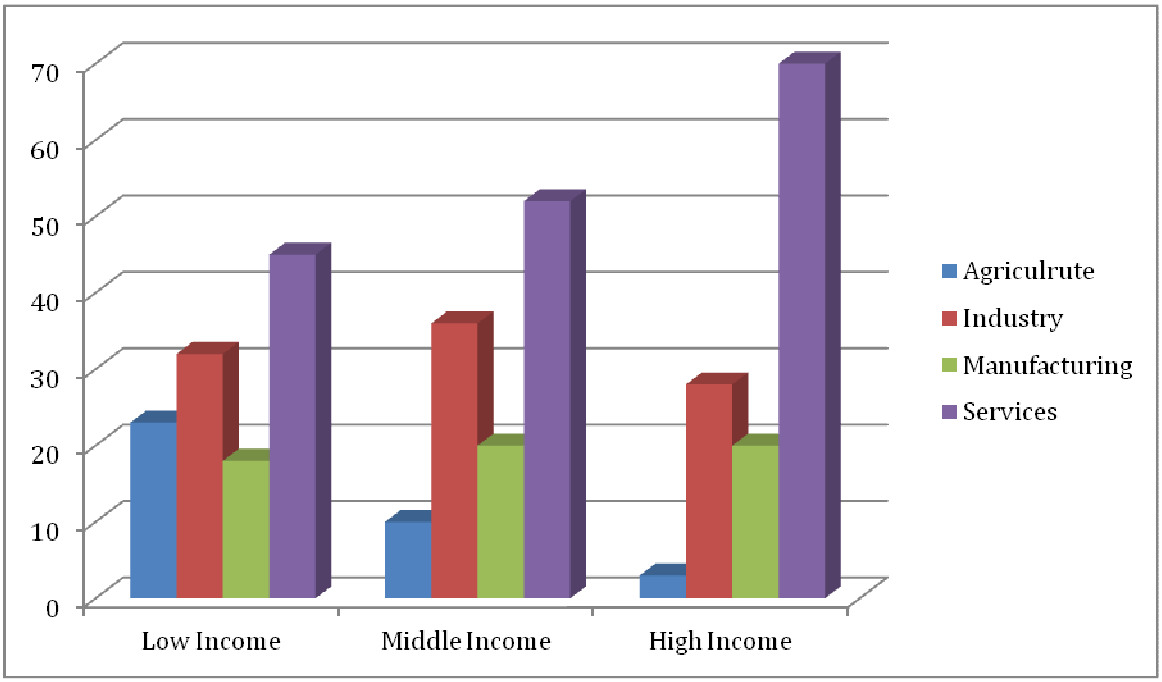


Figure 45: World Development Indicator
Source: World Development Indicators 2003, The World Bank, p.192

The interest of development agencies in ICTs is not so much the impact which ICTs may have on business or national economic performance because the overall focus is on poverty reduction. ICT applications clearly have potential to enhance the delivery of mainstream development goals (in health, education and so on), regardless of the effect of the ICT sector on national economic performance. Although the achievement of these development goals is likely to be easier in a context of economic growth, the relationship between the two is dualistic: economic growth is also more likely to be achieved in societies that are healthier and better-educated, where individuals and communities have the skills and capacity to fulfil their potential and to develop new business opportunities. ICTs can thus play a part in improving both national economic performance and mainstream social development, a dual potential which should be better understood by policy-makers in both ICT and development for a developed country.

Since the introduction of the Internet in 90's, ICT has been considered as a formidable tool to close the gap between the developing world and the developed world by skipping certain stages of industrial development and leapfrogging into the Information Economy. Used in the right way and for the right purposes, ICT can have a dramatic impact on achieving specific social and economic development goals.

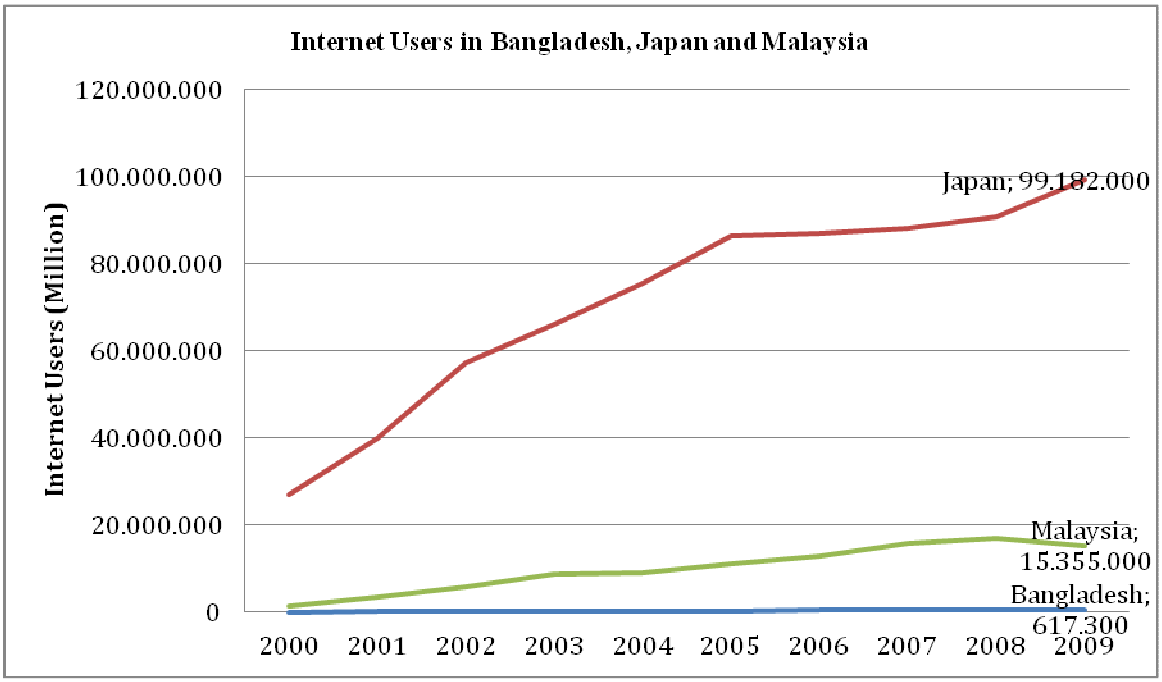


Figure 46: Internet Users

Data Source: World Bank, World Development Indicators – Last updated March 2, 2011

Table 6: Internet Users in Bangladesh, Japan and Malaysia

Country / Year	Bangladesh	Japan	Malaysia
2000	30,000	27,060,000	1,500,000
2001	140,000	40,000,000	3,400,000
2002	150,000	57,200,000	5,700,000
2003	240,000	66,000,000	8,692,100
2004	280,000	75,430,000	9,000,000
2005	300,000	86,300,000	11,016,000
2006	400,000	87,000,000	12,860,000
2007	500,000	88,110,000	15,868,000
2008	560,000	90,910,000	16,903,000
2009	620,000	99,182,000	15,355,000

Source: CIA World Factbook accurate as of January 1, 2011

Figure 4 and Table 2 shows the number internet users in Bangladesh, Japan and Malaysia between 2000 to 2009. The numbers of internet users in all three countries are increasing. Japan records a rapid growth rate in these years but as for Bangladesh and Malaysia the number of internet users' growth rate is slower than Japan. Though Bangladesh has the highest population compared to Japan and Malaysia, the number of internet users in Japan and Malaysia has outnumbered the users in Bangladesh. Apart from having very high literacy rate i.e. Japan (99%) and Malaysia (72%) compared to Bangladesh literacy record (48%) [24], the other factor that may also contribute in allowing Japan and Malaysia to have more internet users is also the number of internet host or the Internet Service Providers (ISPs) available in these countries. As the number of hosts is one indicator of the extent of internet connectivity. Table 3 below shows the number of ISPs in Bangladesh, Japan and Malaysia.

Table 7: Internet Host in Bangladesh, Malaysia and Japan

Country Name	Internet Host (ISP)	Year of Estimate
Bangladesh	68,224	2010
Japan	54,846,000	2010
Malaysia	344,452	2010

Source: CIA World Factbook accurate as of January 1, 2011

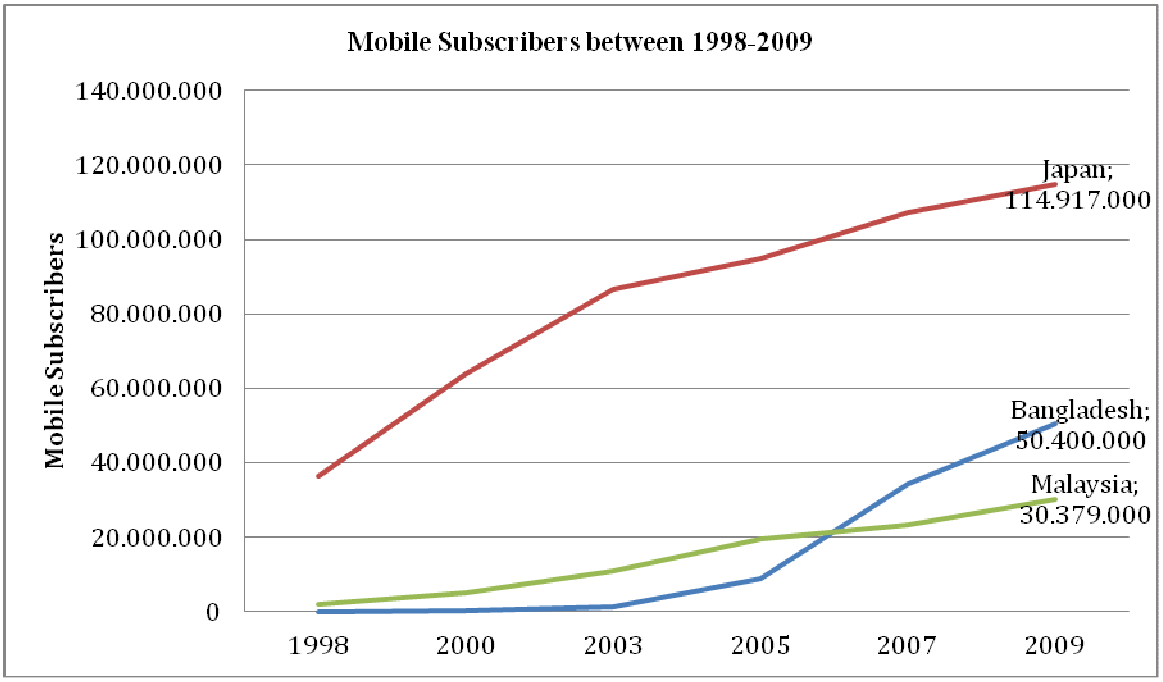


Figure 47: Mobile Cellular Subscription

Data Source: World Bank, World Development Indicators – Last updated March 2, 2011

Figure 5 and Figure 6 show the mobile cellular subscriptions in Bangladesh, Japan and Malaysia between 1998 and 2009. The cellular subscription has increased in all three countries especially from 1998. Even in terms of mobile subscription, Japan still records a very large figure compared to Bangladesh and Malaysia. Based on the figure above we can also see that upon 2004, the mobile cellular subscribers increased for Bangladesh even more than in Malaysia.

