Managing Economic Growth by the Improvement of Environmental Quality: The Case of European Union

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Abstract

One of the most debatable issues in behavioral studies is the relationship between economic growth and the environment. From the policy point of view, what is important is the formulation of the best-suited policies for both growth and the environment. But the implementation of regional and environmental policies requires the existence of methods for evaluating the economic and environmental situation in each country. This paper offers such a method and applies it in the case of EU member-states by positioning them in an Environmental Quality-Income map. Our findings suggest that the notion of sustainable development is best suited for countries characterized by below average Environmental Quality and Income. 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.

Keywords: *growth; environment; EU.*

1. Introduction

One of the most debatable issues in Economics is the relationship between economic growth and the environment. According to conventional economic thinking, environmental problems exist because of the failure of the pricing system (Tietenberg, 1994). In a similar line of argument, it is supported that economic growth is necessary in order to provide resources to pay for environmental protection and reverse environmental deterioration (Grossman and Krueger, 1993). Market-determined prices fail to fully reflect the social cost of environmental damage caused by economic activity, and the solution to the environmental problem is to correct the price mechanism. This is to be done by internalizing the social costs of environmental damage. As a result, prices of products would fully reflect the social costs of using environmental resources and such use would be efficient (Booth, 1998).

A compelling idea, however, is that profit oriented economic agents will have a strong propensity to externalize instead of internalize environmental problems. According to a Schumpeterian view, the creation of new industries based on new technologies is fundamental to macroeconomic growth (World Bank, 1992). Growth is driven by qualitative change in the structure of the economy. Qualitative changes inevitably lead to changes in the natural environment. New industries invariably create new environmental problems by virtue of their inherent propensity to externalize environmental costs. Some researchers also build upon this view, invoking the entropy principle (Daly,1991). According to him, production is inherently entropic, converting high-quality low entropy matter and energy into high-entropy environmentally disruptive waste. From an environmental point of view, growth is seen as creating adverse ecological consequences that originate from expansions of industrial activity.

At the micro economic level, once the basic needs of the population have been met, further increases in GDP through the production of goods which consumers and governments have been made to want may not increase welfare in any meaningful sense: such production preempts public expenditure in amenities which would in fact be preferred by the population (Galbraith,1958).

On the empirical basis, there were attempts made to provide measures of the reduction in economic welfare due to the negative effects of economic development on environment (Mishan,1967; Nordhaus and Tobin, 1972; Easterlin, 1973 and King, 1974). 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. State environmental regulations adversely affect job growth in three of the four industries analyzed (List and Kunce, 2000). The finite nature of world resources limits the growth of gross world product and suggest policies aimed at achieving zero growth rate (Forrester, 1971 and Meadows et al., 1972).

In a World Bank paper it is argued that environmental protection is easier to achieve with economic growth than without it. In more details, the paper showed that since 1970 OECD Europe's growth rate had risen by 80 per cent and lead emissions had fallen by 50 per cent. The World Bank has long maintained that economic growth is good for people and good for the environment. Yet skepticism persists about whether this "win-win-win" scenario applies in all places at all times. In some case there are tradeoffs that clearly have to be considered: A new factory that brings higher incomes, for example, may also foul the air and water. In a similar line of argument there was no evidence found that environmental quality deteriorates steadily with economic growth (Grossman and Krueger, 1995). The series of studies 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. Most societies choose to adopt policies and to make investments that reduce environmental damage associated with growth (Shafik, 1994). Action tends to be taken where there are generalized local costs and substantial private and social benefits on the other hand supports that the evidence for a Kuznets curve is inconclusive, and cannot be generalized across environmental quality as a whole (Ekins,1997).

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.

However, from the policy point of view, what is important is the formulation of the best-suited policies for both growth and the environment. Regional policy aims at the increase in GDP per capita, whereas environmental policy aims at the improvement of the quality of the environment. Environmental and regional policies are equally important for the sustainable development in a region or country. Sustainability is here defined as maintaining continuity of economic and social developments while respecting the environment and without jeopardizing future use of natural resources. But the implementation of regional and environmental policies requires the existence of methods for evaluation the economic and environmental situation in each country. The purpose of this paper is to offer such a method and therefore to assist environmental and regional policy makers in formulating the best suited policies for growth and the environment.

