ANALYZING THE CONNEXIONS BETWEEN ECONOMIC DEVELOPMENT AND ENVIRONMENTAL COMPLIANCE: AN INTEGRATED APPROACH

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Abstract
The paper presents, in an integrated approach, the relationship between the levels of economic development and environmental compliance within a country, using the connexions between the Kuznets curve and the aggregate pollution abatement curve. In certain circumstances, we can assume that there is a breakeven point on the Kuznets curve corresponding to the optimal level of pollution abatement costs. Therefore, we present each component of environmental costs, as well as a set of strategic options for flattening the Kuznets curve, in order to ensure the harmonization between the economic interests and the environmental liabilities of a country, when developing an economic growth strategy.
Keywords: economic development, environmental compliance, Kuznets curve, pollution abatement cost, pollution control.

1. INTRODUCTION

Harmonizing the economic growth principles with the environmental protection principles is still being intensively debated at international level, as the importance of environmental issues within the decision-making processes has continuously grown in the last years. The main problem resides in identifying the optimal level of economic development susceptible to simultaneously attain the expected economic value targets and the environmental and social welfare objectives, so that both the economic agents and the community are satisfied. Therefore, the paper summarizes the relationship between economic growth and environmental protection, using, as a connector, the aggregate pollution abatement curve.

The fundamental assumption of the paper is based upon Grossman and Krueger's (1993) statement, that there is an inverted-U relationship between the levels of environmental degradation and the economic development of a country, which is similar with the relationship between the Kuznet's U-inverted curve (Kuznet, 1966) which describes the dependence between the level of economic development and the income inequality. Therefore, in the first stages of economic growth, the pollution level grows rapidly because people

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are more interested in obtaining income than in protecting the environment (Stern, 2004), so the economies are too poor to cover the pollution abatement costs, and the environmental regulation still has several weaknesses. As the standard of living increases, the community becomes more aware and sensitive regarding the environmental issues, while the income becomes high enough for covering the pollution abatement costs. Moreover, the economic agents are promoting eco-technologies, in order to obtain a sustainable competitive advantage (Heerink et al., 2001) and regulatory institutions become more effective.

Assuming this hypothesis, the paper presents a short literature review both on Environmental Kuznets Curve (EKC) and on the main types of pollution abatement costs. It also presents the intimate relationship between the EKC and the evolution of each type of pollution abatement cost and a set of strategic options for flattening the EKC, proving that, if applied correctly, these strategic options could determine the achievement of environmental compliance at a lower level of GDP per capita.

2. LITERATURE REVIEW

The necessity of identifying solutions for ensuring a sustainable economic growth, without irreversibly affecting the environment, emerged in early 1990s, when several industrialized countries began the transition process towards the market economy. In this context, Shafik and Bandyopadhyay (1992) stated the empirical dependence between per capita income and an aggregate pollution factor, encompassing the level of air pollution, the rate of deforestation, the quality of water, and the generation of solid wastes. In this study, as well as in Grossman and Krueger's (1993) research, the authors found that the SO2 concentrations had rose proportionally with the GDP per capita up to 5.000 – 5.500 USD, beyond which they declined. Further, many authors had carried out similar econometric researches within different countries. Even if they obtained different levels of GDP per capita, the existence of the EKC was confirmed.

At present, EKC existence is being explained by the evolution of the demand for and supply of environmental quality which occur during the economic development process (Kearsley and Riddel, 2010).

Concerning the demand side, people at different stages of economic development are typically characterized by different willingness to pay for a cleaner environment (Gawande et al, 2000). Concerning the supply side, the environmental quality depends on pollution abatement costs, which are intimately influenced by the current state of technology. Therefore, both factors – the willingness to pay for a cleaner environment, and the dynamics of pollution abatement costs – influence the relationship between the economic development and the environmental degradation (Kelly, 2003).

However, the use of EKC model for describing the relationship between the levels of economic development and environmental compliance may prove inaccurate, unless specific assumptions are being respected:

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- the marginal damage of pollution is growing;
- the marginal utility of consumption is either constant or decreasing;
- the disutility of pollution is growing;
- the marginal cost of pollution abatement is growing.

