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Measuring Regional Inequalities by Amenity Productivity Approach for Sustainable Economic and Environmental Policies in European Union

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ABSTRACT

This paper classifies the European Union (EU) member countries on an amenity-productivity map based on environmental quality and income differentials. This classification is useful because it provides information about the relative attractiveness to consumers and producers of the total bundle of such attributes indigenous to each region environmental and other. It also assists European policy makers to formulate the best suited regional and environmental policies in the EU. Our findings suggest that the notion of sustainable development is best suited for low productivity countries such as Greece, Portugal, Spain, Ireland, and Italy.

Keywords: Environmental Quality and Income Inequalities, Environmental Policy, Isocost, Isoutilty, Regional Policy, Amenities, Productivity

JEL Classifications: Q5, Q50, R11, R58, Q56

1. INTRODUCTION

The European Union (EU) has a core containing a high concentration of economic development, modern infrastructure, and advanced social indicators as the “golden triangle.” All the attributes of post-industrial life are concentrated in the core. The periphery contains the regions traditionally designed as underdeveloped, which have been outside the main strands of European development. Regions in the periphery remain locked in the rural life styles of another age. It is also recognized that some regions are chronically poor not because of their location, but because of economic factors. Such regions had depended on one major economic activity, such as steel making or textiles. When the economic viability of the activity declined, the region lacked the resources necessary to diversify and fell into chronic recession.

By this paper, we do attempt to challenge the neo-classical view by offering an alternative explanation; in the presence of free mobility, consumer income differentials can persist because some factors are inherently immobile, e.g., the environmental and climatic characteristics that are unique to a region. It is possible that

several regions share the same site-specific characteristics, but it is unlikely that their distribution will be exactly the same. Economic agents would be willing to pay or accept different level of incomes depending on the value they place on these characteristics. For example, a transportation company may find that its location in a region with good airport(s), port(s), and intra- and intercity transport system saves time and reduces its production costs. This implies that this particular firm can offer relatively higher incomes to its employees and still remain competitive with other transportation companies located in lower-income regions since the characteristics of the transport system of the region is offering it a cost advantage. Since office space and other facilities in the area are limited, the companies attracted by the transport system of the region will increase the demand for both labor and office space. These increases in the prices of labor and office space will continue until in equilibrium they have completely offset the cost advantage of the transport system of the region.

The purpose of this paper is to identify EU countries according to the extent they are dominated by supply and demand responses to their net bundle of country-specific attributes. The countries are then

classified into four groups based on the relative values of a country's per capita income and environmental quality (EQ). These are then identified as high amenity (low consumer income, high EQ), low amenity (high consumer income, low EQ), high productivity (high consumer income, high EQ), and low productivity (low consumer income, low EQ). The usefulness of this classification is two-fold: First, it provides information about the relative attractiveness to consumers and companies of the total bundle of environmental and other attributes indigenous to each country of the EU. Second, it assists European policy makers to formulate the best suited regional and environmental policies in the EU. High amenity countries or regions, for example, require regional policy measures so as to increase their income. Similarly, low amenity countries or regions require environmental policy measures so as to increase their quality of life. Finally, in low productivity and low amenity areas both policies, regional and environmental, are important for increasing the consumer's income and his/her EQ of life.

This paper reviews regional and environmental policies of the EU, providing a theoretical framework to determine the importance of amenity and productivity differences as sources of income and EQ inequalities across countries in the EU. Regional and environment policies represent two of the most important policies of the EU. Unlike regional policy, environmental policy is a more recent policy of the EU. When the Treaty of Rome was written in 1956-57, its authors saw no need to provide a common policy on the environment because they did not perceive any common threat. It was not until October 1972 that a conference of heads of state or government insisted that a common policy was needed, and since then more than 200 items of union legislation on the environment have been enacted. These are the products of action programmes which the Council of Ministers has been endorsing since 1973.

In 1975 the European Community established the European Regional Development Fund (ERDF). The ERDF is one of the key structural funds. Its commitments for 1996 were more than ECU 11.8 billion. Although the ERDF was created in 1975, in the wake of the accession of Britain, Ireland and Denmark, it is the development of the single market which has been the catalyst for strengthening union solidarity with poorer regions at risk of being left further behind. That is why the Single European Act of 1986 introduced a new Title V into the Treaty of Rome called "Economic and Social Cohesion." When the Maastricht Treaty on EU laid the basis for establishing an Economic and Monetary Union (EMU) by 1999 (at the latest), it was also decided to address the risk that EMU could worsen regional inequalities. The treaty's requirement that budget deficits be limited to a maximum of 3% of gross domestic product (GDP) also limits the possibilities of poorer states increasing investments to catch up with their richer partners. In response, therefore, the treaty established a new cohesion fund to channel financial assistance to the four poorest states with a per capita GDP of <90% of the union's average. Eligible projects have to be in the fields of the environment and trans-European networks.