One of the reasons of this spike was because in 2004, TeleTalk cellular mobile was launched. Teletalk is a GSM based state-owned mobile phone company in Bangladesh. Teletalk is the first operator in the country that gave Bangladesh Telegraph and Telephone Board (BTTB) [25] now BTCL incoming facility to its subscribers.

Apart from the launching of TeleTalk, during 2004 Bangladesh annual GDP growth was higher than Malaysia's as shown in Figure 6.

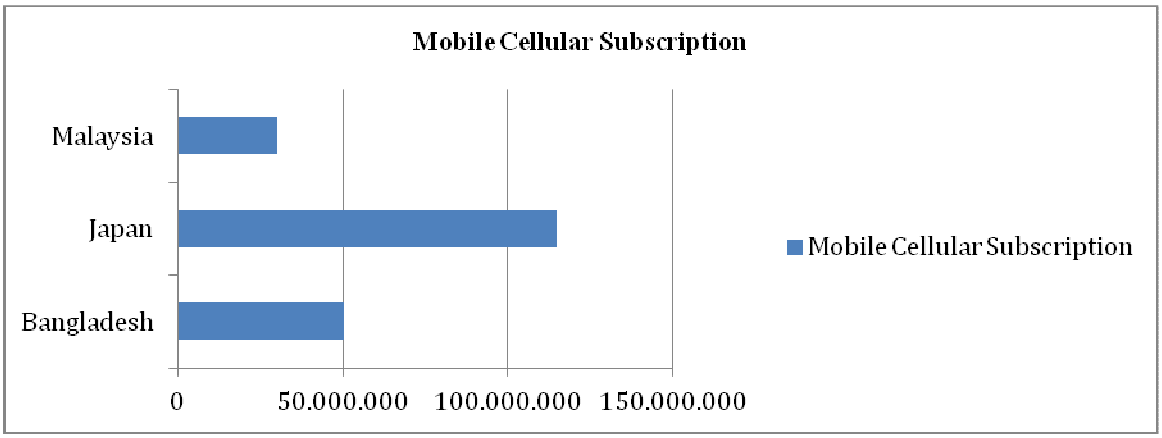


Figure 48: Bar Chart of Mobile Cellular Subscription

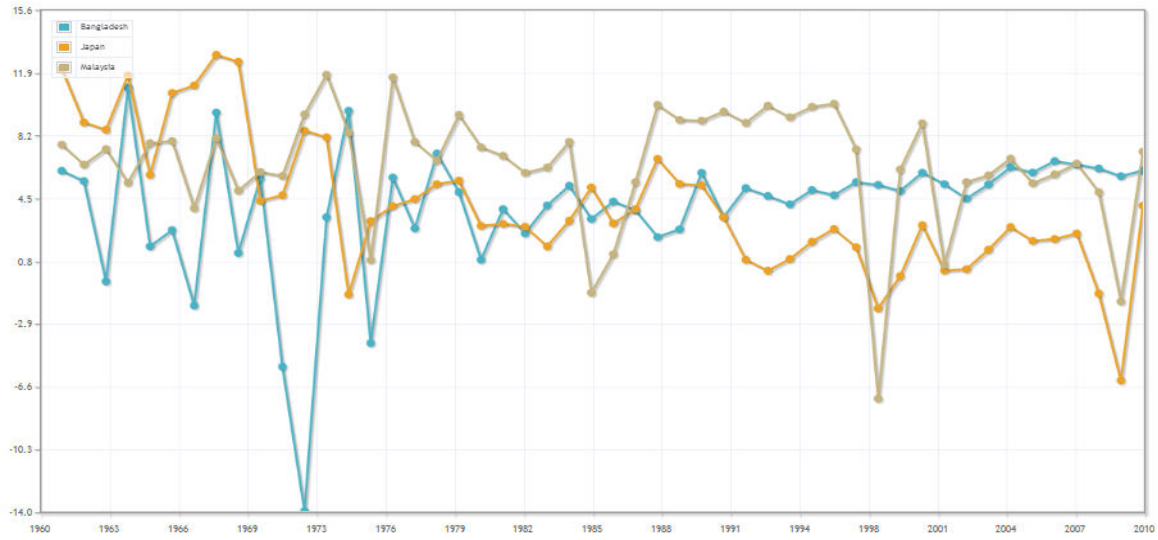


Figure 49: GDP Growth (annual %)
Data Source: World Bank, World Development Indicators – Last updated March 2, 2011

Over the past few years, positive benefits of ICT programs have been widely acknowledged among government leaders in developing countries. However, when undertaking such programs are suggested to be practised, most of them do not achieve expected results, especially e-government programs, have been found not to bring expected results.

The position of Government Chief Information Officer (GCIO) has been adopted by many developing countries seeking to leverage technology within the management of public administration. The position calls for an operational executive who can make important strategic decisions that can impact public agency ICT.

The role of CIO/ GCIO in developed countries has evolved as a response to the development of ICT and the force of market dynamics. In fact, the CIO concepts start from the private sector with a desire of the higher effective operation and an increase in the firm value via applying ICT strategy. Then, it spreads to the public sector to create GCIO positions with the expectation of applying ICT more effectively and providing better public services. Governments also strengthen GCIO's authorities by law.

Contrary, developing countries follow the model of developed country with the belief that the addition of the GCIO position in high level management can catalyse the potential of ICT for economic

development. In other words, their CIO/GCIO is imposed by the government regulation rather than as a result of ICT development process and economic requirements. The comparison of the GCIO creation process is illustrated in Figure 7.

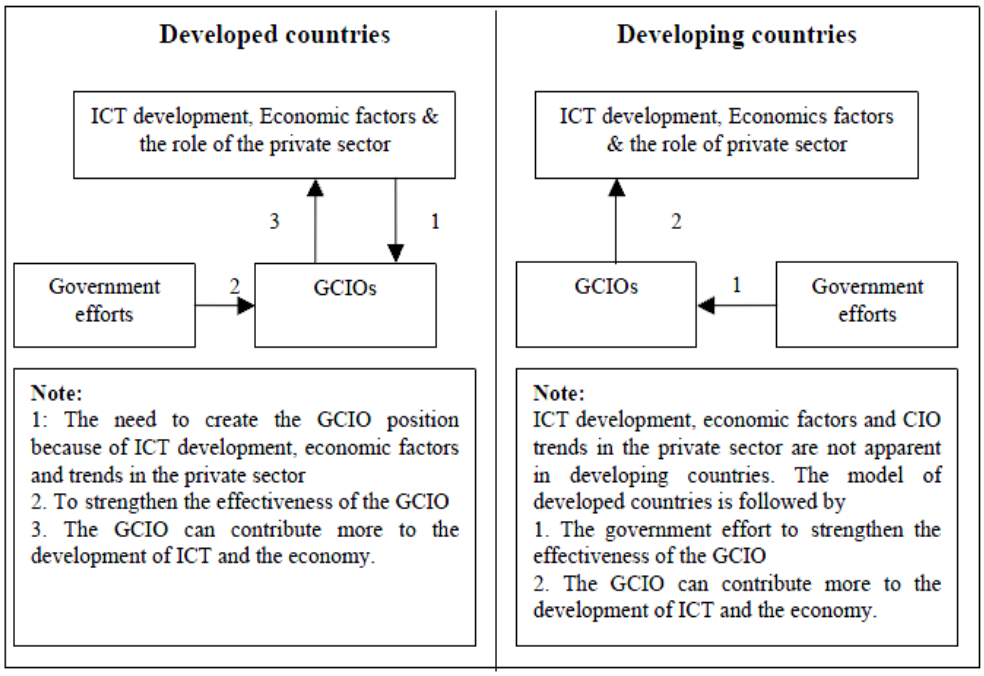


Figure 50: Comparison of the Creation of GCIOs in Developed and Developing Countries

7. Future Challenges

The biggest ICT challenge in Bangladesh is to implement E-Governance to all government sectors for establishing rule of law. To achieve this goal information technology is the major tools, the technology dealt with the information must be driven by the manpower that have philosophical commitment and patriotism. However, due to the high level of corruption many would not happy if E-Governance is applied in the country as it would highly reduce their illegal source of income. Therefore, it is up to the government to ensure that the target has been achieved for the betterment of the nation and to its subject.

In Bangladesh, almost half of the population are female. However, most of them are not familiar with the modern ICT technology. Thus the second ICT challenge is to educate women with ICT knowledge. Thirdly, almost 80 percent of Bangladesh's population lives in the rural areas and 54 percent of them employed in agriculture. However, most of the rural areas in Bangladesh are not developed and sometimes don't have any communication infrastructure. Thus it is very important for the government to take proper planning to bring those rural areas under communication development network.

Malaysia has built a competitive ICT industry and has achieved high penetration rate for communication thus far. However the ICT industry in Malaysia continues to face several challenges.

The transferal of the profit pools to content and services is a challenge that Malaysia faces. Infrastructure and access are increasingly perceived as commodities, globally. Therefore, by moving into content and service the telecommunication operators risk is becoming a low margin, and profit margins are growing positively as mostly it is required by dominant global companies. At present, 80% to 90% of the content accessed on the Internet in Malaysia is from overseas [7].

Modern telecommunications technology is able to expose additional potential especially in education and healthcare sectors. Malaysia has made decent progress though the exposure of these technologies is these sectors are conducted in a fragmented approach that regularly driven by the public sector.

Implementation in these sectors guarantees higher penetration rate in ICT industry in Malaysia. Unfortunately, at present telecommunications has limited leverage for the increasing rate and productivity in other sectors.

In Malaysia, the current infrastructure has reached maturity, with limited growth expected in fixed lines and mobile penetrations. Future applications and content will require new infrastructure. Particular challenges in Malaysia are the rollout of a nationwide fibre network and fourth generation (4G) mobile networks, with very different challenges in urban and rural areas. In urban areas, coverage and quality will be paramount whereas in rural areas, mass affordability and inclusiveness are the key drivers.

