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Theoretical Framework of Environmental Degradation, Energy Consumption, and Globalization: The Relationship Between Them

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Abstract:
This research explores the relationship between environmental degradation, energy consumption, and globalization through the lens of the Environmental Kuznets Curve (EKC) theory, initially proposed by Kuznets (1955). The study aims to examine the validity of the EKC hypothesis across various economies, particularly focusing on developed countries. By investigating the interplay between economic growth and environmental quality, the research assesses how globalization and energy consumption impact environmental outcomes, thereby contributing to the understanding of the EKC theory in contemporary contexts.

Keywords: environmental degradation, energy consumption, globalization, CO2 emissions, Environmental Kuznets Curve (EKC).

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To start with, the Environmental Kuznets Curve (EKC) is used to graph the idea that as an economy develops rose rapidly, market forces begin to increase, economic inequality decreases, while the environment will be damaged. Therefore, the green economy has become a primer tool to achieve economic growth and development without an adverse effect on the environment. Actually, sustainability on its part has represented as one of the most important policy goals explored in the environmental Kuznets curve (EKC) literature.

Nowadays, there is a plethora of studies and research has been conducted to support the EKC theory. Ipso facto, these studies have used different variables and methods to estimate environmental degradation. In the current study, we have focused on three variables, which are globalization, energy consumption, and environmental degradation represented as CO2 emission.

Above all, the present research contributes to ongoing literature by studying different EKC specifications for a group of developed countries in various regions of the world over the period of 1980-2019, using long-term static and dynamic panel data methods.

Research purpose and hypotheses:

The present research attempts to use CO2 emissions as the dependent variable based on the EKC theory, which refers to the level of environmental damage. Therefore, the main objective of this research is to investigate the existence of the EKC in various economies categorized as developed countries.

The main purpose of the present research is to find answers to the following question:

- Does the environmental Kuznets Curve exist in the 21st have relationship with globalization, environmental degradation and energy consumption ?

The hypotheses:

In order to address the issue of the study, we relied on the following hypotheses:

- There is either a flat pattern or no relationship between environmental degradation and income.

- There is a monotonic increasing relationship such as the environmental degradation increases along with economic growth.

- There is a monotonic decreasing relationship between environmental deterioration and income.

- We can see the classical inverted U-shaped EKC.

- There is a U-shaped relationship between environmental degradation and income.

- There is a cubic polynomial or N-shaped relationship between environmental deterioration and income.

- There is an inverted, or opposite, N-shaped relationship between environmental degradation and economic growth.

Importance of the study:

First, the significance of the current study is to highlight the environmental degradation issue. Several researches have addressed the same issue, as the results of the importance of the environment, which is the only home that humans have, and it provides us with the air, food, and other needs.In fact, the studies that addressed the environmental issues show the way in which countries can develop sustainable strategies to protect the environment.

On its part, this research helps to develop an understanding of how globalization and energy consumption are damaging and affecting the environment. Moreover, the present study attempts to contribute to new knowledge by introducing and analysing the EKC hypothesis. Besides, it improves student's research capabilities

limitations:

Many limitations have been met during conducting this research, We find some difficulties to access the published article in international journals; that is to say that many international articles are not free available. Additionally, to present the literature review that interprets the research's subject, we have focused on the main concepts that are relevant in the context of the present study, as the result of luck of resources .

The following diagram characterizes the relationship between the study variables that was used in the study to facilitate the understanding of the research topic:

Figure1. explains the relationship between the study variables which was created by researcher

Since the Industrial Revolution, manufacturing sector turns into a main driven factor of economic development in various countries. The wide use of machinery and technological inputs in the production process has brought a significant and profound change in economic activities, although, industrial economic growth has led to an increase in environmental degradation problems.

In the late of 20th century, some countries became more connected and the world became more globalized. Therefore, globalization plays an essential role in the economy of the country, since it helps to enhance the economic development greatly depends on international trade and industrial development.

However, industrialization and product activities lead to rise in energy consumption, so the level of CO2 emissions. As the result, the over-usage of non-renewable energy and globalization pushed to destroy the environmental quality.