We have chosen the EU case because both regional and environmental policies are equally important policies in a European context. In addition, the ideas and theories of sustainable development in Europe have been examined and discussed by a number of important Commission policy documents (CEC, 1992,1993,1994). Sustainable development was made the center piece 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 (CEC, 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 139r of the Maastricht Treaty stated the need for all areas of EU policy to make environmental objectives an integral part of any future strategies.

2. Methodology and data

2.1. Methodology for evaluating a region's economic growth and environmental quality

Our framework assumes that regions or countries are fully described by a bundle of environmental attributes. These specify the environmental quality index of a country or region, EQ, which includes all aspects of natural environment of a consumer's life. EQ affects the utility of consumers, U(.), and the production cost of firms, C(.), where the production technologies are assumed to exhibit constant returns to scale.

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 wood-processing company may find that its location in a region with many forests and woods reduces its production costs. This implies that this particular factory can offer relatively higher incomes to its employees and still remain competitive in relation to other wood-processing factories located in lower-income regions since the characteristics of the region is offering it a cost advantage. Since office space and other facilities in the area are limited, the wood-processing companies attracted by the rich in wood 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 forestry region. 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.

Similarly, for their own reasons consumers put their own value on a region. Consumers consider the overall environmental quality of a region when they make a decision concerning the place they will live in. They are assumed to consider the distribution of the characteristics of the natural environment. The region, for example, with many forests that offered a cost advantage to some firms producing furniture may be attractive to consumers because of high air-quality. 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 high air-quality region as compensation for lower wages and higher rents.

The final income differentials between a geographical area with many forests 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 forestry area than in the other, then the firm's response dominates the rent determination process. If incomes are relatively lower in the forestry area, then the consumer's response dominates the process. In both cases, rents will be higher because both households and firms value positively the existence of forests. Rents would be lower than in otherwise comparable geographical areas if forests were not important to both parties. 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 characteristics has a greater net effect on company location decisions or consumer location decisions.

Our framework is illustrated in Figure 1. The downward sloping curves in Figure 1, labeled V(R), show combinations of income, I, and environmental quality, 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. The income of a consumer is assumed to be determined by a hedonic wage equation, which depends among others (e.g., personal characteristics, education, experience, etc.) on environmental quality. The slope of these curves is the trade-off that households are willing to make between wage income and environmental quality 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

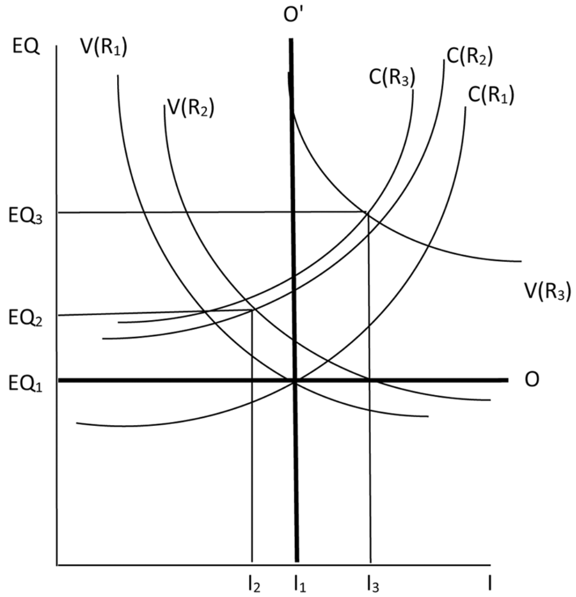

Figure 1. Combinations of income and environmental quality

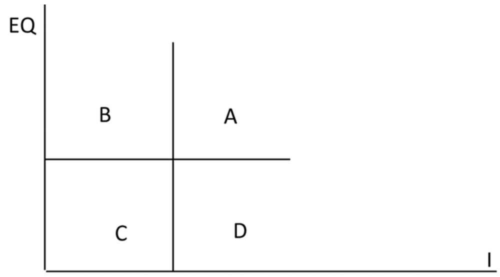

Figure 2. Quadrants for combinations of EQ and I

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 environmental quality 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 environmental quality then determines the relative income and the implicit prices of the real estate market in equilibrium. In Figure 1, in region 1, where environmental quality equals EQ1, the equilibrium income will be I1 and the equilibrium implicit rental prices R1. Using region 1 as a reference point, which could be thought as the average region, we can see in the following how interregional differences in environmental quality will be reflected in differences in incomes and implicit rental prices.