As shown before, the pollution abatement costs as regarded as a key role in defining the EKC and can be divided into four categories (Brechet and Jouvet, 2001; Kelly, 2003), as follows:

- cost of direct damage, which includes the cost of all the irreversible damages produced upon the environment, as a result of the economic activity (accidental spills, uncontrolled explosions, gas emissions);
- cost of avoiding damage, which includes all the pro-active financial measures taken by economic agents in order to prevent a direct damage (contingency plans, pollution provisions, protection equipment);
- cost of compliance, which includes all the expenses made by an economic agent or by a country in order to come into line with the environmental regulation (pollution fees, investments in new technology, investments in purchasing green certificates or other tradable permits);
- cost of pollution control, which includes the cost of monitoring the emissions, so that the maximum allowable limits won't be exceeded (EMS implementation, EMAS implementation, Environmental Strategic Plans).

In this context, the paper emphasize that there is an intimate connexion between the aggregate abatement curves (which are results of the previous pollution abatement cost functions) and the Environmental Kuznets Curve, which leads to a direct dependence between the amount of money invested for environment protection and the GDP per capita.

3. MAIN INTERDEPENDENCIES BETWEEN ENVIRONMENTAL KURNETS CURVER AND POLLUTION ABATEMENT CURVE

By performing an Aggregate Abatement Curve deployment within a state, it is revealed that each type of abatement cost advance in a specific manner, which depends on the point on EKC where that state is being placed, as shown in Figure 1.

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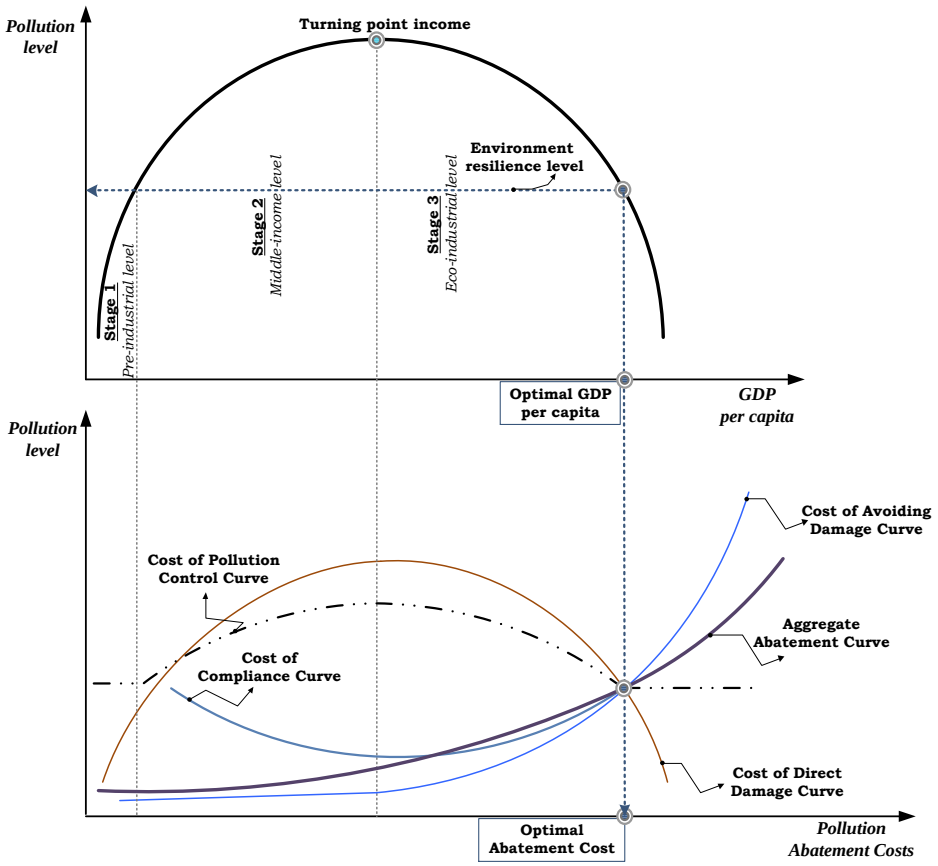

FIGURE 1 - CORE CONNEXIONS BETWEEN ECONOMIC EKC AND POLLUTION ABATEMENT CURVES

Along the Environmental Kuznets Curve, the pollution levels grow in the middle-income range and then fall toward pre-industrial levels in wealthy societies (Kearsley and Riddel, 2010). Thus, there are three key areas on the EKC, as follows:

- The first stage, until the EKC crosses the Environmental Resilience Level Line is specific to low technical capital economies. This stage occurs at the beginning of the economic development process, being retrieved frequently in case of poor countries, with less than 1.000 Euros per capita GDP. At this level of economic development, an intensive exploitation of natural resources is used, which consequently leads to the growth of pollution level towards the Environmental Resilience Line and even above it. The economy of these countries is mostly based on agriculture, while the industry is being focused on primary and secondary industries.
- The second stage on the EKC, starting from the Environmental Resilience Line and lasting until the Turning Point Income is specific to developing economies, where the average GDP per capita is about 1.000 - 5.500 Euros and the economy suffers primary structural changes. In this state, as a consequence of industrialization, the rural population migrates towards urban area, lowering the pressures on the

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forests and agricultural land. More than 35% of the GDP within these countries is provided by heavy industry (metallurgy, chemicals, petrochemicals, construction materials manufacturing, pulp industry, paper industry, etc.). The development of industries, in general, and of heavy industries, in particular, leads to an intensive environmental degradation and to high emissions of pollutants, especially SO_2 and NO_x, in the atmosphere.

- The third stage on the EKC, starting from the Turning Point Income and lasting until the Environmental Resilience Line and below it, is specific to developed countries, where the average GDP per capita overcomes 6.000 Euros and the economy suffered another shift, towards the information economy or even towards the knowledge-based economy. Less than 20% of the GDP within these countries is provided by industry, while the rest of 80% is being provided especially by IT&C, eco-industries and services. This type of economic development generates a sharp raise of income, which can also supply the environmental investments.

Thus, along the Environmental Kuznets Curve, pollution levels off in the middle-income range and then falls toward pre-industrial levels in wealthy societies (Kelly, 2003). According to many authors, the long run decrease of the pollution level, below the Environmental Resilience Line, requests pollution abatement costs of 5%-6% of the annual GDP of a country, while the short run decrease of the pollution level below the Environmental Resilience Line requests pollution abatement costs up to 10% of the annual GDP of a country, which, in both cases, is a significant effort, even in the case of developed countries.

Regarding the pollution abatement costs, we can observe a close relation with the EKC, as follows:

- The cost of direct damage curve is similar to EKC, growing since the beginning of the economic development until the Turning Point Income, where the economy shifts from an industrialized perspective toward non-polluting industries development strategy. Hence, the direct damage curve is rising in the first two stages of EKC, as the income is low and the existing financial resources are being directed to investments in heavy industry rather than in eco-technologies.

- The cost of compliance curve is opposite the EKC, dropping since the EKC cuts the Environmental Resilience Line, until the EKC reaches the Turning Point Income. Assuming that the Environmental Resilience Line is the conventional expression of the maximum allowable limits for pollutants, the cost of compliance refers to the expenses requested by the environmental regulations, in order to keep the pollution level below the Environmental Resilience Line. In the first two stages of EKC, the curve is dropping, as the states tend to relax the environmental constraints, in order to encourage investments, while when reaching the Turning Point Income, the environmental regulations are strengthened, and the curve starts growing, taking into account that the economic agents had reached a certain level of income, allowing them to pay more for environmental compliance.

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- The cost of avoiding damage curve follows an exponential trend, growing permanently, since the beginning of the economic development process. The curve has lower growth rates in the first two stages of EKC, when the countries face the lack of experience in realising contingency plans for avoiding environmental damage, and a faster growth rate in the last stage of the EKC. After the pollution level has reached the Environmental Resilience Line, investing in avoiding damage measures becomes inefficient und useless.
- The cost of pollution control is constant until the EKC passes the Environmental Resilience Line, and then evolves similarly with the EKC, until the EKC crosses again the Environmental Resilience Line, remaining constant again. The cost of pollution control is not directly dependent on the evolution of EKC, but it releases on the cost of direct damage curve evolution, which is similar with EKC, as stated above.
- The Aggregate Abatement Curve is the compound function of the previous pollution abatement curves and it synthesizes the relation between the economic development and the environmental costs. Hence, if the abatement costs are low, the level of pollution is high; also, if the income (GDP per capita) is high, the pollution abatement costs grow and the pollution level decrease. In a perfect economy, it can be shown that the breakeven point where the EKC passes, for the second time, the Environmental Resilience Line corresponds to an optimal GDP per capita, and also to an optimal pollution abatement cost. Beyond this point, both the economic development and the pollution abatement investments are inefficient.