I-Conceptual and theoretical Framework

In order to understand the core topic of the present research, we have to introduce conceptual and theoretical definitions of the variables that were used in this study.

In this section, we highlight the study variables, including globalization, energy consumption, and environmental degradation

1. Globalization:

Although the phenomenon of globalization is not new, it made one of the reasons for the existence of debate among scholars about when it can appear. Indeed, some scholars believe that globalization began as a phenomenon in the early human immigration, or with the conquests of Genghis Khan. However, some scholars suggested that it is more contemporary. Mean while some scholars assumed that globalization is a modern phenomenon that did not start before World War II.

Also, the term of globalization has been used since the 80s, where some scholars believe that globalization cannot be older than the late forties of the last century, that is, in the post-war period, and the time of the emanation of the USA as the most powerful country in the world.

Globalization can be defined as the expansion of economic activities across political boundaries of nations. It is a process of economic integration and economic interdependence among nations in the world economy. That is to say that It is associated not only with an increasing cross-border movement of goods, services, capitals, technologies, information, and people, but also with an organization of economic activities, which straddle national boundaries.

Yalcin (2018) illustrates that globalization is an outcome of capitalist progress. As the advancement of communication, technologies and the increase in productivity necessitate states' expansion of their market territory. Therefore, the decline in protective social policies, the increase in the incentives for foreign trade, and the convergence of the free-market economy.[1]

Farhad and Mohammad, (2011) defined globalization as the process by which different economies and societies become more closely integrated, and concordant with increasing worldwide connectivity; covering a wide range of distinct political, economic and cultural trends.

Martin et al (2018) believe that globalization, of course, is nothing new; it has been an evolving feature of world economic activity ever since the age of exploration in the 16th century and characterized many ancient systems, such as the Roman Empire. However, they said that since the mid-1970s, it is known broadly as the increasing extension, interpenetration, and interdependence of

[1] Betul Yalcin, what is globalization?, Oxford University press, 2009,p18

production systems, corporations, markets, networks of flows across national borders.[1]

Above all, Globalization has a huge effect on the county's economy. Ipso facto, today, it seems to be one of the most important factors for economics to make a change. If a country has a good or high globalization indicator, it will be a positive point for that country. It can make difference; by involving the country in the mass production economics, so globalization will help the country to enhance its economic growth.[2]

2. Energy consumption:

Today the energy sector plays an important role in our everyday life . The importance of energy is a crucial component in economic growth as well as in any strategy to improve the quality of human life.

Teba (2021) indicated that today we are taking a closer look at the definition of the term "energy consumption". She defined Energy consumption as "ALL" the energy that is used to perform an action, manufacture something or simply inhabit a building. The energy sources can be divided into three main categories: fossil fuels (oil-coal-natural gas), renewable sources (Wind Energy, Hydroelectric, Ocean Energy...), and nuclear sources. In spite of the development of using the renewable energy source in today's activities, Oil and Gas are expected to be one of the most important sources of energy.

[1] Aisha Shahzad, What is Globalization - Historical Background, Jadavpur Journal of International Relations, 10(1)2018, pp 204-212.
[2] Aisha Shahzad, What is Globalization - Historical Background,Op.cit,p214

