Civil and Environmental Research
ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)
Vol.10, No.4, 2018

The Critical Review of the Environmental Kuznets Curve (EKC)

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Abstract
The Environmental Kuznets Curve (EKC) stated a nonlinear relationship between income and pollution .According to this hypothesis, economic growth is the cause as well as remedy to the environment problems. Therefore, developing countries should care about the economic growth, and economic growth would automatically care the environment at the later stage of economic development. In this research study, we examined the theoretical and empirical basis of the EKC. We found that given the controversy over the theoretical and empirical basis of the EKC, it cannot be based for the development and environment policies of the world.

1. Background of the EKC

Historically there has been divided opinion about the economic and social cost of economic growth. Meadows (1972)[1]concluded that the economy of the world would reach to its physical limits of growth very soon due to ecological damages of economic growth. One year later to this report the first oil crises took place that led to the sense that world is going to face the dearth of natural and energy resources. This crisis also raised the issue of sustainability of economic growth. In Literature two conflicting views appeared that time. On one side, economists like Klaassen and Opschoor (1991) argued that substitution and technical progress can make up of the depleting of natural resources and high level of consumption in future can be sustained. According to them main concern should be to investigate the institutional arrangements for technical progress that will lead to sustainability of economic growth.

On the other side, environmental economists argued that substitution possibilities are constrained by physical laws even if there are continuous technological changes, the environmental degradation would limit the process of economic growth on both production and consumption side Tahvonen (2000).In the 1970s the notion of sustainable development[2] replaces the concept of Limits to growth. Sustainability is a growth process that fulfills the economic needs of the current generation without compromising over the capabilities of upcoming generations to fulfill their particular requirements. Sustainability includes three components, the environmental, economic and sociopolitical sustainability Ekins (1993). But for the serious commentator of economics , pollution remained a consequence of market failures and they did not consider the scarcity of natural resources in economic growth model as pointed out by Stern and Cleveland (2004). They stated that "there is still an inbuilt bias in mainstream production and growth theories to downplay the role of resources in the economy, though there is nothing inherent in economics that restricts the potential role of resources in the economy". Beckerman (1992) was the first who used to say that "too poor to be green" means to say that least developed countries have deficient resources for the protection of environment and it is economic growth that can resolve environmental problems.

World Development Report (1992) concluded that certain environmental problems are aggravated by economic growth and are linked with the deficiency of economic development. The Report recommended that accelerated equitable income growth as a mean to realize more world output and an improved environment. This suggestion placed the basis of the so-called Environmental Kuznets Curve (EKC) literature, which appears at the start of 1990s. The first set of the empirical EKC studies appeared in World Bank[3] (1992), IRO (1993)[4], Grossman and Krueger (1994)[5].

They all had the same conclusion. It was (Panayotou, 1993) who used the term environmental Kuznets curve (EKC) first time in literature because it resembles to Kuznets hypothesis of income Inequalities. He used

[1]Meadows, Donella H. "Dennis l. Meadows, Jorgen Randers, William W. Behrens III.: THE LIMITS TO GROWTH. A Report to the Club of Rome." (1972)
[2] " Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other"
[3]The World Development Report 1992 of the World Bank as a part of the study for the relationship between growth and environment Shafik and Bandyopadhyay (1992).
[4]Development Discussion paper as a part of the study for International Labor Organization Panayotou (1993).
5 AN NBER working paper as a part of the study of environmental impacts of NAFTA G. M. Grossman and Krueger (1994)

cross-country data and found the association between certain indicators of pollution and per capita income as inverted-U curve. Since from, EKC has developed to a basic notion to define the connection between environmental quality and economic growth. The basic thinking of the EKC-theory is reflected in Beckerman's assessment about the consequence of economic growth that there is "clear evidence that, economic growth usually leads to environmental deterioration in the early stages of development but in the end, the best and probably the only-way to attain a decent environment in most countries is to become rich" Beckerman (1992).

2. Theoretical Explanation of the EKC

EKC-hypothesis postulates that more economic growth can recover environmental degradation after the economy has reached to a sufficient position of economic growth. At initial phases of economic growth, there is agrarian primary production, natural resource are in abundance and waste generation is limited due to limited economic activity. As the development process starts through industrialization, depletion of natural resources starts and waste start to accumulate and in this phase environmental degradation is positively related to income growth, and with further economic growth technology improves, services and information diffusion limits the material bases of economy that reduce degradation of environment per unit of GDP (Panayotou, 2003). The rationality for the presence of an EKC type relationship has been assessed on both supply and demand side. The supply side effects can be disintegrated into scale effect, technique effect and composition effect by (G. Grossman & Krueger, 1995)