2. LITERATURE REVIEW

Various studies have investigated the existence of consumer income inequalities among regions or countries. The irrefutable

conclusion is that they exist and persist for long periods of time (Bellante, 1979; Johnson, 1983). Researchers dealing with regional policy in the EU generally assume that income inequalities are caused by geographical and economic variables (Eberts and Stone, 1986). The concepts of core and periphery have been the most influential geographical explanation of EU regional inequalities. The idea is that regions distant from the core of activity in a country fail to develop equally with areas closer to the core. Ott (1978) considered that within a framework in which regions and factors are identical and all economic agents are free to move, neo-classical analysis supports the view that the output (and income) of different regions should tend to converge over time towards a steady state. This view, however, has been challenged by a number of new growth models (Solow, 1970). These new growth models assume non-convexity in production or externality arising from the accumulation of human capital. In these models, regional outputs per head can actually diverge (van der Ploeg and Tang, 1980). From a growth-oriented view, environmental protection measures are perceived as constraints to economic development. Growth is also seen by environmentalists as creating adverse ecological consequences that originate from expansions of industrial activity (Booth 1998). Researchers point out that in the long run, the economic potential of future production factors will increasingly depend on the state of environmental conditions (Daly 1991 and Hope 1991). Pearce, D et al. (1991) found that this can be clearly depicted by effects that accumulated pollution levels are known to have on human health and land productivity.

Similarly, for their own reasons consumers put their own value on a region. Consumers consider the overall EQ of a region when they make a decision concerning the place they will live in; where the EQ is defined to include all aspects of their environment (natural and non-natural) (Romer 1998 and Tietenberg 1994). Consumers are assumed to consider the distribution of the characteristics of the natural environment and of all regional amenities, including cultural, public services, transport, and other opportunities. The region, for example, with the good transport system that offered a cost advantage to some firms may be attractive to consumers because of reduced travel time to work (Hope and Parker 1995). Consequently, as more consumers move into the area, the supply of labor increases as well as the demand for housing. Thus rents increase and wages fall until individuals are in equilibrium no longer willing to accept moving to a region with a better transport system and a better overall EQ as compensation for lower wages and higher rents (Galbraith 1958).

The final income differentials between a geographical area with a good transport system and one without depends upon the relative size of the demand and supply responses to site characteristics. If incomes are observed to be higher in the good transport system area than in the other, then the firm's response dominates the rent determination process (Krugman and Venesables 1990). If incomes are relatively lower in the good transport system area, then the consumer's response dominates the process. In both cases rents will be higher because both households and firms value a good transport system. Rents would be lower than in otherwise comparable geographical areas if the regional transport system was not important to both parties. Incomes and rents will vary across

regions according to the value companies place on the region-specific attributes in each region and their ability to substitute between factors of production (World Resources, 1992-93). Consequently, by observing relative consumer incomes and rents, or by observing other variables having a monotonic relationship with them, it is possible to identify whether a region's bundle of environmental and other characteristics has a greater net effect on company location decisions or consumer location decisions (World Bank 1992).

Due to these interrelationships, development and environment should be brought together into the same conceptual framework from which mutual beneficial objectives may be achieved. Sustainable development is the notion which entails this conceptual framework. Sustainability is defined as maintaining continuity of economic and social developments while respecting the environment and without jeopardizing future use of natural resources (Thomas and Belt 1997).

Gould et al. (1988) declares that the ideas and theories of sustainable development have been examined and discussed by a number of important commission policy documents. Regional policy aims at reducing variations in the economic performance of the different member states. In accordance with Human Development Report (1993) the preamble of the Treaty of Rome calls for a reduction "of the differences existing between the various regions and the backwardness of the less favored regions," while Article 2 refers to the goal of harmonious development of economic activities, a continuous and balanced expansion. Sustainable development was made the centerpiece of the EU's Fifth Environmental Action Programme in alignment with the commitments made at the 1992 UNCED at Rio. In the last chapter of the GCE White paper (CL 1993) the basis for a new development model was explored which focused on the objectives of sustainability. Integrating environmental policy into regional policy field is essential if sustainable development is to succeed. In recognition of the more holistic approach that this intimates, Article 139-r of the Maastricht Treaty states the need for all areas of EU policy to make environmental objectives an integral part of any future strategies. Finally, in a recent paper it is argued that environmental protection is easier to achieve with economic growth than without it (Hope and Parker, 1990). In more details, the paper showed that since 1970 OECD Europe's growth rate had risen by 80% and lead emissions had fallen by 50%.

On the empirical basis, Mishan (1967), Nordhaus and Tobin (1972), Easterlin (1973) and King (1974) attempted to provide measures of the reduction in economic welfare due to the negative effects of economic development on environment. Walters (1975) has supplied improved measures of these diseconomies and Griffin (1974) and Baumol and Oates (1971) have attempted to devise relevant methods of control and to estimate their costs. List and Kuncze (2000) found that state environmental regulations adversely affect job growth in three of the four industries analyzed. Forrester (1971) and Meadows et al. (1972) argued that the finite nature of world resources limits the growth of gross world product and suggest policies aimed at achieving zero growth rate.