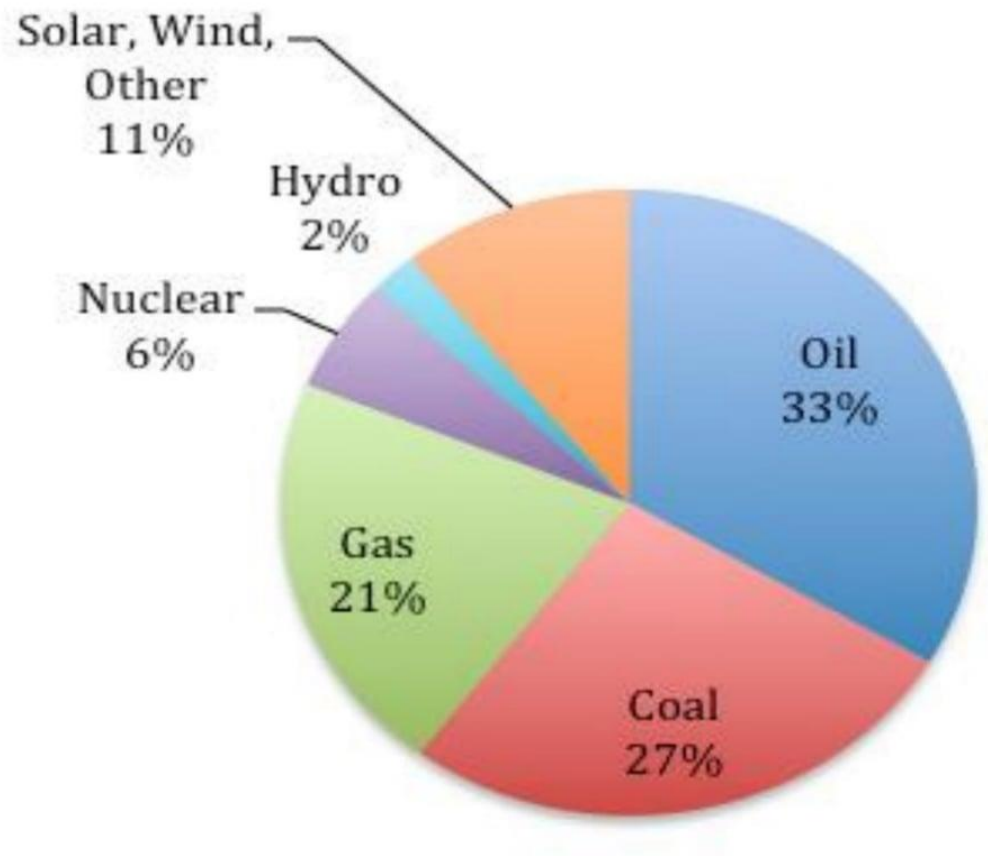


Figure 1.1: Source of global Energy 2017. (International Energy Agency (iea.org))

In figure 1.1, it can be seen clearly from the data provided that the global energy is highly dependent on fossil fuels, which accounts approximately 81% of global energy sources, followed by natural sources with only 11%.

As mentioned, energy consumption is the total energy provided and consumed by humans. Usually, it measured per year; accounting all energy utilized from different energy sources. Closely related to energy consumption is the concept of total primary energy supply. The figure 1.2 shows the world energy supply, such as coal, oil, and natural gas (R B Jackson et al 2019). World energy consumption is projected to rise 28% by 2040 (oil and gas journal, 2017). It is predicted to continue as the most important source of energy for the next century.[1]

[1] Arifur Rahman ,al, Evaluating the EKC Hypothesis for the BCIM-EC Member Countries under the Belt and Road Initiative, Sustainability Journal, 12(4)2020, p178.

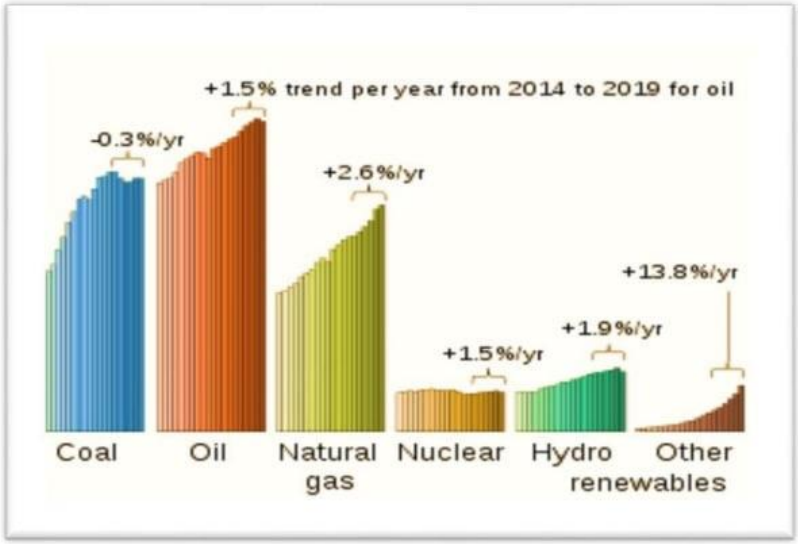


Figure 1.2: Global Energy Consumption 2019-2020. (R B Jackson et al, 2019)