4. FLATTENING THE ENVIRONMENTAL KUZNETS CURVE – KEY ISSUE FOR ENSURING ENVIRONMENTAL COMPLIANCE

One key issue for hastening the reduction of pollution levels resides in finding strategic options for flattening the Environmental Kuznets Curve. As shown in Figure 2, the flattening of EKC determines the achievement of environmental compliance at a lower level of income (GDP per capita), which seems to relax the existing trade-off between the economic development and the environmental compliance.

The most usual strategic options for flattening the Environmental Kuznets Curve, which are currently implemented, are:

- the internalization of externalities;
- the promotion of eco-technologies;
- the development and implementation of environmental policies.

The internalization of externalities, strategic option based on the assumption that the pollution effects are visible on two different levels: as internalization, within each of the economic agents (by including the aggregate pollution abatement costs in the total manufacturing cost, and thus raising the price with a few percentages) and as externalities, within the community (by quantifying the social costs requested for recovering the environment or the human health). Hence, the internalization of externalities is a necessary strategic option, as it increases the entrepreneur's awareness towards the environmental issues. In this context, the idea that the society should bear, by subsidies, the pollution abatement costs is abandoned and replaced with the polluter-pays principle, which is widely promoted nowadays.

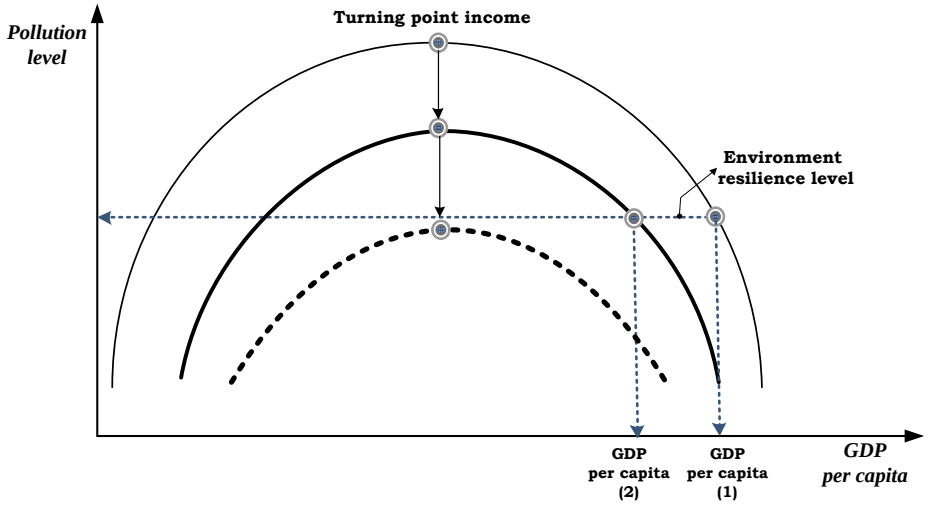

FIGURE 2 - EFFECTS OF FLATTENING THE ENVIRONMENTAL KUZNETS CURVE

The promotion of eco-technologies, another strategic option, with a lot of adherents, is susceptible to support the economic agents in achieving a sustainable competitive advantage. Even if the eco-technologies are still more expensive than classical technologies, the environmental regulations, as well as the consumers' pressures determine the preference for such technologies rather than for classical ones. The development and implementation of environmental issues is a main concern of the policy-makers and is one of the most powerful strategic options applied at macroeconomic level, with high impacts on each of every economic agent which is susceptible to produce environmental damages.

5. CONCLUSIONS

Revealing the tension between the economic development and the environmental compliance is still an up-to-date challenge both for national governments and for economic agents. Although several environmental actions were taken, especially regarding the development of environmental standards and regulations, there is still a trade-off between the economic growth and the environmental issues. Given the evolution of the

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pollution level, depending on the net income, which was proven by econometric analyses and resembled with Kuznets Curve, as well as the relationship between this curve and the pollution abatement costs, a viable option for harmonizing the economic and environmental concerns within a community resides in identifying as many strategic options for flattening the EKC, as possible.

Hereby, the paper focused on describing the relationship between the EKC and the pollution abatement costs, but a deeper analysis concerning the practical ways to determine the flattening of the EKC is strongly recommended, as this might be the key for entering a new era with regard to the relationship between the economic development and the environmental compliance.

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