From the above analysis, it can be seen that: (i) when environmental quality is valued more by consumers, ceteris paribus, C(R2) and V(R2) have both been moved up and C(R2) has moved up relatively more, and (ii) when environmental quality is valued more by firms, ceteris paribus, C(R3) and V(R3) have both moved up and V(R3) has moved up relatively more.

Within this framework in which regions differ only in their environmental quality, we can determine whether environmental quality and income differences reflect interregional differences in consumer-attractiveness or firm-productivity by examining the patterns of environmental quality and incomes across regions. If environmental quality and income differences primarily reflect consumer-attractiveness differences across regions, we would see a negative relationship between environmental quality and incomes. If they reflect firm-productivity differences, the relationship would be positive.

Within the same framework, we can also classify individual areas on the basis of whether their incomes and environmental quality differ from the average. These classifications are summarized in Figure 2. Environmental quality is higher than the average in areas A and B and lower than the average in areas C and D. On the other hand, incomes are relatively higher than the average in areas A and D and lower than the average in areas B and C.

Each region is characterized by an environmental quality 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 environmental quality and income differences 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 environmental quality change relative to these shifts. The (EQ, I) equilibrium combinations associated with equal shifts of both curves would coincide with the EQ1O and I1O' lines in Figure 1, where EQ1 is the mean environmental quality and I1 is the mean income.

For any region with above average incomes and environmental quality, the shift of the C(R) (firm-productivity) curve must be less than the shift of the V(R) (consumer-attractiveness) curve. The less the direct effect of environmental quality 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, in quadrant A in Figure 2, the primary reason that this region's incomes, environmental quality and rents differ from those of the average region is the above-average firm-productivity effects of environmental quality. 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 environmental quality.

Similarly, regions in quadrant C firms are compensated for the below average environmental quality effect on productivity with below-average rental prices and income.

Above average environmental quality 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 environmental quality. Quadrant D then identifies regions where the environmental quality is greater than the average and the dominant factor determining relative incomes and rents is the consumer-attractiveness effect. For regions in quadrant B, the dominant factor is their below-average consumer-attractiveness value.

2.2. Data for the Environmental Quality-Income method in the EU case

The above theoretical framework can be applied in the case of EU member countries. To compute the environmental quality, EQ, for each EU member state, the following variables of the natural environment of a country were available and considered:

- $Y_{1,i}$: Emissions of traditional air pollutants in kgs. per 1,000 people
- $Y_{2,i}$: Fresh water recourses per capita
- $Y_{3,i}$: Annual internal renewable water resources per capita,
- $Y_{4,i}$: Wilderness area as a % of total land area,
- $Y_{5,i}$: % of national land area protected for wildlife and habitat,
- $Y_{6,i}$: Endemic flora as a % of total,
- $Y_{7,i}$: Number of botanical gardens,
- $Y_{8,i}$: Forest area as a % of land area,
- $Y_{9,i}$: Average annual deforestation,
- $Y_{10,i}$: Municipal waste generation per capita,
- $Y_{11,j}$: Industrial waste per unit of GDP (tons per million US$),
- $Y_{12,i}$: Hazardous and special waste generation (metric tons per km^2),
- $Y_{13,i}$: Waste paper recycled as % of paper consumption,

$Y_{14,i}$: Average annual fertilizer use (kgs per hectare of cropland),

$Y_{15,i}$: Average annual pesticide use (metric tons of active ingredient),

$$QOL = \frac{\sum_{k=1}^{N}(w_k a_{ki})}{\sum_{k=1}^{N}(w_{kj})} \quad \text{for } i=1,2,3,....,m$$

The environmental quality can be defined as follows: where a_{ki} is the kth environmental characteristic of region i, w_k is the weight for the characteristic k, N is the number of environmental and other characteristics considered, and m is the number of regions being examined. The weights w_i can be all equal to 1/N or be assigned a-theoretically using principal component or survey results. However, in all cases the weights should be the same across regions, that is, they should not be indexed by i.