8. Our Recommendations

The adoption of ICT and related business processes and management skills is pertinent for the developing countries in the rapidly changing and highly competitive global market. The benefits of ICT usage in a developing country is dependent on a national enabling ICT environment that relies on several factors such as access, infrastructure, education, human capacity, global and national governance issues and legal framework. Based on the comparative analysis in Section VI it is obvious that the developing countries like Bangladesh and Malaysia are still lacking on the implementation of certain factor as below:

- Education
    - Though Bangladesh and Malaysia have already introduced ICT education at the elementary and secondary level, but the effectiveness of this education should be evaluated periodically. This will not only ensure that the syllabus are on par with the latest trends and technology advancement but also enables the younger generation to relate this knowledge with the latest ICT issues.
- Human Capacity
    - The E-Revolution has to deal not only with external difficulties, but also with the internal resistance to change, which can be an obstacle for the modernization of the public offices. In fact, many employees do not see e-government as an opportunity, but as a threat for their future. The employees may refuse to adopt the new working methodologies or continue to work in the same manner they worked before behind the administrators' backs. An organized management of change has to be established. The organizational change has to be discussed with the people involved and they have to be well informed on the transition.

- Global and National Governance Issues
    - Legal Framework of national ICT Policies
    - The role and contribution of Public Authorities in providing infrastructure and human capacity and encouraging the use of ICT
    - Support ICT's use by SME's, and consumers, including remote areas, by providing easy and low cost access to ICT solutions.
    - Organise regular consultative meetings and share knowledge with other destinations in order to define appropriate ICT strategies and implementation plans and timetables.

- Legal Framework
    - Without governments understanding these opportunities and challenges, and failing to address these issues in the form of legal policies, and by not adopting pro-active implementation the nations will fail to take advantage of the opportunities to improve the economy, and is unlikely to compete with other developed countries.

9. Conclusion

A major pre-occupation in the literature on ICTs and development has been the question of the "digital divide". It is often illustrated by data on access to particular ICTs. The digital divide is defined as the disparity in ICT diffusion and use between industrial and developing countries (or, indeed, between rich and poor, men and women, urban and rural areas within individual countries). For example, data published in 2002 showed that although the average OECD country has roughly 11 times the per capita income of a South Asian country, it has 40 times as many computers, 146 times as many mobile phones, and 1,036 times as many Internet hosts. In many ways, this digital divide merely parallels similar disparities in access to and use of other development "goods" – health, education and so on – which are more readily available to rich than poor, or in industrial countries than in developing countries. A digital divide is to be expected: the key questions for policy-makers are the extent to which it matters (in terms of equity and any secondary effects in other sectors) and to which it is likely to grow or diminish over time, and the identification of ways in which it might be bridged.

Developing countries need to adopt ICT's and associated business processes and management skills in order to remain competitive in the constantly changing and increasingly competitive global market. The positive effect of ICT in a developing country depends on a national enabling ICT environment that relies on multiple factors such as accessibility, infrastructure, global and national governance issues, and human capacity. One of the most important steps to get the maximum benefit from ICT a country needs to make sure the accessibility of the ICT to all levels of the society. Once a country assures that ICT has reached everywhere in the society, then only the country can expect to get the all-out benefit. Doing so, the infrastructural growth of the ICT should also be taken into account. Skilled man power is one the most vital issues to get the benefit of ICT. To support the accessibility, infrastructure, and human capacity, a country also needs legal framework for the national ICT policy. The role and contribution of public authorities in providing infrastructure and human capacity and encouraging the use of ICT should be considered in the policy. The policy should also consider necessary steps to provide easy and low cost access to ICT solutions to the rural areas as well as the urban.

Investing more money in the telecommunication industry will definitely uplift these two nations into new culture of civilization in the world and such measures can contribute to another culture of excellent.

Acknowledgement

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THE SPATIAL AND TEMPORAL PATTERNS OF DECLARED INCOME ACROSS GREECE: 2001-8

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Abstract
The paper studies the income mosaic of Greece at the local community level, from the time the country joined the EMU to the advent of the international crisis. It econometrically isolates the average income, income-filer population size, and annual effects, and brings to light sub-regional and cross-regional patterns that might otherwise go undetected. This provides a better understanding of the internal heterogeneity of the country and facilitates the formulation of better-targeted interventions aiming to reduce disparities and stimulate economic growth.

Keywords: *personal income, disaggregated data, delineation of micro-regional policy areas, urban and rural development*
JEL, **classification** R10, R40, R30

Introduction

Caught in the tide of an international economic crisis while having surrendered monetary-policy sovereignty for the operation of the euro-zone, the small and open Greek economy is faced with the prospect of a disheartening recession. Under the circumstances, it is imperative (among other things) to: (a) Stretch the funds permitted by the fiscal straitjacket to go further in treating social disparities and stimulating economic growth. For the greater good, this has to be performed with more sense and precision than ever before. Accordingly, policy-makers may have to question the way they put together plans and allocate resources, and analysts to question the way they study the data and offer advice. For instance: Are the (shapes of the) territorial zones for which policies are devised and implemented perpetually fixed along predetermined administrative lines or should they be treated as likely to have changed over time (as some or several policies bear fruits and the values of crucial variables change)? In the case of the latter, should not resources be targeted accordingly? And might the shapes of the policy areas be traced (revealed) through statistics? If these issues are linked, then we may be able to make some or considerable progress. (b) Identify the territorial zones that seem to perform better than the rest in order to improve the chances of deducing what the causes may be, and employ the recipe wherever possible.

The argument in favor of relying on disaggregated data

Most studies geared towards the preparation or assessment of sub-national economic development and social cohesion plans tend to rely on figures supplied at conventional territorial levels such as regions, provinces, counties, prefectures, cantons and the like. Against this tendency, and bearing in mind the issues raised above, the paper takes the view that if regions, provinces etc. are (or have become) internally heterogeneous in terms of the aspects relevant to the analysis, then they may not constitute as appropriate a spatial grid for policy interventions as generally considered. Drawn after geographic, historical, gerrymandering, geometric or other factors, these territorial partitions have for a long time been accepted as a convenient framework on the basis of which national and/or EU resources may be allocated and programs devised, implemented or appraised. However, to the extent they provide a blurred if not distorted view of micro-reality (Amrhein, 1995), reliance on their average or amalgamated statistics may affect the suboptimal use of scarce resources earmarked for alleviating disparities or stimulating growth. To prevent this from happening, disaggregated data have to be used and individual communities or clusters of communities (i.e., micro-regions) with diverging features to be identified. Indeed, to the extent some or several regions or provinces comprise all kinds of

communities, funds and efforts may be directed to places that are not in serious need or to places that need a different policy-mix compared to surrounding areas or the rest of the region or province. Sadly, while policy-makers recognize that their interventions ought to be tailored to local idiosyncrasies, nearly all discussions and analyses are conducted at the fairly aggregated territorial levels mentioned above.

The study of personal income across space and time in Greece

As monetary income constitutes an important (albeit not the sole) component of the individual (or household) utility and social welfare functions, its regional and sub-regional level, distribution, and growth (often traced through its crude proxy, the GDP) serve as decisive factors in the commencement, continuation or suspension of economic development and social cohesion policies. Understandably, by affecting the perceptions of policy-makers about people's living standards and ability to help their own selves, these aspects have profound implications on the state of the national and federal public purse.

Justifiably, the spatial distribution and the temporal evolution of personal income in Greece have attracted the attention of analysts (a) initially in the Centre for Planning and Economic Research (KEPE); (b) intermittently in research and academic institutions outside Greece; (c) in several such institutes within Greece, such as the University of Macedonia, the Bank of Greece, the Agricultural Bank of Greece, the National Centre for Social Research (EKKE), the Athens University of Economics and Business, the University of Athens; or (d) engaging in collaborations.

From the publications that either focused or touched on the spatial and/or temporal patterns of personal incomes observed at the population at large, a good number relied on the annual figures obtained from the individual and family tax statements collected by the Revenue Service of the Ministry of Finance. For the most part the analysts examined the evolution of inequality over time (occasionally looked at correlations), and in once instance attempted to probe the spatial dimension as well (Prodromidis, 1975).

However, the majority relied on data solicited via household surveys conducted from time to time on representative samples of the population by the National Statistical Service of Greece. For the most part the analysts examined inequality over time and across space (occasionally looked at correlations). As the cross-sectional nature of the data permitted the econometric isolation of various effects (including spatial effects), the opportunity was seized right from the start (Crockett, 1967). Eventually, a sophisticated treatment of the regional dimension was produced by Kanellopoulos (1986).

Researchers in the EKKE probably came close to providing a more detailed picture at the sub-regional level through their own surveys (Karagiorgas et al., 1988), which they apparently completed (Balourdos et al., 1990). However, their attention was diverted to answering other questions. So, the breakthrough on this front came from researchers in the Bank of Greece (Voloudakis and Panourgias, 1980, 1984), who by matching the population data from three censuses to personal income estimates obtained from the national accounts at the prefectural level were able to provide an alternative glimpse into the evolution of inequality across time and space. However, the relatively small number of observations did not favor an in depth econometric analysis. For that, one would need a dataset that could supply more observations, presumably disaggregated observations.

As technology in data management advanced, researchers in KEPE were able to proceed with a variant of the previous approach, by matching the *2001 Census* statistics against the household income data obtained from the 2002 tax reports (pertaining to the previous year) at the municipal and postal-area levels (hereinafter, revenue districts or districts). Hence, they managed to econometrically explain income formation in terms of local population density, household composition, occupational, educational and other factors (Prodromídis, 2006). This way, the spatial analysis of personal income, which for about forty years had been conducted in terms of two or three spatial states (e.g., Athens and rest of Greece; urban, rural and intermediate areas), and for about twenty years in terms of regions (twice in terms of prefectures) as well, was eventually carried out at the local community level. At first sight it provided a fresh look at the economy as a collection of clusters and communities, without preconceptions that certain units or sub-regions should fit in the inherited regional or prefectural framework. A closer look revealed that income disparities were larger within rather than across the (conventional) territorial formations considered by the national and EU authorities, policy makers,

advisors and analysts who devise implement and assess convergence and prosperity plans. In view of the above, it might make sense if territorial economic development and social cohesion policy were conducted at a rezoned or functional-area framework.
As additional series of disaggregate declared income data have been collected since then, we attempt to explore the patterns of personal (individual taxpayer, not household) income not only across space (the country's 932 revenue districts) but also time (between 2001 and 2008). The intent is to obtain a better sense of how the country's sub-national generation of personal income operated more or less (for it is intertwined with redistribution) from the time the country joined the European Monetary Union to the time the international financial and economic crisis reached its shores.

Two snap shots: one from the beginning and one from the end of the period
According to the revenue statistics from the period in question, personal incomes increased from about € 62.615 to 98.792 billion, at the compound rate of 57.78%, even as the consumer price index rose from one year to the next and subsequent years at a compound rate of 26.32% (Table 1).