Grossman and Krueger (1995) found no evidence that EQ deteriorates steadily with economic growth. Their study revealed that environmental degradation and income have an inverted U-shaped relationship (sometimes called Kuznets curve), with pollution increasing with income at low levels of income and decreasing with income at high levels of income. Shafik (1994) also found that most societies choose to adopt policies and to make investments that reduce environmental damage associated with growth. Action tends to be taken where there are generalized local costs and substantial private and social benefits. Ekins (1997) on the other hand supports that the evidence for a Kuznets curve is inconclusive, and cannot be generalized across EQ as a whole.

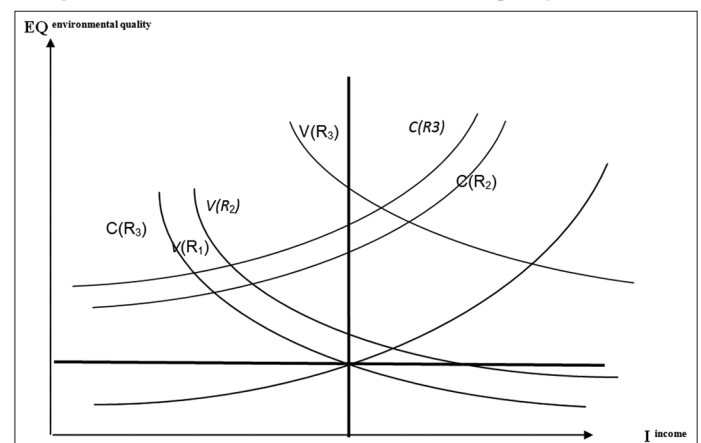
Finally, Hart (2002) and Glover (1999) support neither the "optimist" (i.e., that increased scarcity of environmental goods will induce adequate conservation responses) nor the "pessimist" view (that these responses will be insufficient without measures to scale of the global economy). Hart (2002) uses a Schumpeterian growth model and cultural theory to interpret these competing positions within a single unifying framework. Glover (1999) looks at the causes of environmental degradation, examines the policy approaches implicit in both camps and suggests an approach that draws elements from both.

3. DATA AND ESTIMATION TECHNIQUES

3.1. Theoretical Framework for Evaluating Economic and Environmental Situation

In this section a theoretical framework is presented and then used to determine the relative importance of amenity and productivity differences as sources of income differentials across countries in the EU. This framework assumes that regions or countries are fully described by a bundle of environmental and other attributes. These specify the EQ index of a country or region, EQ, which includes all aspects of natural and non-natural environment of a consumer's life. EQ affects the utility of consumers, $U(\cdot)$, and the production (where the production technologies are assumed to exhibit constant returns to scale) cost of firms, $C(\cdot)$. Our framework is illustrated in Figure 1. The downward sloping curves in Figure 1, labeled $V(R)$, show combinations of income (the income of a consumer is assumed to be determined by a hedonic wage equation which depends among others (e.g., personal characteristics, education,

Figure 1: Correlations between environmental quality and income



experience, etc.) on EQ.), I, and EQ, EQ, for which utility is equal to v , where v is the maximum utility that a consumer can enjoy at all sites within a country in equilibrium, so that there is no incentive for any relocation, and R is a vector of implicit prices of housing characteristics (for example. $R = (R_1, R_2, R_3)$) is the vector of implicit prices for the vector of housing characteristics $h = (h_1, h_2, h_3)$, so that the rental price P , of a house that is described by the vector of characteristics (h_1, h_2, h_3) is $P = R h'$ where h' is the transpose of h .

The slope of these curves is the trade-off that households are willing to make between wage income and EQ for any given level of implicit prices for housing characteristics (R) and the given utility level v . Along each curve, the implicit prices of housing characteristics is fixed and the curves shift up (down) as the implicit prices of the housing characteristics increase (decrease). Combinations of EQ and I for which the unit costs of firms are equal are also depicted in Figure 1 and given by the curves $C(R)$. The value of the environmental characteristics of a region to firms is fixed along each iso-cost curve, $C(R)$, and the curves shift up (down) as the environmental characteristics of a region increase (decrease) the productivity of firms and the implicit prices, R , of the real estate market. Each region is characterized by an EQ index and a vector of implicit rental prices that are associated with a specific pair of iso-cost and iso-utility curves as in Figure 1.

The intersection of any two curves for each region at the level of its EQ then determines the relative income and the implicit prices of the real estate market in equilibrium. In Figure 1, in region 1, where EQ equals EQ_1 , the equilibrium income will be I_1 and the equilibrium implicit rental prices R_1 . Using region 1 as a reference point, which could be thought as the average region, we can see in the following how interregional inequalities in EQ will be reflected in inequalities in incomes and implicit rental prices.