An environmental quality index that takes into consideration all aspects of the 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:

1) $y_{ji}^* = 100\ (Y_{ji} - Y_{jimin})/(Y_{jimax} - Y_{jimin})$

where, y_{ji}^* is the transformed variable, Y_{jimin} is the minimum value of Y_{ji}, and Y_{jimax} is the maximum value, for j = 2, 3, 4, 5, 7, 8, 13 that is, for all variables having a positive relationship with EQ, and all i, and

2) $y_{ji}^* = 100 - [100\ (Y_{ji} - Y_{jimin})/(Y_{jimax} - Y_{jimin})]$

where, y_{ji}^* is the transformed variable, Y_{jimin} is the minimum value of Y_{ji} in the sample of countries and Y_{jimax} is the maximum value, j = 1, 6, 9, 10, 11, 12, 14, 15 that is, for all variables having a negative relationship with EQ, and all i.

Finally, to compute the environmental quality EQ for each country we have used data for the year 2000 from the World Development Indicators (2002) Human Development Report (2002).

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

$I_i^* = 100\ (I_i - I_{min})/(I_{max} - I_{min})$

where, I_i^* is the transformed index, I_{min} is the minimum index value in the sample of countries and I_{max} is the maximum value, and i = 1, 2, 3, ...,m.

The environmental quality 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 1. Table 1 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.

	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
United Kingdom	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

Table 1. Per capita income and Environmental quality index

This identifies three group of countries as illustrated at Figure 3. Countries with high income per capita and high value of Environmental Quality, such as Sweden, Finland, Germany, Denmark, France, Austria (quadrant A): In these countries the firm-productivity effect is strong. Quadrant B includes countries with low income per capita and low value of Environmental Quality, such as Greece, Portugal, Spain, Ireland and Italy: In these countries the firm-productivity effect is weak. Finally, Quadrant D includes countries with high income per capita and low value of Environmental Quality. In these countries the consumer-attractiveness effect is weak.

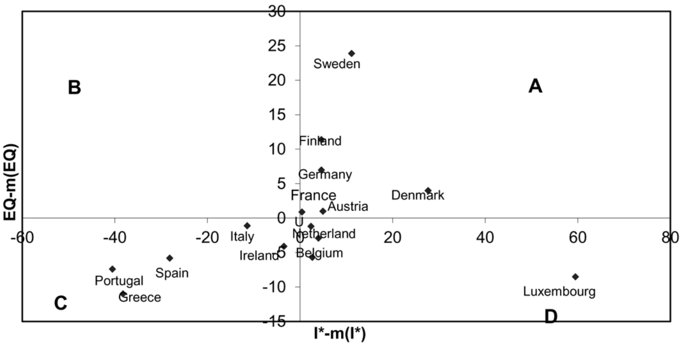

Figure 3. Per Capita Income and Environmental Quality

3. Results and Discussions

Our findings suggest that environmental and regional policies are equally important for the sustainable development in a region or country. This is because both slow -and fast-growing economies can suffer from severe environmental derogation. The notion of sustainable development is best suited in countries located at Quadrant C. 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 countries located in quadrant D, emphasis should be given to environmental measures, since its high income and low environmental quality characterize this group.

4. Conclusions

In this paper we offered a method for evaluating the economic and environmental situation in the European Union. A theoretical framework was used to position EU member states on an Environmental Quality-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 Environmental Quality. Among the rest, the Benelux countries plus the U.K have attained high incomes and low values of environmental Quality. Finally, the European South plus Ireland are characterized by low values of income and environmental Quality. 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.

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