3. Environmental degradation:

To open with, the Environment in terms were defined as the earth's components, which include: air, land, and water, all layers of the atmosphere, all organic matter and living organisms, and the interacting natural systems that include components referred to above. [1]

Since the beginning of human activity on the planet, environmental features have been changed dramatically. These changes increased rapidly with the beginning of what is known as the Industrial Revolution, which influences the environment in general, and presented the new issue of environmental degradation.

Apparently, Environmental degradation is one of the largest threats to our planet, and globally was considered as the most important issue that should be handled to protect our plant. By the way of illustration, The United Nation International Strategy for Disaster Reduction (UISDR) defines environmental degradation as "The reduction of capacity of the environment to meet social and ecological objectives and needs.

[1] Eyup Dogan , Roula Inglesi-Lotz, The impact of economic structure to the environmental Kuznets curve (EKC) hypothesis: evidence from European countries, Environmental Science and Pollution Research, Springer Nature,2020,p30

Neelam Garg, and Rajan Paudel (2011) asserted that environmental degradation affects our health significantly in various ways, either directly by exposing people to harmful factors, or indirectly, by disturbing life-sustaining ecosystems.

Approximately, Environmental degradation constitutes systemic destruction and depletion of the earth's ecological systems, such as water resources, air, plants, and the natural soil, which are the main sources of life. It appears in many aspects of our world that it causes air pollution, water pollution, toxic pollution, deforestation, and global warming.

The major causes of environmental degradation are urbanization, industrialization, overpopulation growth, deforestation, non-renewable, and fossil energy consumption etc.[1]

II- The relationship between globalization, energy consumption, and environmental degradation

First, there are several reasons to be interested in studying the relationship between globalization, energy consumption, and environmental degradation. The three major reasons are the future energy needs, environmental pollution from carbon dioxide (CO2) emissions, and the future of an integrated world economy.

Second, over three decades, academics and researchers have devoted a great deal of time to studying the linkage between globalization, energy consumption, and environmental degradation. In this section, we will discuss the relationship between different variables, and attempt to find the link between them.[2]

1. The relationship between globalization and energy consumption

To start with, Globalization's target is to benefit countries around the world by helping international trade to be more efficient, enhancing corporation competition, limiting political conflicts, and increasing human life quality. Since the 1940s, the global economy has been rose dramatically. In fact, various reasons helped to increase the global economy in that time; one of them is World War II. Moreover, the beginning of the 1950s, the global economy has

[1] Amine Lahiani al,), The Role of Globalization in Energy Consumption: A Quantile Cointegrating Regression, Op.cit.
[2] Cristina Teba, What does energy consumption mean? dexma Energy Intelligence, Posted on February 12, 2018

continued to grow furiously, and practically the industrial sector faces an increase in the global demand for products.

Therefore, the globalization term has been brought up to explain the rose of global cooperation and coordination among countries, and its influence on all aspects; politically, economically, social and cultural aspects …etc.By the way of illustration; in the economic aspect, the world GDP of the global economy has grown up significantly; the word GDP refers to the aggregate of all nation GDPs.

Figure1.4 shows that world GDP has been doubled from 12.40 trillion $ in 1955 to 24.84 trillion $ in 1971, and then the world GDP has registered a great increase till 2015 with more than 108 trillion $.