TABLE 1

The evolution of declared personal income in Greece (2001-08)

Year	Number of filers in thousands	statemen change	Income declared per filer in euro	change	Total declared income in billion euro	change	Rate of inflation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	7,734.7		8,095.3		62.61		
2002	7,908.1	2.2 %	8,590.3	6.1%	67.93	8.5%	3,6%
2003	7,942.1	0.4 %	8,911.0	3.7%	70.77	4.2%	3,5%
2004	8,336.2	5.0 %	9,259.9	3.9 %	77.19	9.1%	2,9%
2005	8,259.0	-0.9 %	9,914.3	7.1 %	81.88	6.1%	3,5%
2006	8,299.0	0.5 %	10,523.9	6.1 %	87.34	6.7%	3,2%
2007	8,308.3	0.1 %	11,358.5	7.9 %	94.37	8.1%	2,9%
2008	8,371.8	0.8 %	11,800.6	3.9 %	98.79	4.7%	4,2%
Compound rate:		8.24%		45.77%		57.78%	26.36%

Sources: Columns (1)-(6): General Secreteriat on Information Systems of the Ministry of Finance.
Column (7): National Statistical Service of Greece. Own calculations.

At the disaggregated lever, both in the beginning and in the end of this period:

- The largest shares originated in (a) the principal population centers of the country, namely, the districts of Athens, Thessaloniki, Patras, Iraklion, Larisa, and four or five revenue districts situated near Athens; and (b) somewhat smaller shares in eleven smaller towns, eighteen districts near Athens, and two districts near Thessaloniki. Collectively, the personal incomes filed in the aforementioned districts accounted for nearly half the overall personal income that was reportedly earned in the country. To visually orient the reader, these 40-41 areas are listed and indicated in Maps 1 and 2 with black.
- Another quarter of the overall personal income originated in 35-39 urban districts around the

country,[78] 32-34 localities near Athens, six localities near Thessaloniki,[79] and one (Nea Ionia) near Volos. These 76-78 districts are indicated in Maps 1 and 2 with dark gray.

- The remaining 813-816 districts supplied the final quarter of the country's overall personal income. They are indicated in Maps 1 and 2 with light gray.

Although things appear to change little from one picture to the next, there are unmistakable signs of change both across as well as within the three sets of districts listed above. In some places, income shares increased considerably (esp. in the towns (revenue districts) of Arta, Grevena, Kozani, Ptolemais, Tripolis, and the Athenian suburb of Gerakas: by 6-8%). In other places they decreased (esp. in the Athenian suburbs of Spata and Imittos: by 11-12%; and also in the districts of Zakinthos, Kerkira, and the Athenian suburb of Voula: by 6-7%). As a result, the districts of Kozani and the Athenian suburb of Neon Iraklion (denoted in Map 1 with dark gray and in Map 2 with black), which at the outset were classified in the second set, by the end of the period had progressed to the first (as residents reported a larger share of income), while the district of Kavala had moved in the opposite direction; and the districts of Grevena, Ierapetra Igoumenitsa, Ialisos (denoted in Map 1 with light gray and in Map 2 with dark gray) had progressed from the third set to the second, while the Athenian suburb of Spata had moved in the opposite direction.

The close association between a district's reported income and taxpayer population is undeniable ($r \approx 99.1\%$ throughout the period). Yet, as we shall see, additional forces also played a role. To advance our understanding beyond the comparison between instances, we construct a model that allows us to (a) estimate the impact of components such as past average income, the size of the local income-filing population, and the annual effects, and (b) examine the spatial patterns of the residuals for they are likely to be associated with crucial, yet, omitted factors.

The model and the empirical analysis

The model is developed from a number of relationships which arise from the understanding that a community's overall personal income, Y, is equivalent to the product of its mean, in this case, average income, y, times the size of the income-earning (and –filing) population, n:

$$Y = y \times n. \quad (1)$$

Hence, in a particular year, $t+1$,

$$Y_{t+1} = y_{t+1} \times n_{t+1}. \quad (2)$$

To the extent y_{t+1} grows at an annual rate b_t,

$$y_{t+1} = (1+b_t) \times y_t, \quad (3)$$

expression (2) may be rewritten as follows:

$$Y_{t+1} = (1+b_t) \times y_t \times n_{t+1}. \quad (4)$$

In linear format:

$$\ln Y_{t+1} = \ln (1+b_t) + \ln y_t + \ln n_{t+1}. \quad (5)$$

The incorporation of six temporal categorical dummies, d_i, in order to distinguish the annual effects, a_i, (if any) from the effects of the measured variables, renders the un-logged version of the expression (5) as follows:

$$Y_{t+1} = (1+b_t) \times y_t \times n_{t+1} \times e^{\Sigma(a \times d)}. \quad (6)$$

Though y_t and n_t are modestly correlated (r=24,6), the transformed regressors considered in expression (5) are further correlated (r=41,5). The empirical results associated with latter expression , recovered from (932 observations × 7 years=) 6,524 observations, are provided in Table 2. The regular estimation attempt (version 1) finds the two coefficients to be close to one; so we resort to a modification (version 2) by which the two coefficients are set equal to one. From the second version's intercept's exponentiation, we deduce that the magnitude of b, which pertains to the reference period

[78] Namely, Komotini, Agrinion, Kavala (in 2008), Veria, Xanthi, Karditsa, Drama, Kozani (in 2001), Alexandroupolis, Corfu, Ptolemais, Arta, Giannitsa, Argos, Rethimnon, Mitilini, Pirgos, Kilkis, Egion, Corinth, Hios, Thebes, Tripolis, Florina, Megara, Livadia, Edessa, Sparta, Grevena (in 2008), Naousa, Preveza, Zakinthos, Nafplion, Igoumenitsa (in 2008), Siros, Ierapetra (in 2008), Kastoria, Megalopolis, Kos, Ialissos (in 2008).

[79] Namely, Petroupolis, Haidarion, Neon Iraklion (in 2001), Alimos, Nea Filadelfia, Salamis, Argiroupolis, Agii Anargiri, Holargos, Agia Varvara, Aspropirgos, Metamorfosis, Ano Liosia, Kesariani, Elefsis, Perama, Vrilissia, Voula, Kropia, Dafni, Moskaton, Kamateron, Pefki, Melissia, Artemis, Gerakas, Ellinikon, Pallini, Markopoulon-in-Mesogea, Nea Erithrea Papagou, Rafina, Imittos, Spata (in 2001) near Athens; Evosmos, Sikee, Ampelokipi, Neapolis, Pilea, Thermi near Thessaloniki.

(2001-02), is, on average, 6.31%; and from the estimated coefficients of the annual dummies and the antilog device suggested by Halvorsen and Palmquist (1980), and Kennedy (1981), $exp[b – (S_b^2/2] – 1$, we deduce that the relative effect of each subsequent year is –2.66% (in 2002-03), –2.92% (in 2003-04), 3.04% (in 2004-05), –0.03% (in 2005-06), +1.86% (in 2006-07), –1.94% (in 2007-08).

TABLE 2

The econometric analysis of declared personal income in terms of average income, the size of income-filling population and temporal components, across the 932 revenue districts of Greece during 2001-08

Dependent Variable Natural logarithm of the overall personal income Explanatory Variables	Version 1: obtained via a robust variance estimator		Version 2: obtained on the condition that the second and third coefficients take the value "1"	
	Coefficients	P>|z|	Coefficients	P>|z|
1. Constant	0.269	*0*	0.061	*0*
2. Natural logarithm of the previous year's average income	0.976	*0*	1.000	
3. Natural logarithm of the income-filling population	1.000	*0*	1.000	
4. Change from the second to the third year (2002-3)	-0.025	*0*	-0.027	*0*
5. Change from the third to the fourth year (2003-4)	-0.027	*0*	-0.030	*0*
6. Change from the fourth to the fifth year (2004-5)	0.033	*0*	0.030	*0*
7. Change from the fifth to the sixth year (2005-6)	0.005	*0.109*	0.000	*0.885*
8. Change from the sixth to the seventh year (2006-7)	0.025	*0*	0.018	*0*
9. Change from the seventh to the eighth year (2007-8)	-0.011	*0.006*	-0.020	*0*
Statistics	R^2 = 99.93 %			

Sources: General Secreteriat on Information Systems of the Ministry of Finance. Own calculations.
Note: The probability values are estimated as in analyses that rely on samples.

Some additional observations pertaining to the steady or not-so-steady evolution of income

The residuals recovered in the process reveal five districts that consistently experienced further (unexplained) income increases throughout the period and 40 districts in which such increases occurred in six out the seven years. About one third of the aforementioned districts appear in clusters situated on a mountainous area separating West Macedonia from Thessaly, a mountainous area in the northern Peloponnese, on the mountain- and hill country of central Crete. A small number are found along the main transit corridors linking West Macedonia with Epiros and Thessaly (on the northern Pindos mountain-range), Thessaly with Central Greece (between the foothills of Mt.Othris and the Malian and Pagasean gulfs), Greece with the former Yugoslavia or Turkey. The rest (nearly one half of the said districts) are dispersed around the country. (They are listed in Map 2, and denoted with black.) All hosted fewer than 8 thousand income-filers in 2001. With the exceptions of Larimna and Leontarion they were associated with low levels of per capita income in 2001 (i.e., below the level found in the median community).

The city of Larisa and a number of large Athenian suburbs (Peristeri, Kallithea) along with 445 smaller districts stretching over most of the country turn out to be susceptible to more oscillations (with fewer "ups" and more "downs" than those mentioned in the previous paragraph). (See Map 3, areas in dark gray.)

Athens, Piraeus, Patras, Iraklion, Ioannina, Volos, along with 515 smaller districts (generally large and with high average income) covering large tracts or forming pockets and string of localities along the transportation network (see Map 4, areas in dark gray) often perform worse than the average district.

Finally, there also exist 47 districts which performed worse than the average in six out of the seven years, and nine districts in which this occurred throughout the period. (See Map 4, areas in back.). These comprise Thessaloniki and several of its suburbs, the towns of Hania and Rethimnon and other places along the northern coast of Crete, the towns of Komotini, Kalamata (and neighbouring Kardamila), Kerkira (and neighbouring Karousades), most of the island of Zakinthos and portions of

neighbouring Kefallinia, and other districts dispersed around the country. Under the circumstances, it is highly likely these communities and clusters of communities may be in need of territorial development planning assistance.

To the extent a good number of areas consistently perform better than predicted year after year, it would make a lot of sense to identify what the source for this of might be, with the prospect of replicating it across the country. Though the discovery process may require considerable thinking, mulling over these patterns (the extent, similarities and dissimilarities of the areas involved) ought to improve the chances of deducing what these factors might may be, and design spatially targeted interventions.