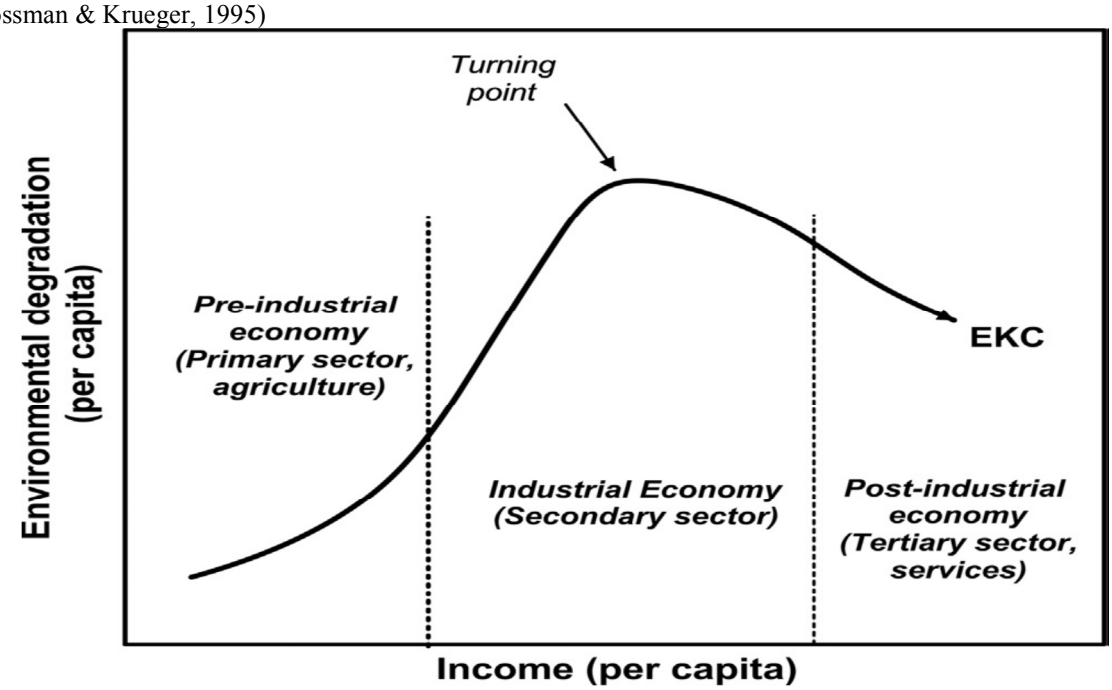

Figure 4.1: EKC Relationships between Income and Environment

The scale effect starts with the surge of economic activity by utilizing more natural resources that lead to more polluting emissions and more waste. And composition effect refers to the modification in production structure of an economy from agrarian base to industrial one and then to service sector. This effect reallocates the resources along with upsurge in environmental worsening in the first stage and reduction in it in the second stage. Lastly, the technique effect ensures better-quality methods of production due to technological advancement. Outdated machineries are substituted and more cleaned technologies are implemented that lead to a decline in pollution. According to this hypothesis, scale effect works against environment while composition and technique effects work in favor of the environment. The direction and extent of these reverse moving effects determine the pollution–income relationship.

On demand side at the early phase of development people are mostly worried about the improvement of their material welfare. They are least worried about the quality of environmental. But as their income upsurges at the advanced stage of industrialization, their inclination to pay for cleaner environment increases and the institutions that regulate environment also develop to more effective; therefore, pollution reduces in the later stage. So this type of connection between demand for environment quality and per capita income converts to an inverted-U shape curve Selden and Song (1994).

Low income countries, cannot bear huge spending for pollution reduction despite the fact demand is there. Economic growth generates the demand of better environment one hand, and makes the resources available for the purpose on other hand. Therefore, it is the higher economic growth that enables the countries for greater public outlays on environmental structure.

Dasgupta, Laplante, Wang, and Wheeler (2002a) in a "conventional" argument of the inverted-U shape association between environment quality and income growth indicated that at the early phase of economic development environment degenerates very quickly as people are more concerned with employment and income generation than the environment. Societies are very much poor to pay for the abatement and directives of environment. People value their environment after a certain level of income.

The EKC relationship implies that economic growth can be used as a powerful device to ensure quality environment for developing countries. So study of tenability of this EKC hypothesis is very relevant to comprehend the likely drift of growth and environmental degradation link in developing countries.

Empirical and theoretical discussions on EKC have been ongoing since it was first claimed. According to (Selden & Song, 1994; G. Grossman & Krueger, 1995), till the mid of 1990s, maximum studies about EKC focused on cross sectional data and some evidences on regional and` local pollutants have confirmed the existence of the EKC. Since from the late 1990s, the EKC studies also used time-series as well as cross-sectional data and compared the EKC for specific economies in terms of height, timing, peaks and shapes of the EKC.