The total output of the world economy; adjusted for inflation and expressed in international-$ in 2011 prices

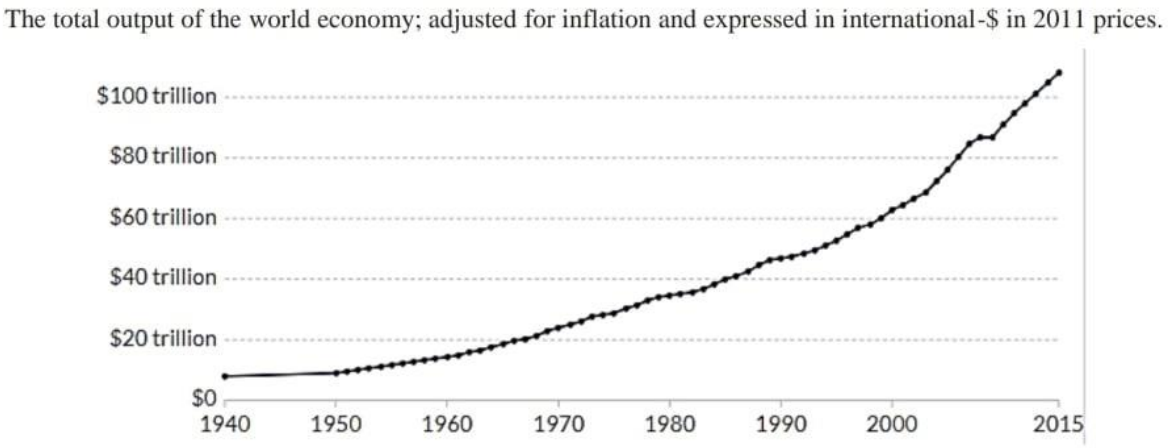
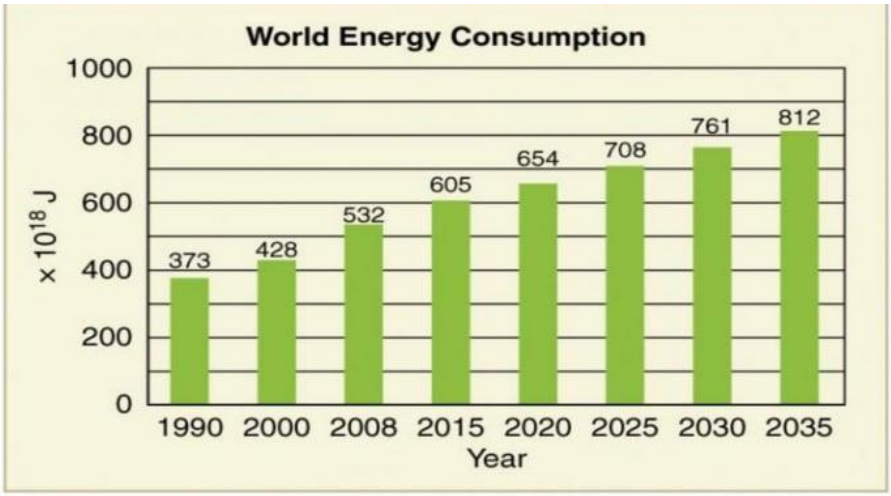


Figure1.4: World GDP from 1940 to 2015. (Our Word in Data)

Globalization has led to an era of economic and cultural integration. Also, it has driven international organizations and companies to work beyond its borders. With the advent of the 21st Century, globalization has been further fueled by rapidly advanced technology and improved communications, as a result, industrialization, transportation, and international trade become more interdependent between countries.

Also, Economic growth means an increase in real output (GDP), therefore, the increased output and consumption have driven the world energy consumption to continue rising, particularly, in developing countries. (See

Figure1.5). The global energy demand has doubled in the last 50 years and it is estimated to double again in the next 20 years.[1]



1Figure1.5: Past and projected world energy consumption. (Based on data from U.S. Energy Information Administration, 2011).

The top five countries for energy consumption are China, the United States, India, Russia, and Japan. Figure1.6 indicates that industry and transportation are the major consumers for energy, while residential and other sectors (including commercial, public services, and agricultural sectors... etc) are using less energy.