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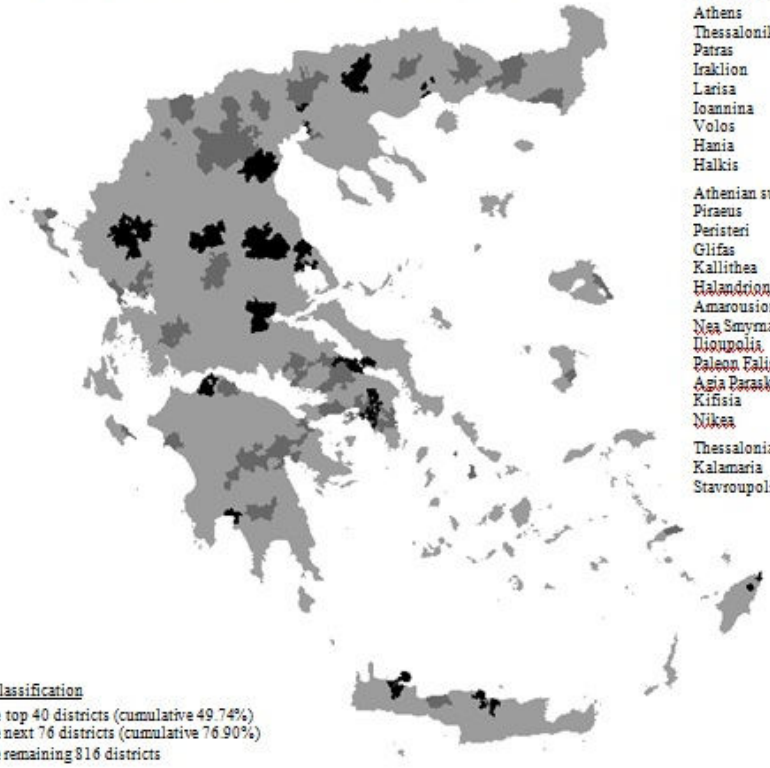
MAP 1: The declared personal incomes scatter across the revenue districts of Greece in 2001



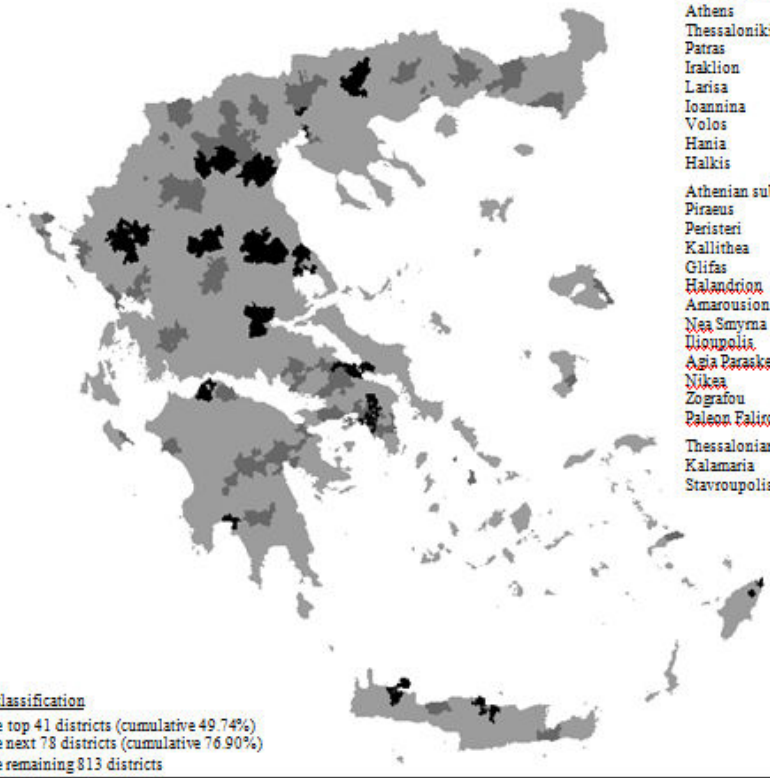
The top 42 districts and their income shares (in %)

Athens	9.43	Serre	0.66
Thessaloniki	4.11	Trikala	0.65
Patras	1.87	Lamia	0.65
Iraklion	1.53	Kavala	0.63
Larisa	1.51	Kalamata	0.62
Ioannina	1.02	Katerini	0.62
Volos	0.99	Rhodes	0.62
Hania	0.86	*Kozani*	*0.59*
Halkis	0.79		
Athenian suburbs			
Piraeus	2.06	Zografou	0.89
Peristeri	1.43	Ilion	0.84
Glifas	1.20	Aharne	0.79
Kallithea	1.20	Keratsinion	0.77
Halandrion	1.16	Agios Dimitrios	0.76
Amarousion	1.13	Nea Ionia	0.76
Nea Smyrna	1.06	Aegaleo	0.75
Ilioupolis	0.98	Vyron	0.73
Paleon Faliron	0.94	Galatsion	0.69
Agia Paraskevi	0.93	Koridallos	0.62
Kifisia	0.92	*Neon Iraklion*	*0.61*
Nikea	0.91		
Thessalonian suburbs			
Kalamaria	1.00		
Stavroupolis	0.66		

Key for color classification

Black: The top 40 districts (cumulative 49.74%)
Dark gray: The next 76 districts (cumulative 76.90%)
Light gray: The remaining 816 districts

MAP 2: The declared personal incomes scatter across the revenue districts of Greece in 2008



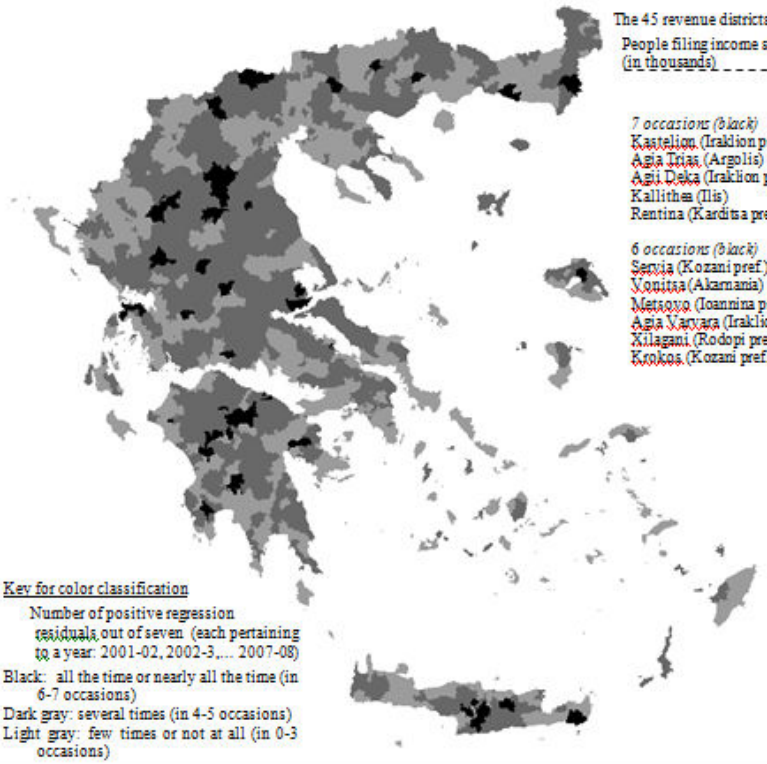
The top 42 districts and their income shares (in %)

Athens	9.07	Trikala	0.69
Thessaloniki	3.90	Serre	0.68
Patras	1.85	Lamia	0.66
Iraklion	1.55	Katerini	0.64
Larisa	1.54	Kozani	0.64
Ioannina	1.05	Kalamata	0.64
Volos	0.97	Rhodes	0.61
Hania	0.88	*Kavala*	*0.60*
Halkis	0.79		
Athenian suburbs			
Piraeus	2.02	Kifisia	0.87
Peristeri	1.44	Ilion	0.86
Kallithea	1.19	Aharne	0.83
Glifas	1.18	Keratsinion	0.78
Halandrion	1.15	Agios Dimitrios	0.77
Amarousion	1.13	Nea Ionia	0.76
Nea Smyrna	1.02	Aegaleo	0.74
Ilioupolis	0.97	Vyron	0.72
Agia Paraskevi	0.93	Galatsion	0.70
Nikea	0.90	Neon Iraklion	0.63
Zografou	0.89	Koridallos	0.61
Paleon Faliron	0.89		
Thessalonian suburbs			
Kalamaria	0.98		
Stavroupolis	0.65		

Key for color classification

Black: The top 41 districts (cumulative 49.74%)
Dark gray: The next 78 districts (cumulative 76.90%)
Light gray: The remaining 813 districts

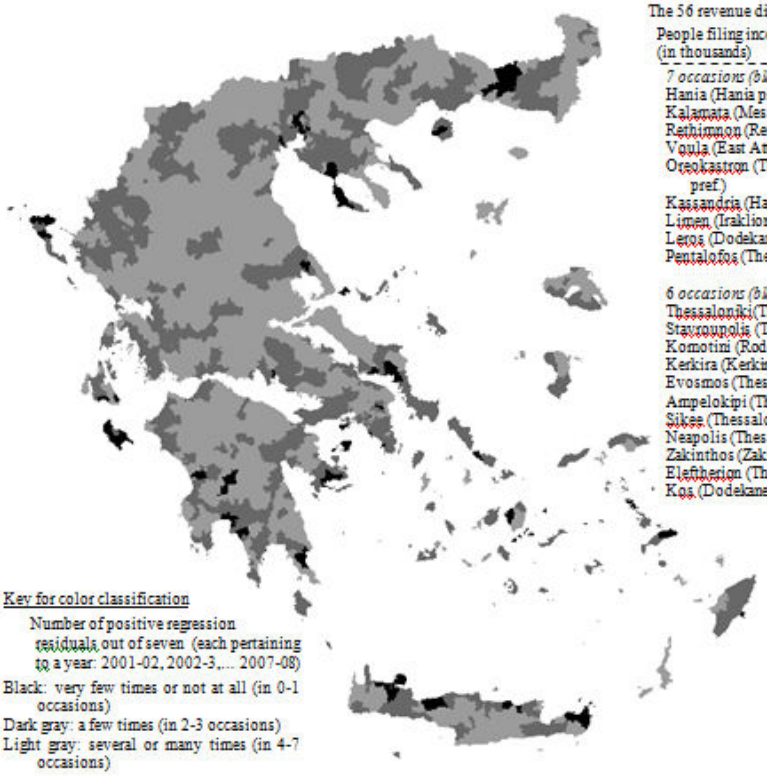
MAP 3: The revenue districts of Greece in terms of their steady or not-so-steady personal income increase (beyond the levels predicted via the 2nd method of Table 2)



