Empirical viability of the environmental Kuznets curve: Discussions and criticisms

Salsabil YACOUR*
FSJES-Souissi, Mohammed V University, Rabat, Morocco – salsabil.yacour@gmail.com

Ahmed EL GHINI
FSJES-Souissi, Mohammed V University, Rabat, Morocco– aelghini@gmail.com

Abstract

The environmental Kuznets curve is an assumption that economists have generalized in order to determine the relationship between economic growth and the environment degradation. Even if this concept is extensively studied in theoretical literature, there is still an increasing interest for research works investigating their empirical issues. Nevertheless, this hypothesis has been criticized mainly, in addition to its theoretical basis, for the nature of the variables that it takes into account to express the environmental deterioration. This paper aims to highlight some recent contributions including their similarities and divergences on the choice of the variables used (e.g. CO_2 emissions, trade openness, financial development, income per capita, etc.) and the econometric approaches employed.

Keywords: Economic growth; Environmental degradation; Trade openness; Income.

I.   Introduction

Since the Kyoto[1] Protocol, environmental efforts deployed by public authorities have become more and more concrete and implemented. In fact, the world has begun to be increasingly aware of the importance of the effects of climate change on global economies. This particular attention is essentially due to global warming and other environmental issues that are becoming crucial.

In this sense, economic theory has attempted to examine this thematic which reflects the impact of economic development on the environment. The relationship between these two variables is usually represented by the environmental Kuznets curve. According to Grossman and Krueger (1990), the Kuznets curve could be observed in the environment domain. In this regard, is the environmental Kuznets curve empirically valid? The objective of this paper is to discuss empirically the validity of this curve and of course to determine some possible impacts of growth on the environment. The rest of the paper is structured as follows: **Section 2** presents the conceptual framework of the environmental Kuznets curve and its origins. **Section 3** explains some empirical studies that have analyzed this hypothesis. In this sense, some research works confirm the existence of this curve while others invalidate it. **Section 4** briefly discusses some criticisms of this curve and **Section 5** concludes the paper.

II.   Environmental Kuznets curve: Conceptualization

The environmental Kuznets curve (EKC) hypothesis holds its origins of the initial curve introduced by Simon Kuznets in 1955, which envisages a correlation between the reduction of income inequalities and the level of global domestic product (GDP). Indeed, he predicts that as income per capita increases, income inequality increases first and then declines after reaching a certain threshold. In other words, income distribution is more uneven at the beginning of growth and then becomes more evenly distributed. The EKC hypothesis, in accordance with the original argument, suggests that environmental damage increases at lower income levels, reaches a maximum level and declines thereafter. Otherwise stated, as the income level per capita increases, this environmental degradation will eventually decline and the country will lead to a clean environment when it becomes prosperous. This curve can be graphically illustrated by FIG. 1.

Figure1 : Environmental Kuznets curve
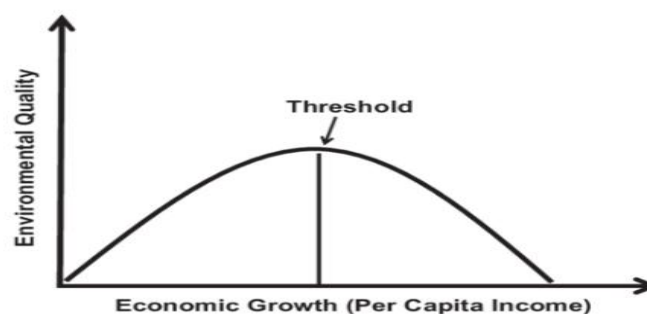
Source: Richard and Kefa (2012)

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[1]It is an international agreement to reduce greenhouse gas emissions and complements the United Nations Framework Convention on Climate Change.

The main explanation of EKC consists when the population attains a sufficiently high standard of living, it gives more importance to environmental equipment. Indeed, after crossing a particular threshold of income per capita, people's willingness to pay for obtain a quality environment increases by a greater proportion than income. This generally has as result the conferment of donations to environmental organizations, demand and consumption of less polluting products. In this sense of ideas, it is necessary to mention that the environment is a "superior good". This means that from a certain threshold, more the income increases and more the demands of respect for the environment increases. Moreover, consumers whose standard of living is high are usually better informed on the conditions of protection of the environment and on the importance to respect them. Usually, the hypothesis of the environmental Kuznets curve could be valid in industrial countries seen that they adopt laws corresponding to the norms of respect of the environment.

III.   Growth and the environment: Some empirical works

Several studies have analyzed the relationship between environmental degradation and GDP per capita, which is designed as an individual income. The hypothesis of the environmental Kuznets curve describes the inverse relationship between these two variables. It is important to signalize that various studies have examined this assumption using other variables that tend to express environmental degradation better as indicators of water quality, indicators of air quality etc.