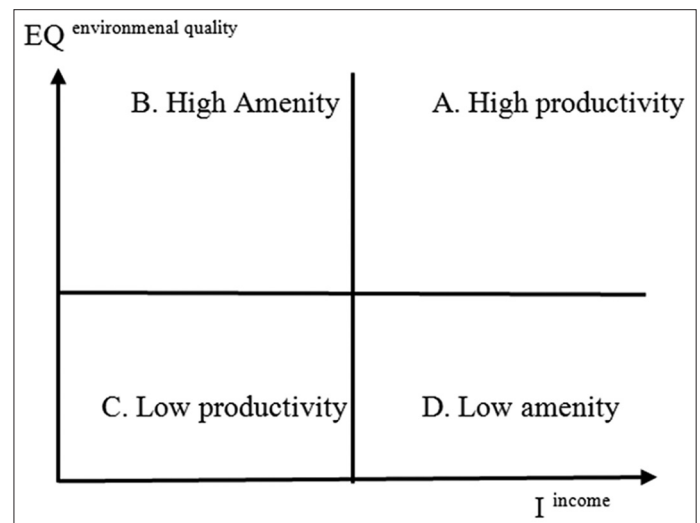
From the above analysis, it can be seen that: (i) When EQ is valued more by consumers, ceteris paribus, $C(R_2)$ and $V(R_2)$ have both been moved up and $C(R_2)$ has moved up relatively more, and (ii) when EQ is valued more by firms, ceteris paribus, $C(R_3)$ and $V(R_3)$ have both moved up and $V(R_3)$ has moved up relatively more. Within this simple framework in which regions differ only in their EQ, we can determine whether EQ and income inequalities reflect interregional inequalities in amenities or productivity by examining the patterns of EQ and incomes across regions. If EQ and income inequalities primarily reflect amenity differences across regions, we would see a negative relationship between EQ and incomes. If they reflect productivity differences, the relationship would be positive. Within the same framework, we can also classify individual regions on the basis of whether their incomes and EQ differ from the average because of above average amenities, below average amenities, above average productivity, or below average productivity. These classifications are summarized in Table 1 and Figure 2. EQ is higher than the average in the high amenity and high productivity regions, and lower than the average in the low amenity and low productivity ones. On the other hand, incomes are relatively higher in the high productivity and low amenity regions.

Table 1: Classification of the EU countries in respect to the EQ and R (EQ)

Country	EQ	R(EQ)
Austria	55.51845	5
Belgium	50.09458	9
Denmark	55.60092	4
Finland	61.62236	2
France	51.1665	8
Germany	60.9489	3
Greece	42.94626	15
Ireland	49.98765	10
Italy	47.98761	11
Luxemburg	44.90285	14
Netherland	54.02812	6
Portugal	45.84456	13
Spain	46.75081	12
Sweden	74.47721	1
UK	53.6395	7

EU: European Union

Figure 2: Amenity-productivity classification



Using the computational approach employed to obtain the above EQ indices, EQ, we can compute another EQ index for each country, EQ', that includes only aspects of the natural environment, that is, only the scaled values of the variables Y_{1j} , Y_{19j} . The EQ' values are given in Table 2. Table 2 also gives EQ* for each country, where $EQ^* = [(EQ'/EQ)-1]$. For countries for which $EQ^* > 0$, its position on the amenity-productivity mapping is based more on the Y_{1j} , Y_{19j} values, that is, on the characteristics of the natural environment of the country, than on the other aspects of its environment. These are Austria, Finland, France, Germany, Ireland, Portugal, and Sweden.

Rankings of the countries might be based on the EQ, EQ', and per capita income relations. The EQ and EQ' rankings are different and the $R_{EQ} - R_{EQ'}$ differences are significant for countries like Portugal, Denmark, and Ireland, where R_i is a ranking based on i , $i = EQ, EQ', I$. In case of such ranking we can obtain the sum of the absolute values of the differences: $\Sigma_1 = 30$, $\Sigma_2 = 36$, $\Sigma_3 = 54$, where Σ_1 is the sum of the absolute values of the $R_{EQ} - R_{EQ'}$ differences and Σ_2 is the sum of the absolute values of the $R_{EQ} - R_I$ differences, and Σ_3 is the sum of the absolute values of the $R_{EQ'} - R_I$ differences.

These imply that overall the differences among the EQ' and per capita income rankings are greater than the others since $\Sigma_1 > \Sigma_2$ and $\Sigma_3 > \Sigma_1$. The ranking is shown in Table 3.

Each region is characterized by an EQ index, EQ, whose effect on household utility and production costs differs from region to region. The problem of classifying regions by the relative magnitude of these two effects becomes one of identifying the EQ and income inequalities in equilibrium relative to the shifts in each curve. This can be done by identifying the combinations of EQ and I in equilibrium that are associated with equal shifts of both curves and determining how incomes and EQ change relative to these shifts. The (EQ,I) equilibrium combinations associated with equal shifts of both curves would coincide with the $E Q_1 O$ and $I_1 O'$ lines in Figure 1, where EQ_1 is the mean EQ and h is the mean income.

From the Figure 1, it can be seen that: (i) when EQ is valued more by consumers, ceteris paribus, $C(R_2)$ and $V(R_2)$ have both been moved up and $C(R_2)$ has moved up relatively more, and (ii) when EQ is valued more by firms, ceteris paribus, $C(R_3)$ and $V(R_3)$ have both moved up and $V(R_3)$ has moved up relatively more.