The 45 revenue districts that often exceeded the predicted level of income

People filing income statements in 2001 (in thousands)		Top (I), middle (II), low (III) income tier in 2001: above the national mean, intermediate, below the median community, respectively)
7 occasions (black)		
Kastelion (Iraklion pref.)	4.7	III
Agia Trias (Argolis)	3.7	III
Agii Deka (Iraklion pref.)	3.3	III
Kallithea (Ilis)	1.2	III
Rentina (Karditsa pref.)	0.6	III
6 occasions (black)		
Servia (Kozani pref.)	7.6	III
Vonitsa (Akarnania)	5.0	III
Metsovo (Ioannina pref.)	4.1	III
Agia Varvara (Iraklion pref.	3.9	III
Xilagani (Rodopi pref.)	3.7	III
Krokos (Kozani pref.)	2.8	III
6 occasions (black)		
Amissa (Pella pref.)	2.6	III
Dafne (Iraklion pref.)	2.5	III
Pelasgia (Fthiotis)	2.5	III
Harmis (Messenia)	2.5	III
Soupni (Magnesia)	2.4	III
Strimonikon (Serre pref.)	2.4	III
Tropea (Arkadia)	2.2	III
Kirria (Drama pref.)	2.1	III
Eani (Kozani pref.)	2.1	III
Kranea (Larisa pref.)	2.1	III
Klitoria (Ahaia)	2.0	III
Vourgarelion (Arta pref.)	2.0	III
Zaros (Iraklion pref.)	2.0	III
Tihteron (Evros pref.)	1.7	III
Agia Paraskevi (Lesvos pr.)	1.7	III
Handras (Lasithion pref.)	1.7	III
Krousonas (Iraklion pref.)	1.7	III
Mesenikolas (Kardista pref.)	1.5	III
Pitsa (Korinthia)	1.2	III
Gkoura (Korinthia)	1.1	III
Leontarion (Arkadia)	1.0	II
Larimna (Fthiotis)	1.0	I
Agios Vlasios (Aetolia)	0.9	III
Foustani (Pella, Kilkis pref.)	0.8	III
Havarion (Ilis)	0.8	III
Idomeni (Kilkis pref.)	0.7	III
Tsaritsani (Larisa pref.)	0.7	III
Peplos (Evros pref.)	0.5	III
Koniskos (Trikala pref.)	0.4	III
Mikropolis (Drama pref.)	0.4	III
Valesinikon (Arkadia)	0.3	III
Kipourion (Grevena pref.)	0.3	III
Kertezion (Ahaia)	0.3	III
Potidania (Fokis)	0.1	III

MAP 4: The revenue districts of Greece in terms of their steady or not-so-steady personal income increase (beyond the levels predicted via the 2nd method of Table 2)



The 56 revenue districts that often fall below the predicted income level

People filing income statements in 2001 (in thousands)		Top (I), middle (II), low (III) income tier in 2001 (as described in Map 3)
7 occasions (black)		
Hania (Hania pref.)	64.6	I
Kalamata (Messenia pr.)	47.9	I
Rethimnon (Rethimnon p.)	27.9	I
Voula (East Attiki)	19.7	I
Oreokastron (Thessaloniki pref.)	10.9	I
Kassandria (Halkidiki)	7.5	II
Limen (Iraklion pref.)	6.2	II
Leros (Dodekanese)	5.5	II
Pentalofos (Thessaloniki pr.)	0.2	II
6 occasions (black)		
Thessaloniki (Thessalonikip.)	80.2	I
Stavroupolis (Thessaloniki p.	59.2	II
Komotini (Rodopi pref.)	47.9	II
Kerkira (Kerkira pref.)	43.9	II
Evosmos (Thessaloniki. pr.)	40.6	II
Ampelokipi (Thessaloniki p.)	28.8	II
Sikies (Thessaloniki. pref.)	25.6	II
Neapolis (Thessaloniki pr.)	21.0	II
Zakinthos (Zakinthos pr.)	18.7	II
Eleftherion (Thessaloniki pr.	16.3	II
Kos (Dodekanese)	16.1	II
6 occasions (black)		
Nea Moudania (Halkidiki)	14.0	II
Aegina (Piraeus pref.)	10.6	II
Naxos (Cyclades)	10.6	II
Sitia (Lasithion pref.)	10.5	II
Neon Psihikon (Athens pr.)	9.0	I
Imittos (Athens pref.)	8.7	I
Aliverion (Euboea pref.)	8.4	I
Karousades (Kerkira pref.)	7.9	III
Likovrisis (Athens pref.)	6.3	I
Maherado (Zakinthos pref.)	6.2	III
Megalopolis (Arkadia)	5.6	I
Anavissos (East Attiki)	4.3	I
Skiathos (Magnesia)	4.2	II
Agria (Magnesia)	4.0	II
Limenaria (Kavala pref.)	3.8	III
Eretria (Euboea pref.)	3.8	II
Ekali (Athens pref.)	3.6	I
Dionisos (East Attiki)	3.5	I
Ermioni (Argolis)	3.2	II
Malia (Iraklion pref.)	3.0	II
Monemvasia (Lakonia)	2.5	III
Ajantion (Piraeus pref.)	2.5	I
Filiron (Thessaloniki pref.)	2.0	I
Keramie (Kefallinia pref.)	1.9	II
Volime (Zakinthos pref.)	1.4	III
Portaria (Magnesia)	1.1	II
Nea Figalia (Ilis)	1.0	III
Platanias (Hania pref.)	1.0	II
Lindos (Dodekanese)	0.9	II
Antikira (Boeotia pref.)	0.9	I
Kardamili (Messenia)	0.9	III
Poros (Keffallinia pref.)	0.8	II
Panormos (Cyclades)	0.3	II
Nea Malgara (Thessalonikip	0.3	II
Neohosouda (Thessaloniki p.	0.3	II
Ihalia (Messenia)	0.3	III

REGIONAL INEQUALITIES IN GREECE
A PROPOSITION FOR THEIR DEPICTION

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Abstract
Regional inequalities are a topic which has timely occupied both the academic society as well as the directorate authorities. The different methodology approaches in solving the problem are offered for critical analysis and possible alterations. In this article, a composite weighted indicator of growth is proposed, which will be used to portray regional inequalities. Moreover, the methodology for the choice of a number of variables as part of the composite indicator will also be put forward. The depiction of the inequalities regards those between the country's regions (NUTS 2) as well as those between ex-prefectures (NUTS 3).
Key words: regional inequalities, composite indicators
JEL classification R10, R40, R30

1. Introduction

The objective portrayal of regional inequalities in Greece is a topic that is maintained seasonable and is often presented in a charged manner. Despite the critics, the depiction of inequalities is approached by calculations of the per capita gross domestic income (Ward 1963, Glitsos 1988, Barro 1991,Petrakos 2003). Another approach is the use of calculations of more than one of the variables (Glitsos, 1998, Polyzos 2008). The calculations are combined to compose a composite indicator in order to calculate quality of life (Liargovas, 2003) or regional inequalities (Petrakos 2004), in the latter instance through a composite indicator of growth (CIG). Beginning with the construction of CIG (Petrakos 2004) - on the basic hypothesis that the weighting of each variable that comprises CIG is proportionate to the contribution of the variable to the fluctuation of the sum of the variables – we propose, on the one hand, a means of weighting the variables that comprise the indicator, and on the other hand a means of choice of variables that contribute to the indicator. Lastly, we use the indicator as a variable, weighting it against the population in order to calculate the variability coefficient and to illustrate regional inequalities.

2. Composite Weighted Indicator of Growth (CWIG)

If X_{ri} the variables for the depiction of regional inequalities, and x_{ri} their arithmetic values in the region of r, where $r=1,2,3,4,\ldots,m$ and $i=1,2,3,..,n$. The transformation $\frac{x_{ri}-\min(x_{ri})}{\max(x_{ri})-\min(x_{ri})}$ (OECD 2008) standardizes the values of the initial variables. For the numeral y_{ri} of the standardized variable Y_i, $0 \le y_{ri} \le 1$. If higher or lower values are an indication of a better or worse level of development in a region, then the sum: $s_r = \sum_{r=1}^{m}(y_{r1}+y_{r2}+y_{r3}+\ldots+y_{rm})$ comprises a composite indicator of growth (CIG) for the region r. Using the numerical value of the sum for each region, it is possible to classify the regions according to their development. A possible objection to the theory regarding the CID could

be the fact that in the equation of the sum, each variable has an equal weighting. Different methods have been proposed for the weighting of the variables (OECD, 2008). One such approach could be to calculate the contribution of each variable to the variance $\mathrm{var}(S)$, where: $\mathrm{var}(S) = \mathrm{var}(\sum_{i=1}^{n} Y_i)$. The contribution of the variables could be calculated as follows. The variance var(*S*) is equal to:

$$\mathrm{var}(S) = \sum_{i}^{n} \mathrm{var}(Y_i) + 2\sum_{i}^{n} \sum_{j>i} \mathrm{cov}(Y_j Y_i) \quad (1)$$

What is valid for the covariance $\mathrm{cov}(Y_j Y_i)$ is: $\mathrm{cov}(Y_j Y_i) = b_{ji} Var(Y_j)$ with $b_{ji} = 1$ if $j = i$

therefore, (1) is equivalent to:

$$\mathrm{var}(S) = \sum_{i}^{n} [b_{1i}\, \mathrm{var}(Y_1) + b_{2i}\, \mathrm{var}(Y_2) + ... + b_{ni}\, \mathrm{var}(Y_n)] \quad (2)$$

The weighting coefficient w_i for the variable Y_i, $i = 1,2,3,..,,n$ as results from (2) equals to:

$$w_i = \frac{\mathrm{var}(Y_i)}{\mathrm{var}(S)} (b_{1i} + b_{2i} + .. + b_{ni}) \quad (3)$$

Therefore, the composite weighting indicator of growth (CWIG) for each region $r = 1,2,3,4,..,m$ is:

$$s_{wr} = \sum_{r=1}^{m} (w_1 y_{r1} + w_2 y_{r2} + w_3 y_{r3} + ... + w_n y_{rn}) \quad (4)$$

3. Applications of the depiction of regional inequalities

In order to depict regional inequalities in Greece, for the years 2003 and 2008, we used 23 of the following variables. [1]: Per Capita gross Domestic Product, [2]:Per Capita Declared Income, [3]:Per Capita Savings, [4]: Per Capita time Savings, [5]: Per Capita of Gross value added by Agriculture/forestry/fishing, [6]: Per Capita of Gross value added by Industry including energy, [7]: Per Capita of Gross value added by Construction, [8]: Per Capita of Gross value added by Wholesale and retail trade-vehicle repairs and household items- Hotels and restaurants-Transportation and communication, [9]: Per Capita of Gross value added by Financial intermediation-Real estate renting and Business activities, [10]: Per Capita of Gross value added by Other services, [11]: New Dwelling by number/1000 residences, [12]: Volume of New Construction Activities/1000 residences, [13]: New Passenger Cars/1000 residences,[14]:New Passenger Trucks/1000 residences,[15]: In service Passenger Cars (private and public)/1000 residences, [16]: In Service Passenger Trucks (private and public)/1000 residences,[17]: Beds in Hotel Accommodation/1000 residences,[18]: Overnight stays of nationals/1000 residences,[19]: Overnight stays of foreigners/1000 residences, [20]:Doctors/1000 residences,[21]:Dentists/1000 residences,[22]: Infirmary rooms/1000 residences, [23]: Per Capita Electrical Power Consumption.