Pao and Tsai (2011) have proved the existence of the environmental Kuznets curve for Brazil during the period 1980-2007. For this purpose, they used the Johansen test for cointegration, ordinary least squares and VECM to test the impact of GDP and energy consumption on carbon dioxid (CO_2) emissions. They concluded that the increase in GDP could reduce CO_2 emissions and energy consumption for Brazil. Indeed, as their growth increases, there is a demand for the quality of the environment. In another study carried out by the same authors in 2011 and during the same period, they analyzed this hypothesis for the BRIC countries. They used panel data to determine the link between GDP, energy consumption, foreign direct investment (FDI) and CO_2 emissions. These economists deduced that the consumption of energy degrades the quality of the environment but on the other hand, FDI does not participate in the evolution of the economic activity as known in these countries.

Ihtisham et al. (2016) have attempted to study the relationship between income per capita, carbon emissions, energy consumption and trade openness for the case of Morocco. The period of study is between 1971 and 2011. For this, they used the method of cointegration to study their problematic. They deduced that there is a long-term relationship between the variables. In fact, energy consumption has contributed to the deterioration of the quality of the environment over the long and short term. Thus, they also concluded that trade openness has a negative impact on carbon emissions. Therefore, the environmental Kuznets curve hypothesis is not verified even if there is a causal relationship between income and carbon emissions. In the same sense of ideas, the invalidity of EKC was also confirmed by **María and Josué (2016)** who studied a panel of 22 Latin American and Caribbean countries during the period 1990-2011. **Manuel et al (2016)** have conducted a study that seeks to determine the relationship between environmental degradation, income per capita, consumption of energy from fossil fuels and trade liberalization in Iceland between 1960-2010. In order to verify the validity of the EKC hypothesis, they have applied the Autoregressive Distributed Lag (ARDL) model. Their results indicate that consumption of fossil fuels in the short term is positive and significant, meaning that an increase in consumption of this type of energy will have a direct and immediate effect on the level of CO_2 emissions to the environment. Furthermore, the sign of the income per capita

squared is negative and significant which shows that the hypothesis of EKC is maintained in the case of this country.

However, **Oztuk and Acaravaci (2013)** have used an error-correction model to determine the relationship between income, CO2 emissions, energy consumption, trade openness and financial development for the case of Turkey. They found a long-term causality relationship between these variables. More precisely, it's financial development that influences CO2 emissions and not the reverse. Therefore, they verify the existence of the environmental Kuznets curve. In the same order of ideas, **Shahbaz et al. (2013)** also have attempted to study the relationship between the same variables as those used previously except for trade openness, in the case of Malaysia. The study period was between 1971 and 2011. For this, they used a VECM approach and the Bounds test. They deduced that financial development impacts negatively CO2 emissions and that energy consumption, economic growth affect positively CO2 emissions. Nevertheless, it should be pointed out that they found a causal relationship between financial development, CO2 emissions and economic growth. They also observed the same causal link between energy consumption andCO2 emissions. Indeed, financial development is helping Malaysia to improve the quality of its environment. On the other hand, the reduction of the activities responsible for the deterioration in the quality of the latter could affect economic growth in one way or another.

Ilhan and Usama (2015) have tried to examine the environmental Kuznets Curve hypothesis for Cambodia during the period 1996-2012. The approach used is Generalized Method of Moments (GMM) and the Two-stage Least Squares. Their study showed that GDP, urbanization, energy consumption and trade openness increase CO2 emissions. However, the control[2] of corruption and governance can reduce CO2 emissions. In short, they don't confirm the validity of EKC hypothesis. The table 1 summarizes some works mentioned above and which treated the question of the validity of the environmental Kuznets curve.

Table 1: Synthesis of some EKC works

Author	Period	Country	Methodology	Variables used in the study	EKC hypothesis
Manuel, A., Arianna, T., María, J.	1960-2010	Iceland	ARLD model	Income per capita, energy consumption from fossil fuels, trade liberalization and CO2 emissions.	Yes
Pao and Tsai	1980-2007	BRIC countries	Cointergration In panel data	GDP, energy consumption, foreign direct investment and CO2 emissions.	Yes
Ihtisham,H. Shujin,Z. Muhammad,S.	1971-2011	Morocco	Cointegration	GDP per capita, carbon emissions, energy consumption and trade openness.	No

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[2] The index of corruption and governance are used to find the inverted-U shaped of EKC. Also, the objective of their introduction in the model is to show the efficiency of the government and the quality of its service.

| Oztuk and Acaravaci | 1971 -2011 | Turkey | Error-correction model | Income, CO2 emissions, energy consumption, trade openness and financial development. | Yes |
| Ilhan, O. and Usama, A. | 1996-2012 | Cambodia | Generalized Method of Moments (GMM) and the Two-stage Least Squares | GDP, urbanization, energy consumption, trade openness, CO2 emissions, control of corruption and governance. | No |