Table 2: Ranking of the EU countries

Country	Percentage of country eligible for funding	Ranking based on [1]	Sum of QOL and [1] based ranking
Austria	40.6	10	15
Belgium	31.3	12	21
Denmark	15.8	15	19
Finland	53.6	6	8
France	47.6	7	15
Germany	39.1	11	14
Greece	100	1	16
Ireland	100	1	11
Italy	55.8	5	16
Luxemburg	42	8	22
Netherland	24.15	14	20
Portugal	100	1	14
Spain	82.9	4	16
Sweden	24.6	13	14
UK	41.9	9	16

EU: European Union

Table 3: Ranking of the countries based on per capita income and EQ index

Country	I*	EQ
Luxembourg	100	45.7
Denmark	68.18	58.2
Sweden	51.62	78.1
Austria	45.45	55.2
Finland	45.13	65.6
Germany	45.13	61.2
Netherlands	44.48	51.3
Belgium	43.18	48.5
UK	42.86	53
France	40.91	55.1
Ireland	37.01	50.1
Italy	29.09	53.1
Spain	12.34	48.4
Greece	2.27	43.2
Portugal	0	46.8

EQ: Environmental quality

For any region with above average incomes and EQ, the shift of the $C(R)$ (productivity) curve must be less than the shift of the $V(R)$ (amenity curve). The less the direct effect of EQ on utility, the greater the increase in consumer income needed to offset the increase in rents and, consequently, the greater the shift of the $V(R)$ curve needed to keep the maximum utility level unchanged and equal to v in equilibrium. Therefore, any region with EQ and income combinations in quadrant A in Figure 2 is classified as "high productivity" region, because the primary reason that this region's incomes, EQ, and rents differ from those of the average region is the above-average productivity effects of EQ. This above-average productivity effect is reflected in the ability of producers in these regions to pay above average incomes and rents for having at their disposal a greater than the average EQ.

Above average amenity effects of a region are associated with increases in rents and decreases in incomes reflecting consumers' willingness to pay relatively more for the effects of the regional characteristics embodied in the region's EQ. Quadrant D then identifies regions where the EQ is greater than the average and the dominant factor determining relative incomes and rents is the high amenity effect. For regions in quadrant B, the dominant factor is their below-average amenity value.

Similarly regions with below average incomes and EQ (quadrant C in Figure 2) are classified as "low productivity" regions, since firms in these regions are compensated for the below average EQ effect on productivity with below-average rental prices and income. Above average amenity effects of a region are associated with increases in rents and decreases in incomes reflecting consumers' willingness to pay relatively more for the effects of the regional characteristics embodied in the region's EQ.

3.2. Data

The countries studied in this paper are United Kingdom, Sweden, Finland, Germany, Denmark, Austria, and Netherlands are high-productivity, Belgium, France, Luxemburg Italy, Ireland, Spain, Portugal, Greece. Regions (countries) were selected based on data availability. The implications of the above theoretical analysis can be used for a classification of the countries within EU. To compute the EQ, EQ, for each country, the following variables of the natural and non-natural environment of a country were available and considered:

$Y_{1,j}$: Emissions of traditional air pollutants in kg per 1000 people,

$Y_{2,j}$: Annual internal renewable water resources per capita,

$Y_{3,j}$: Wilderness area as a % of total land area,

$Y_{4,j}$: % of national land area protected for wildlife and habitat,

$Y_{5,j}$: Number of threatened mammals per 10,000 km²,

$Y_{6,j}$: Number of threatened birds per 10,000 km²,

$Y_{7,j}$: Number of threatened reptiles per 10,000 km²,

$Y_{8,j}$: Number of threatened amphibians per 10,000 km²,

$Y_{9,j}$: Endemic flora as a % of total,

$Y_{10,j}$: Number of botanical gardens,

$Y_{11,j}$: Forest area as a % of land area,

$Y_{12,j}$: Average annual reforestation,

$Y_{13,j}$: Municipal waste generation per capita,

- $Y_{14,j}$: Industrial waste per unit of GDP (tons per million US\$),
- $Y_{15,j}$: Hazardous and special waste generation (metric tons per km²),
- $Y_{16,j}$: Waste paper recycled as % of paper consumption,
- $Y_{17,j}$: Average annual fertilizer use (kg/ha of cropland),
- $Y_{18,j}$: Average annual pesticide use (metric tons of active ingredient),
- $Y_{19,j}$: Per capita carbon dioxide emissions,
- $Y_{20,j}$: Daily travel time to and from work,
- $Y_{21,j}$: Urban population as a % of total,
- $Y_{22,j}$: Population density (per 1000 ha),
- $Y_{23,j}$: Life expectancy at birth (years),
- $Y_{24,j}$: Adult literacy rate,
- $Y_{25,j}$: Mean years of schooling (25+),
- $Y_{26,j}$: Population per doctor,
- $Y_{27,j}$: Maternal mortality rate,
- $Y_{28,j}$: Daily newspaper circulation per 1000 people,
- $Y_{29,j}$: Television per 1000 people,
- $Y_{30,j}$: Telephones per 1000 people,
- $Y_{31,j}$: Passenger cars per 1000 people,
- $Y_{32,j}$: Deaths from road accidents per 100,000 people,
- $Y_{33,j}$: Suicides per 100,000 people,