Subsequently, the initial variable values were standardized. The values of the composite weighting indicator of growth (s_{wr}) were calculated from (4). The range of variables that comprise the indicator affect its values, because variance $\mathrm{var}(S)$ -which is necessary to calculate the weightings of each variable- is affected. It's important therefore to examine whether the presence or not of variables with small weightings will affect the regional rankings, as will result from the indicator (s_{wr}). In order to provide an answer, we conducted a statistical test in order to test the hypothesis $H_0 : \sigma_n^2 = \sigma_k^2$ with the alternative of $H_1 : \sigma_n^2 \neq \sigma_k^2$ where $n \neq k$ is the different number of variables. For the regions NUTS2 we used the rank sum dispersion test by Siegel-Tukey (Gopal, 2006) – a non parametric test. For the regions NUTS3, the statistical test γF was used which regards to variables that are correlated (Gopal, 2006). We expect that in the instance that the hypothesis H_0 is accepted, the rankings from the range of variables to be correlated. Using the Kendall indicator (Siegel, 1956) the intensity of correlation was calculated. If the correlation is strong, the hypothesis which states that the addition of variables doesn't affect the variance var(S) is reinforced, and consequently the regional rankings are

not affected. Furthermore, we do not expect the ranking of a region to be affected with regards to the Median value and the Quartile values of the indicator (s_{wr}) .Cohen's Kappa indicator (Cohen, 1960) was used to examine the degree of concordance with regard to the ranking of the regions (above or below or in between), in relation to the indicator's (s_{wr}) Median and Quartile values, as results from the different number of variables. A high *K* indicator value confirms that the addition of variables - which from the point of statistical importance do not affect the variance var(S) - also do not affect the ranking of the region in relation to the positioning standards aforementioned. Lastly, after being weighed up against each regions population, the new variable (s_{wr}) was used to calculate the coefficient of variation to portray the regional disparities.

4. Results and Conclusions

From (3) the weightings for each of the 23 variables arose. Three variables have the lowest weighting values both for NUTS2 level and NUTS3, for both the two years. The variables are: Per Capita Electrical Power Consumption, in service trucks/1000 residences and the share of the gross added value within the branches of agriculture, forestry and fishery. The three variables were subtracted and the variance var(S) was re-calculated with 20 variables. The statistical test value γF and *z,* the degree of freedom *df* and the level of significance α are presented in table 1. In table 2 the results regarding Kendall's correlation coefficient r_K are presented. Table 3 depicts the results regarding the values of Cohen's *Kappa* indicator, the Quartile Q_1, Q_3 values, and the median M as well as the mean $\bar{s}$ for 23 and 20 variables respectively.

Table 1. Statistical Test of the Hypothesis $H_0 : \sigma_{23}^2 = \sigma_{20}^2$

Nuts 3 (Year 2008)	Statistical Test Value $\gamma F = 0.069$, $df = 49$, $a = 0.01$ and $a = 0.05$
Nuts 3 (Year 2003)	Statistical Test Value $\gamma F = 0.034$, $df = 49$, $a = 0.01$ and $a = 0.05$
Nuts 2 (Year 2008)	Statistical Test Value $z = -0.718$ $a = 0.01$ and $a = 0.05$
Nuts 2 (Year 2003)	Statistical Test Value $z = -0.718$ $a = 0.01$ and $a = 0.05$

Table 2. Correlation of rankings of 23 and 20 variables

Nuts 3 (Year 2008)	$r_K = 0.962$	Nuts 2 (Year 2008)	$r_K = 0.949$
Nuts 3 (Year 2003)	$r_K = 0.965$	Nuts 2 (Year 2003)	$r_K = 0.949$

Table 3. Cohen's Kappa, Median, Quartile and Arithmetic Mean values

	Number of Variables 23	Number of Variables 20	Cohen's-Kappa
Nuts 3 (Year 2008)	$Q_1 = 0.167$ $M = 0.243$ $Q_3 = 0.297$ $\bar{s} = 0.255$	$Q_1 = 0.166$ $M = 0.240$ $Q_3 = 0.306$ $\bar{s} = 0.257$	$Kappa = 0.895$
Nuts 3 (Year 2003)	$Q_1 = 0.167$ $M = 0.227$ $Q_3 = 0.290$ $\bar{s} = 0.242$	$Q_1 = 0.169$ $M = 0.230$ $Q_3 = 0.299$ $\bar{s} = 0.247$	$Kappa = 0.843$
Nuts 2 (Year 2008)	$Q_1 = 0.181$ $M = 0.194$ $Q_3 = 0.323$ $\bar{s} = 0.268$	$Q_1 = 0.191$ $M = 0.203$ $Q_3 = 0.327$ $\bar{s} = 0.275$	$Kappa = 1.00$
Nuts 2 (Year 2003)	$Q_1 = 0.143$ $M = 0.190$ $Q_3 = 0.322$ $\bar{s} = 0.266$	$Q_1 = 0.171$ $M = 0.207$ $Q_3 = 0.343$ $\bar{s} = 0.277$	$Kappa = 0.794$

The statistical test of the hypothesis $H_0 : \sigma_{23}^2 = \sigma_{20}^2$ (table 1) showed that H_0 was accepted. Furthermore, the high correlation values for the Kendall indicator (table 2) based on the results for the indicator (s_{wr}), leads us to the conclusion that the regional rankings are highly in accordance when using 23 variables, to the regional rankings when 20 variables are used for the indicator (s_{wr}) values. On the basis of the indicator (s_{wr}) results, when 23 or 20 variables are used and by applying the Median and Quartile parameters Q_1, M, Q_3, we limit the regions to more or less developed. The high Kappa values (table 3) signifies a high degree of accordance for the ranking of regions with regards to the ranking parameter Q_1, M, Q_3. Therefore, acceptance of the hypothesis $H_0 : \sigma_{23}^2 = \sigma_{20}^2$ is greatly amplified, meaning that the subtraction of three variables does not affect the ranking and positioning of the regions. In the following tables 4 and 5 the regional rankings are exemplified for 20 and 23 variables as result from the values of the indicator (s_{wr}).

Table 4. Regional rankings (NUTS2)

NUTS2	2008 (23M)	2008 (20M)	2003 (23M)	2003 (20M)
Attiki	1	1	1	1
Notio Aigaio	2	2	2	2
Kriti	3	3	4	3
Kentriki Makedonia	4	4	3	4
Ionia Nisia	5	5	5	5
Sterea Ellada	6	7	9	9
Peloponnisos	7	6	11	10
Ipeiros	8	8	6	6
Thessalia	9	10	8	8
Voreio Aigaio	10	9	7	7
Dytiki Makedonia	11	11	10	11
Anatoliki Makedonia & Thraki	12	12	12	12
Dytiki Ellada	13	13	13	13

Table 5. Regional rankings (NUTS3)

NUTS3	2008 (23M)	2008 (20M)	2003 (23M)	2003 (20M)	NUTS3	2008 (23M)	2008 (20M)	2003 (23M)	2003 (20M)
Attica	1	1	1	1	Kozani	27	25	18	18
Dodecanese	2	2	2	2	Fthiotida	28	29	37	37
Kiklades	3	3	5	5	Messinia	29	28	33	33
Lefkada	4	6	15	15	Preveza	30	32	31	32
Zakinthos	5	4	4	4	Kastoria	31	31	27	25
Kefallonia	6	8	10	9	Evros	32	30	22	22
Iraklio	7	7	6	7	Pieria	33	33	36	36
Thessaloniki	8	5	3	3	Trikala	34	34	35	34
Chania	9	9	7	6	Lesvos	35	35	29	28
Lasithi	10	10	11	11	Lakonia	36	36	32	31
Chalkidiki	11	11	25	24	Drama	37	37	34	35
Rethimno	12	12	13	14	Imathia	38	38	39	39
Chios	13	13	12	12	Arta	39	39	38	38
Samos	14	15	14	13	Grevena	40	40	42	42
Ioannina	15	14	9	10	Kilkis	41	42	41	41
Arkadia	16	16	19	17	Xanthi	42	41	40	40
Korinthia	17	17	28	26	Fokida	43	45	45	43
Evoia	18	21	26	27	Karditsa	44	43	44	45
Argolida	19	20	30	30	Aitolokarnania	45	44	49	47
Magnisia	20	19	16	16	Pella	46	46	50	50
Larissa	21	18	17	19	Evritania	47	47	47	46
Kavala	22	22	21	20	Florina	48	49	48	49
Thesprotia	23	23	24	23	Serres	49	48	43	44
Viotia	24	27	23	29	Rodopi	50	50	46	48
Achaia	25	24	20	21	Ilia	51	51	51	51
Kerkira	26	26	8	8					

Having taken the performance of the indicator (s_{wr}) into consideration, from table 4 the regions which hold the top five positions during the years 2003 and 2008 arise. These are: Attiki, Notio Aigaio, Kriti, Kentriki Makedonia and the Ionia Nisia . During the same years the regions of Anatoliki Makedonia & Thraki and Dytiki Ellada rank in the last two positions. Also, on the basis of regional performance, from table 5 what transpires is Attiki's dominance on the one hand, and on the other hand, the decline of Thessaloniki's position in 2008 compared to 2005. As for the last 12 positions (40 up to and including position 51), the same NUTS3 regions occupy them with only slight reclassifications. Lastly, table 6 regards the weighting coefficient of variation (wCV) for the levels NUTS 2&3 and for 20 and 23 variables

Table 6. Weighting Coefficient of Variability

		Number of variables: 23	Number of variables: 20
Year 2008	Nuts 3	wCV=102.0%	wCV=103.2%
Year 2003	Nuts 3	wCV=122,2%	wCV=118,2%
Year 2008	Nuts 2	wCV=143,2%	wCV=134,7%
Year 2003	Nuts 2	wCV=144,5%	wCV=127,4%

The variability coefficient's high values show inequalities for both years on both NUTS levels. It should be noted that, when using NUTS3 level a tendency of reduction of inequalities within the two years emerges, whereas on NUTS2 level the inequalities seem invariable. In conclusion, with the method described we suggest a way in which to weigh the variables that comprise a growth indicator of a region which could subsequently be used to depict regional inequalities. Furthermore, with the

proposed statistical test there's the possibility to evaluate whether the portrayal of regional inequalities is affected by the number of variables that comprise the indicator - with the presence of variables with a marked linear correlation not causing a methodological or theoretical problem (OECD, 2008).

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Announcements, Conferences, News

9TH WORLD CONGRESS OF REGIONAL SCIENCE ASSOCIATION INTERNATIONAL

Conference Overview[80]

The 9th World Congress of Regional Science Association International was held by the Faculty of Economics and Business Administration – West University of Timisoara and the Romanian Regional Science Association in Timisoara, Romania in May 9-12, 2012. The Conference entitled "Changing Spatial Patterns in a Globalizing World" has been organized in association with Timis County Council, Timisoara Municipality, Timis Prefecture, West Regional Development Agency and Timisoara Chamber of Commerce, Industry and Agriculture.