Various experts of development and environment economics, confirmed the presence of an EKC type relation between income and pollution. Therefore, there are suggestions that further degradation of environment can be retard and environmental conditions of a country can be improved as it has occurred in various zones of the globe by the EKC transition. EKC as an optimal growth path and high income as a prerequisite for environment improvement have fascinated the development and environmental policies of the world (Chimeli & Braden, 2002). Some researchers and policy makers also quoted "grow first and clean up later" and recommended an EKC transition as a growth path for developing countries (Dasgupta, Laplante, Wang, & Wheeler, 2002b).

The initial high investment costs of abatement technologies along with increasing returns to scale also confirmed the existence of the EKC. The high cost of pollution abatement practices reduce the ability of poor countries to device pollution control policies. The costly pollution control can more freely be attained by communities when incomes are rising (Andreoni & Levinson, 2001).

2. Arguments against EKC

There are different argument generated by different empirical and theoretical studies on the EKC as the study of Shafik (1994) pointed out that the EKC did not hold everywhere, every time and for all pollutants. The studies by Kaika and Zervas (2011) that connect economic growth with the environment by energy consumption, pointed out that the course of economic growth does not decrease CO_2 emissions automatically. It is also argued that the EKC-studies emphasized only on the production side activities and ignored the evolution of consumption with economic growth. According to the studies of Arrow *et al*. (1995),Panayotou (1997), Lieb (2004),Ansuategi and Escapa (2002),Dinda (2004), EKC have different outcomes depending on the pollutant in the query. The EKC transition is very true for the pollutants that have local and regional dimensions and can be reduced at the relatively low cost of economic growth. Such pollutants have a negative effect on quality of life that is easily recognized by societies. But no EKC-pattern arises in cases of pollutants like CO_2 emissions and of greenhouse gasses that have global dimensions with long-term effects, with little immediate effect on quality of life and have relatively high abatement cost. The most of the empirical studies about CO_2 emissions show a positive relationship with income instead of an inverted-U relationship.

It is also stated that developed countries are cleaner now because they have shifted their pollution-intensive industry to developing countries as this phenomenon is known as the "pollution haven hypothesis" (PHH). Stern (2004a) raised the concerned that in our limited world, current developing countries would not be able in future to find more countries to transfer their polluting industries. Cole (2004) also showed same concerns and pointed out that current developing countries may not face same domestic and international conditions for growth as developed countries of today have faced.Nahman and Antrobus (2005) also highlighted that development pattern of the EKC may not be available to present underdeveloped countries.

Several studies such as (2003), (Panayotou, 2003; Dinda, 2004; Lieb, 2004) pointed out another issue that most of the empirical EKC-studies, using either cross-sectional or panel data try to assess a turning point of the EKC for average income level of the countries by assuming that that world income is normally distributed. But, world income is highly skewed with a greater number of people living below the world average income, so serious consequence is that estimated turning point of studies beyond which environment may start to improve is not an achievable income level for the representative economic agent. So estimation of turning point income level of EKC is meaningless if the major part of the population of a country is well below the average income.

. Ezzati, Singer, and Kammen (2001) demonstrated that EKC can only be true under some specific conditions and it requires a number of factors that shape the environment- income scheme rather than a single main factor. Martinez-Alier (1995) questioned about the assumption of EKC transition that rich people are more careful of the environment than the poor and the available evidence is not conclusive yet. It is also questionable

that economic growth raises the possibility of the introduction of modern and less polluting technology that may push down the pollution per unit of GDP but the absolute level of pollution may go up with the increase in economic growth. So the total effect of technological change on pollution is ambiguous yet.

After reaching to high-income level it is also detected that the pollution again starts to rise gradually due to augmented demand for electronics and luxuries that may lead to a cubic form of EKC. According to Raymond (2004), EKC knowledge is an inadequate guide for environment and development policy makers of the world. The EKC methodology and econometric techniques used by researchers who proved its existence is also in question and highly criticized by Aslanidis (2009).

3. Conclusion

From above discussion, we can conclude that, theoretically and empirically the EKC is still controversial. The EKC literature is reasonably large and the outcomes are at best diverse. Although most of the studies agree about its existence for domestic and regional pollutants but have disagreement about the shape and turning point of EKC asCopeland and Taylor (2003) stated that: ‘‘our review of both the theoretical and empirical work on the EKC leads us to be skeptical about the existence of a simple and predictable relationship between pollution and per capita income.’’ A great part of studies also examined the role of the different factors in determining the shape and turning point of EKC like the structural changes, technical progress, and improvements in energy efficiency, source of energy generation, international trade, income distribution, the institutional structure governance and consumer preferences and so on. There is also no consensus about the most important determinant of the income environment relation. So we conclude that the given the so much disagreements about the theoretical basis of the EKC and diverse outcome of the empirical research on the EKC, it cannot be based development and environment policies for the developing countries.

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