3.3. Computation of Indices and Identification of Environmental and Economic Policies Priorities for the EU

An EQ index that takes into consideration all aspects of the natural and non-natural environment of a consumer's life could be taken to be equal to the mean of these variables. However, a mean cannot be computed directly, because of differences in the units of measurement of the above variables. Therefore, these variables need to be scaled before a mean is computed. To be more specific, the above variables for each country are scaled from 0 to 100 using the following transformations:

$$y_{ij}^* = 100 (Y_{ij} - Y_{ijmin}) / (Y_{ijmax} - Y_{ijmin}) \quad (1)$$

Where, y is the transformed variable, Y_{ijmin} is the minimum value of Y_{ij} , and Y_{ijmax} is the maximum value, for $i = 2, 3, 4, 10, 11, 12,$

$16, 22, 23, 25, 28, 29, 30, 31,$ that is, for all variables having a positive relationship with EQ, and all j , an:

$$y_{ij}^* = [100 (Y_{ij} - Y_{ijmin}) / (Y_{ijmax} - Y_{ijmin})] \quad (2)$$

Where, y_{ij} is the transformed variable, Y_{ijmin} is the minimum value of Y_{ij} in the sample of countries and Y_{ijmax} is the maximum value, $i = 1, 5, 6, 7, 8, 9, 13, 14, 15, 17, 18, 19, 20, 21, 24, 26, 27, 32, 33,$ that is, for all variables having a negative relationship with EQ, and all j . Finally, to compute the EQ for each country we have (i) used data from the World Resources 1992-1993 and the Human Development 1993, the World Commission on Environment and Development (WCED) 1987 and (ii) taken the mean of the scaled variables y_{ij}^* .

The per capita income, I , of each country is also scaled from 0 to 100 using the following transformation:

$$I_j^* = 100 (I_j - I_{jmin}) / (I_{jmax} - I_{jmin}) \quad (3)$$

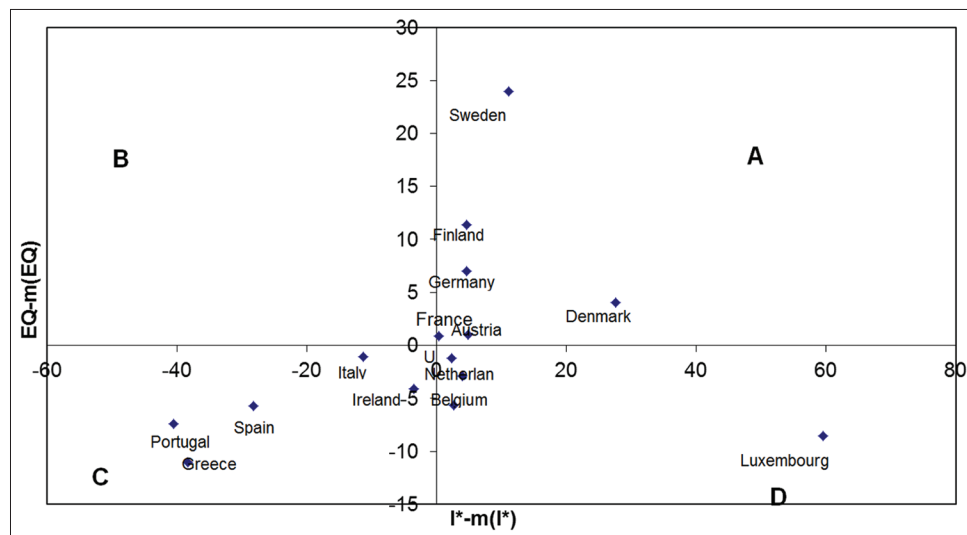
Where, I_j^* is the transformed index, I_{jmin} is the minimum index value in the sample of countries and I_{jmax} is the maximum value, and $j = 1, 2, 3, \dots, m$.

The EQ and per capita income combinations, (EQ, I^*) , for Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom are given in Table 4 (missing values for a Y_{ij} variable have been replaced by the mean of the existing ones). These missing values were for Luxembourg: $Y_1, Y_{11}, Y_{12}, Y_{14}, Y_{16}, Y_{17}, Y_{18}, Y_{30}$. Denmark: Y_{12} . Greece: Y_{15}, Y_{17} . Germany: Y_{32} . Belgium: Y_{33} . Ireland: Y_1, Y_{16} . Table 4 and the results of our theoretical analysis imply the positioning mapping of Figure 3, where $m(EQ)$ and $m(I^*)$ are the means of EQ and I^* , respectively. This identifies four groups of countries, namely, the high-productivity ones: Sweden, Finland, Germany, Denmark, Austria, and Netherlands, the low-productivity ones: Italy, Ireland, Spain, Portugal, and Greece, the low-amenity ones: France, Belgium, and Luxembourg, and United Kingdom which is the only country being characterized as high-amenity.