The chair of the Congress was Roberta Capello and the members of the Scientific Committee, who have contributed to and participated in, were Dorel Ailenei, Åke E. Anderson, Richard Arnott, Patricio Aroca, Carmen Babaita, Antoine Bailly, Peter W. J. Batey, Ewa Bojar, David Boyce, Roberta Capello, Michel Carroll, John I. Carruthers, Richard Church, Graham Clarke, Daniela L. Constantin, Paul Dalziel, Tomaz Dentinho, Alessandra Faggian, Manfred M. Fischer, Henk Folmer, Grzergorz Gorzelak, Eduardo Haddad, Geoffrey J. D. Hewings, Yoshiro Higano, Takeo Ihara, Romeo V. Ionescu, Dorin Jula, Yoshitsugu Kanemoto, Charlie Karlsson, Tschango John Kim, Jan Kowalski, Johan Lundberg, Gunther Maier, Phil McCann, Peter Nijkamp, Jan Oosterhaven, Jean Paelinck, Alexander Pelyasov, Marilen Pirtea, Mark Partridge, John M. Quigley, Aura Reggiani, Laura Resmini, Piet Rietveld, Danni Shefer, Hiroyuki Shibusawa, Robert J. Stimson, Roger R. Stough, Ioan Talpos, Jean Claude Thill, André Torre, Maciej Turala, Jouke van Dijk, Anthony Venables, Eric Verhoef and Hans Westlund.

The Conference was separated into seven special sessions:

- ✓ The New Urban World
- ✓ NECTAR I – Equity in Networks
- ✓ NECTAR II – Modelling Accessibility in Spatial-Economic Networks
- ✓ Transport and Logistics in a Globalizing World
- ✓ Territorial development and governance of rural and periurban areas
- ✓ FDI in Europe: how is it going?
- ✓ Spatial Modeling and Location Analysis

During this Congress themes have been discussed including "Emerging challenges for Regional Development", "Vision and management of sustainable cities", "Rural and local development", "Accessibility, infrastructure and regional economic growth", "Social capital and regional development", "Agglomeration, clusters, congestion and policy", "Learning from failures in European Regional Policy", "Crisis of Public Finances", "Governance and Regional Development", "Globalization and Regional competitiveness", "Cross-border cooperation and development", "Migration, cultural networks and regional development", "Social segregation poverty and social policy", "Spatial issues of the labor market", "Climate change and sustainable regional development", "Entrepreneurship, networks and innovation", "Innovation, knowledge economy and regional development", "Geographical information systems and spatial analysis", "Spatial econometrics", "New frontiers in regional science: theory and methodology", "Infrastructure, transports and communications", "Land use real estate and housing markets", "Location studies", "Tourism, Cultural Industries and regional development", "Urban governance and cities regeneration" and "Territorial marketing".

[80] **Conference overview by Antonia Obaidou, Aristotle University of Thessaloniki, Greece**

Mid-Continent Regional Science Association 42nd Annual Conference – IMPLAN

National User's Conference 9th Biennial Conference

Conference Overview[81]

The MCRSA organized its 43rd Annual Conference in conjunction with MIG, Inc.'s 9th Biennial IMPLAN User's Conference, in June 6-8, 2012 at the Hilton Minneapolis/St Paul's airport Mall of America.

The conference offered a stimulating mix of academic and applied research perspectives. The officers who took part in are: Russ Kashian, Past President University of Wisconsin – Whitewater Ron Gunderson, President Northern Arizona University Greg Alward, President Elect MIG, Inc. Scott Loveridge, Vice President and Chair, Student Paper Competition North Central Regional Center for Rural Development Michigan State University John Leatherman, Secretary/Treasurer Kansas State University Steve Deller, Representative to the North American Regional Science Council University of Wisconsin – Madison. From the Department of Agricultural Economics Kansas State University the Compiler was John Leatherman, with assistance from Emily Mollohan, Student Research Assistant and Rebecca Bishop, Extension Associate.

During the Conference the following researches were presented:

- An Exploration into Recent Input-Output Multiplier Innovations
- Measuring University Contributions to Regional Economies: A Discussion of Guidelines for Enhancing Credibility
- The Settlement of San Francisco and the Land Use Changes in the Fan
- Is Irrigated Rice Cultivation Sustainable in Kurunegala District of Sri
- An Examination of Short-Run and Long-Run Factors Affecting Regional Income Inequality in the United States
- An Analysis of Home Mortgage Foreclosures in Sioux Falls, South Dakota
- Economic Multipliers in Local Colorado Economies: The Merits of and Procedures for Including Construction and Local Government Spending in Input-Output Multipliers
- The Effect of Oil Revenue on Consumption Expenditure in Iran
- Economic Impact of Federal Spending on Agriculture and Rural Economic Development Programs in Mississippi, 2010
- Measuring the Economic Impact of ASDI Benefits
- A Dynamic Demand Driven, Supply Constrained Input Output Approach to Modeling Economic Impacts of Water Disruption Events.

[81] **Conference overview by Antonia Obaidou, Aristotle University of Thessaloniki, Greece**

Academic Profiles

Roberta Capello is Full professor of Regional Economics at Politecnico of Milan, Faculty of Building Engineering and President of the RSAI (Regional Science Association International). Her first degree was in Economics at Università Commerciale Luigi Bocconi, Milan, Italy. Ph.D. in Economics, Free University of Amsterdam, The Netherlands. She's Editor in chief of the Italian Journal of Regional Science. Co-Editor of Letters in Spatial and Resource Science, Springer Verlag, Berlin. She's also member of the European Organizing Committee and Treasurer of the European Regional Science Association (ERSA) (2000-2006) and member of the Coordination Committee of the Italian Section of the Regional Science Association. National Secretary of the Italian Section of the International Regional Science Association, 1995-98.

In her long research career she has focused in particular on regional growth and regional economics. She's additional Member of the editorial board of the Annals of Regional Science and of the Revue d'Economie Régionale et Urbaine and Author of a textbook in Regional Economics, published in Italian (Il Mulino, 2004), and in English (Routledge, 2007).

Her most recent publications include (2000-2009):

- Capello R. and Spairani A. (2006), "Accessibility and regional growth in Europe. The role of ICTs policies", in Vertova G. (ed.), The Changing Economic Geography of Globalization, Routledge, London, pp. 192-215
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By Antonia P. Obaidou, Aristotle University of Thessaloniki, Greece

Francisco José Lopes de Sousa Diniz is a distinguished Associate Professor with Aggregation and Principal Investigator at the University of Tras-os-Montes and Alto Douro. He published 32 articles in peer reviewed journals and 38 papers in proceedings of events, has 15 book chapters and five books published. It has 98 items of technical production. He participated in 52 events abroad and 58 in Portugal. Guided four PhD theses supervised 19 dissertations and co-directed in one area of Economics and Management. Between 1986 and 2008 participated in 12 research projects, with 3 of these coordinated. Currently involved in three research projects, and one of these coordinates. Works in the area of Social Sciences with an emphasis in Economics and Management. In his professional activities interacted with 82 employees in co-authorship of scientific papers. In its curriculum DeGóis the most frequent terms in the context of scientific, technological and artistic-cultural are: Rural Development, Regional Development, Regional Development, Rural Development, Rural Tourism, Management, Tourism, Public Management, and Small and Medium Towns Small and medium-sized town.

His most recent publications include:
Recent Publications
"Inovações do investimento em regiões periféricas – Leader I ao
Leader II nos Açores e Madeira" (Co-autoria com Fernanda Nogueira) in Perspectivas de Desenvolvimento para as Regiões Marítimas Actas do VII Encontro Nacional da APDR. (2000) vol I pp 65-79.
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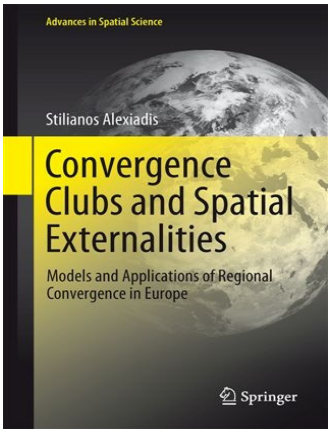
Book Reviews



Convergence Clubs and Spatial Externalities: Models and Applications of Regional Convergence in Europe

by Stilianos Alexiadis

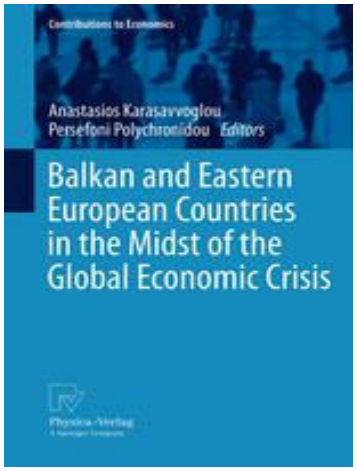
Springer, 2012

ISBN: 978-3-642-31626-5

This book provides an extensive analysis of models and applications of regional convergence. In particular, it is argued that club convergence is attributed to differences in technology creation and adoption and agglomeration externalities across regions. This argument is developed in an explicitly spatial context, taking into account interaction and spillovers from technology creation across geographical areas. To support this argument, a theoretical model is developed, which postulates that convergence amongst regions is feasible only if they share similar structural characteristics, regarding the creation and adoption of technology. The book by Stilianos Alexiadis can be used by lectures and students at undergraduate and postgraduate levels. At postgraduate level, especially, this book would be useful for students in Regional Economics, and Economic Geography given that there are very few (if any) textbooks devoted exclusively on regional convergence. Economists dealing with practical and applied issues will also find this volume an efficient and easy-to-use textbook. Planners, policy-makers and regional development institutions in the EU, especially in the new member states, will find this book particularly useful.

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 Vilelmini G.Psarrianou, RSI Journal



Balkan and Eastern European Countries in the Midst of the Global Economic Crisis

Editors: Karasavvoglou, Anastasios, Polychronidou Persefoni
Springer, 2013

ISBN (hardcover version): 978-3-7908-2872-6

Taking into consideration the ongoing economic and financial crisis, which has still serious effects on global economies, this book highlights the necessity of investigating new methods in order to achieve sustainable economy. Furthermore, the study of the Balkan and Eastern European Countries, which make of a vital part of both European and global economy, is a matter of great importance.

Specifically, the issues being thoroughly developed are the following:

- Origins of Foreign Direct Investment in Croatia: Application of an Expanded Gravity Model
- Balkan Area and EU-15: An Empirical Investigation of Income Convergence
- The Economic Relations of Bosnia–Herzegovina and FYROM with the Other States that Emerged from the Breakup of Yugoslavia Considering the Ohrid and Dayton Agreements: The Phenomenon of Yugonostalgia in Trade and Economic Relations of Those Countries
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Book Review by Maria St. Karagianni, RSI Journal

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