IV.   Application of the Kuznets curve to the environment: Some criticisms

The application of the Kuznets curve to the environmental domain has given way to several methodological and theoretical controversies. In fact, if the pollution according to the income follows an inverted-U shaped relationship, then it is enough to continue to produce and consume as before and then the pollution will decrease of itself passed a certain threshold. Therefore, we will not need to pollute. Grossman and Krueger have only shown a correlation between the reduction of some pollution and the exceeding of a threshold of income per capita in some countries only. Outside this logic, which is for some economists limited, their work could not represent a predictive analysis. Thus, developing countries will not necessarily exhibit the same pattern. Their emissions will don't fall "automatically" once it has crossed an income threshold. In this sense, the curve would be only the juxtaposition of two different scenarios: one concerning the industrialized countries and the other the developing countries. Pollution in industrialized countries decreases linearly with income. On the other hand, in developing countries, it grows linearly. The juxtaposition of these two divergent scenarios gives the famous environmental Kuznets curve and could invalidate all the interpretations that could have of it.

Moreover, it's a decelerated curve that for some pollutants with localized effects such as sulfur dioxide, nitrogen dioxide, etc. However, it is necessary to include in the studies other pollutants with global environmental effects. By way of illustration, the occupation or exploitation of the land and the use of natural resources are not reduced with the increase in income as the basis of the said curve indicates. In addition, many natural services produced by ecosystems such as freshwater supply and regulation, soil and fisheries fertility continue to decrease in the majority of developed countries. It would be misleading to declare a decline in pollution in a country if it is only exported beyond geographical boundaries.

V.   Conclusion

By way of conclusion, this paper attempts to clarify the link between environment quality and income in the framework of the environment Kuznets curve hypothesis. As the empirical works show, the EKC assumption is sometimes confirmed and sometimes denounced. This divergence between results could be owed to the degree of development of the country studied, the nature of the variables used and the econometric approach employed. In general, the Kuznets curve could be highlighted in some data on some local environmental issues such as air pollution, but this is not the case for others such as soil renewal or biodiversity. We could also emphasize that the effects of climate change such as species loss and loss of biodiversity are irreversible.

References

Acaravci, I. Ozturk, I, (2013)."The long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey". Energy Economics **36**, 262-267.

Behnaz, S., Jamalludin, S., (2013).''Environmental degradation, economic growth and energy consumption: Evidence of the environmental Kuznets curve in Malaysia". Energy Policy**60**, 892–905.

David, I.S. (2004). "The Rise and Fall of the Environmental Kuznets Curve". World Development**32**, No. 8, pp. 1419–1439.

Faridul, I. , Shahbazb,M. ,Ashraf, A. , Mahmudul, A. (2013). ''Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis". Economic Modelling, **30**, 435–441.

Ihtisham,H., Shujin,Z., Muhammad,S. (2016)."Empirical investigation of environmental Kuznets curve for carbon emission in Morocco".Ecological Indicators **67**, 491–496.

Ilhan, O., Usama, A. (2015)."Investigating the validity of the environmental Kuznets curvehypothesis in Cambodia". Ecological Indicators **57**, 324–330.

Manuel, A., Z., Freddy, F., G, Kliffer, A.,H. (2016). "Bounds Testing Approach to Analyze the Existence of an Environmental Kuznets Curve in Ecuador". International Journal of Energy Economics and Policy**6(2),**159-166.

Manuel, A., Arianna, T., María, J. (2016)."Testing the Environmental Kuznets Curve Hypothesis In Iceland: 1960-2010".Revista de Economíadel Rosario **19(1).**

Mayra, B., Kevin, O., Carolina, T., Tatiana,V. (2017). "Economic Growth, Renewable Energy and Methane Emissions: Is there an Enviromental Kuznets Curve in Austria?".International Journal of Energy Economics and Policy**7(1)**, 259-267.

María, P,R., Josué, J. (2016)."Economic growth and energy consumption: The Energy-Environmental Kuznets Curve for Latin America and the Caribbean". Renewable and Sustainable Energy Reviews**60**, 1343–1350.

Muhammad, S., Samia, N., Khalid, A., Shawkat, H. (2017)."Trade openness–carbon emissions nexus: The importance of turning points of trade openness for country panels". Energy Economics **61**, 221–232.

Pao, H., Tsai, C. (2011a), Modeling and forecasting the CO2 emissions, energy consumption, and economic growth in Brazil.Energy **36(5),** 2450-2458.

Pao, H., Tsai, C. (2011b), Multivariate granger causality between CO2 emissions, energy consumption, FDI (foreign direct investment) and GDP: Evidence from a panel of BRIC (Brazil, Russian Federation, India, and China) countries. Energy **36(1)**, 685-693.

Richard, S., Kefa, M. (2012). "Chinese economic expansionism in Africa: a theoretical analysis of the environmental Kuznets Curve Hypothesis in the Forest Sector in Cameroon". African Geographical Review.1-21.