Table 4: Ranking of the EU countries for the funding purposes

Country	EU regional development funding [1]	Population [2]	[1]/[2]	Ranking based on [1]/[2]	Sum of QOL and [1]/[2] based ranking
Austria	1574	7.7	204.42	12	17
Belgium	2096	10	209.60	11	20
Denmark	843	5.1	165.29	14	18
Finland	1652	5	330.40	6	8
France	14,938	57	262.07	8	16
Germany	21,724	79.9	271.89	7	10
Greece	15,131	10.2	1483.43	3	18
Ireland	6103	3.5	1743.71	1	11
Italy	21,646	57.7	375.15	5	16
Luxembourg	104	0.4	260.00	9	23
Netherlands	2615	15	174.33	13	19
Portugal	15,038	9.9	1518.99	2	15
Spain	34,443	39	883.15	4	16
Sweden	1377	8.6	160.12	15	16
UK	13,155	57.6	228.39	10	17

QOL: Quality of life, EU: European Union

Figure 3: Per capita income and environmental quality

4. CONCLUDING REMARKS

Our findings suggest that the notion of sustainable development is best suited in the low productivity group of countries. As mentioned before, this group includes Greece, Portugal, Spain, Ireland and Italy. Sustainable development brings together amenity and productivity into the same conceptual framework from which mutually beneficial objectives may be achieved. In the low amenity group, which includes France, Belgium and Luxembourg, emphasis should be given to environmental measures, since this group is characterized by its high income and low EQ. Finally, in the case of the UK, emphasis should be given to regional policy, since the country is characterized by low income and high EQ.

This paper identified EU countries according to the extent they are dominated by supply and demand responses to their net bundle of country-specific attributes. This kind of classification is useful because it provides information about the relative attractiveness to consumers and producers of the total bundle of environmental and other attributes indigenous to each region. A theoretical framework is used to position the European Union member countries on an amenity-productivity map. The analysis shows that United Kingdom is the only country that can be characterized as high-amenity.

Among the rest, Sweden, Finland, Germany, Denmark, Austria, and Netherlands are high-productivity, Belgium, France and Luxemburg are low-amenity and all the rest (Italy, Ireland, Spain, Portugal, Greece) are low-productivity. A ranking of the European Union countries based on the EQ (incorporating either all aspects of the environment or only those relevant to the natural environment) show that Greece and Luxembourg are at the bottom of the ranking and Sweden, and Finland on the top.

Our findings suggest that the notion of sustainable development is best suited for productivity group of countries. As mentioned before, this group includes Greece, Portugal, Spain, Ireland and Italy. Sustainable development maintains continuity of economic and social developments while respecting the environment without

jeopardizing future use of natural resources. The EU development funding was taken keeping into consideration total 1994-1999 EU funding allocated to member states for regional development; millions of ECU. Population is assumed to be millions of people.

In this paper we offered a method for evaluating the economic and environmental situation in the EU. A theoretical framework was used to position EU member states on an EQ-income map. The method can assist environmental and regional policy makers in formulating the best suited policies for growth and the environment in the EU. The analysis showed that the Scandinavian countries plus some other Northern European countries are characterized by high values of income and EQ. Among the rest, the Benelux countries plus the UK have attained high incomes and low values of EQ. Finally, the European South plus Ireland are characterized by low values of income and EQ. Our findings suggest that the notion of sustainable development is best suited for the countries of the European periphery low productivity group of countries. Sustainable development maintains continuity of economic and social developments while respecting the environment without jeopardizing future use of natural resources. The old notion of "growth versus environment" has given way to a new view in which economic development and environmentally sustainable practices go hand in hand. Better environmental stewardship is essential to sustain development. And only with faster economic growth in poor countries can environmental policies succeed.

REFERENCES

- Baumol, W.J., Oates, W.E. (1975), *The Theory of Environmental Policy: Externalities, Public Outlays and the Quality of Life*. Englewood Cliffs, NJ: Prentice-Hall.
- Bellante, D. (1979), The North-South differential and the migration of heterogeneous labour. *American Economic Review*, 69(1), 166-175.
- Blomquist, G., Berger, M., Hohen, J. (1988), New estimates of quality of life in Urban areas. *American Economic Review*, 78(1), 89-107.
- Blomquist, G., Berger, M., Waldner, W. (1985), *Quality of Life: Ranking Urban Areas Using a Wage and Rent Based Index*. University of

- Kentucky, Department of Economics, Working Papers, No. E-85.
- Booth, D. (1998), *The Environmental Consequences of Growth*. London: Routledge.
- Commission of the European Communities (CEC). (1992), *A Community Programme of Policy and Action in Relation to the Environment and Sustainable Development (The Fifth Action Programme)*, COM(92) 23 Final, Brussels.
- Commission of the European Communities (CEC). (1993), *Growth, Competitiveness and Employment: The Challenges and Ways Forward into the 21st Century*, White Paper. Luxembourg: Official Publications for the EC.
- Commission of the European Communities (CEC). (1994), *Economic Growth and the Environment: Some Implications for Economic Policy Making*, COM (94) 465 Final, Brussels.
- Daly, H.E. (1991), *Steady State Economics*. 2nd ed. Washington, DC: Island Press.
- Easterlin, R.A. (1973), Does money buy happiness? *The Public Interest*, 30, 3-11.
- Eberts, R., Stone, J. (1986), Metropolitan wage differentials: Can Cleveland still compete? *Federal Reserve Bank of Cleveland*, 2, 2-8.
- Ekins, P. (1997), The Kuznets curve for the environment and economic growth: Examining the evidence. *Environment and Planning A*, 29, 805-830.
- European Omnibus Survey. (1988), *Les Européens et Environnement en 1988*.
- Forrester, J.W. (1971), *World Dynamics*. Cambridge, Mass: Wright-Allen.
- Galbraith, J.K. (1958), *The Affluent Society*. Boston: Houghton Mifflin.
- Glover, D. (1999), Economic growth and the environment. *Canadian Journal of Development Studies*, 20(3), 609-623.
- Gould, L., Gardner, G., DeLuca, D., Tiemann, A., Doob, L., Stolwijk, J. (1988), *Perceptions of Technological Risks and Benefits*. New York: Russell Sage Foundation.
- Griffin, J. (1974), An econometric evaluation of sulfur taxes. *Journal of Political Economy*, 82(4), 669-688.
- Grossman, G.M., Krueger, A.B. (1993), Environmental impacts of a North-American free trade agreement. In: Garder, P.M., editor. *The Mexico-US Free Trade Agreement*. Cambridge, Mass: MIT Press.
- Hammer, J., Shetty, S. (1995), *East Asia's Environment*, World Bank Discussion Paper No. 287, Washington, DC.
- Hart, R. (2002), Growth, environment, and culture-encompassing competing ideologies in one new growth model. *Ecological Economics*, 40(2), 253-267.
- Hope, C., Parker, J. (1990), Environmental indices for all - The need for a monthly index. *Energy Policy*, 18(4), 312-319.
- Hope, C., Parker, J., Peake, S. (1991), A pilot index for the UK - Results of the last decade. *Statistical Journal of the UN, Economic Commission for Europe*, 8(1), 85-107.
- Hope, C., Parker, J. (1995), Environmental indices for France, Italy, and the UK. *European Environment*, 5(1), 13-19.
- Hope, C., Parker, J., Peake, S. (1992), A pilot environmental index for the UK in the 80s. *Energy Policy*, 20(4), 335-343.
- Human Development Report. (1993), Published for the United Nations Development Programme.
- Human Development Report. (1993), UK: Oxford University Press.
- Johnson, G. (1983), Inter-metropolitan wage differentials in the United States. In: Triplett, J.E., editor. *The Measurement of Labour Cost*. Chicago: University of Chicago Press.
- King, M.A. (1974), Economic growth and social development - A statistical investigation. *Review of Income and Wealth Series*, 20(3), 251-272.
- Krugman, P., Venesables, A. (1990), An integration and the competitiveness of peripheral industry. In Bliss, C., De Macedo, J.B., editors. *Unity with Diversity in the European Economy: The community's Southern Frontier*. Cambridge: Cambridge University Press. p56-75.
- Meadows, D.H., Meadows, D.L., Randers, J., Behrens, W.W., IIIrd. (1972), *The Limits to Growth. A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.
- Mishan, E.J. (1972), *The Cost of Economic Growth*. London: Staple Press.
- Nordhaus, W.D., Tobin, J. (1972), Is Growth Obsolete? In NBER 50th Anniversary Colloquium. Vol. 5. New York: Economic Growth.
- Ott, W.R. (1978), *Environmental Indices: Theory and Practice*. Michigan, USA: Ann Arbor.
- Pearce, D., Turner, R., Brown, D., Baternan, I. (1991), *The development of environmental indicators. Report to the DOE*. London: University College.
- Romer, P.M. (1998), Increasing returns and long run growth. *Journal of Political Economy*, 98, 71-102.
- Solow, R.M. (1970), A contribution to the theory of growth. *Quarterly Journal of Economics*, 70, 65-94.
- Thomas, V., Belt, T. (1997), Growth and the environment: Allies or foes? *Finance and Development*, 34(3), 222-224.
- Tietenberg, T. (1994), *Environmental Economics and Policy*. New York: Harper Collins.
- van der Ploeg, F., Tang, P. (1980), The macroeconomics of growth: An international perspective. *Oxford Review of Economic Policy*, 8(4), 15-28.
- Walters, A.A. (1975), *Noise and Prices*. London: Oxford University Press.
- World Bank. (1992), *Development and the Environment*. Washington, DC: World Bank.
- World Commission on Environment and Development (WCED). (1987), *Our Common Future*, Oxford: University Press.
- World Resources 1992-93. (1992), *A Guide to the Global Environment*. Oxford: Towards Sustainable Development, Oxford University Press.