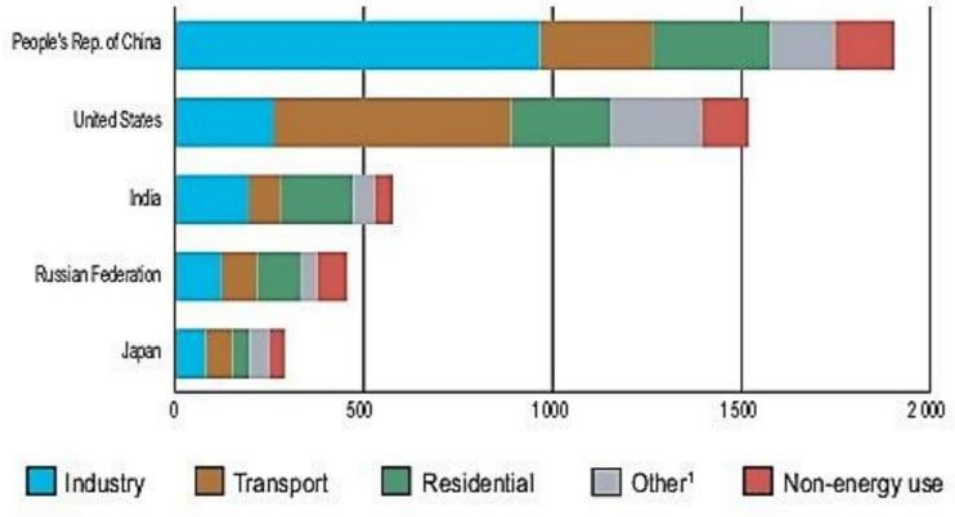


Figure1.6: The top five countries for energy consumption by sector. (International Energy Agency (IEA), 2017)

As the world becomes more globalized, total energy consumption will change; the demand and supply of energy will be more affordable. However,

[1] Cristina Teba, What does energy consumption mean? dexma Energy Intelligence,opcit.

this change will increase or decrease depending on several elements, one of them is globalization.

In the last decades, the reciprocal relationship between globalization and energy consumption has appeared strongly. Globalization has made the world into a single system, because countries nowadays are more connected to one another, throughout oil, gas resources (Buhari Dogan and Osman Deger, 2016), therefore, energy trade made globalization an embodied fact. In this sense, energy can be construed as an essential factor of globalization[1].

There also is a huge impact of globalization on energy consumption when energy has become a significant element for international policies as well as being a major input for production and consumption activities. It is observed that energy diversion helps to create multinational energy cooperation, which pushed to open many energy markets that are taking place in every part of the world, leading to the globalization of the energy markets.

Amine Lahiani et al, (2018) investigated the relationship between globalization and energy consumption. The findings of the study indicate that the positively correlation between globalization energy consumption in the long term for many countries. In addition, energy consumption is strongly related to globalization in the long term. However, the influence of globalization in the short term on energy demand is sometimes limited insignificantly for highly globalized countries.[2]

2. The relationship between globalization and environmental degradation

Globalization has a huge effect on our lifestyle. It led to rapid access to technology, improved communication, and mass production of goods. Environmental activists indicated that globalization drives to increase the consumption of products significantly, which has affected the ecological cycle. Not only increased the consumption of the product, but also leads to improve energy consumption, therefore Globalization increase the pressure on our environment.

[1] Amine Lahiani , al,The Role of Globalization in Energy Consumption: A Quantile Cointegrating Regression, Approach, Munich Personal RePEc Archive,2018,p12

[2] Amine Lahiani , al,The Role of Globalization in Energy Consumption: A Quantile Cointegrating Regression,opcit,p22

Globalization and economic growth have pushed to increase consumption of non-renewable resources and industrial waste accumulation, which produced higher levels of pollution, global warming, and the potential loss of environmental habitats.[1]

To analyze the tradeoff between non-renewable resources and consumption, the production possibility frontier curve (PPF) in Figure1.7 shows when consumption increases, the stock of non-renewable resources will decrease. For example, in the last century, rapid global economic growth has led to a decrease in the availability of natural resources such as forests.

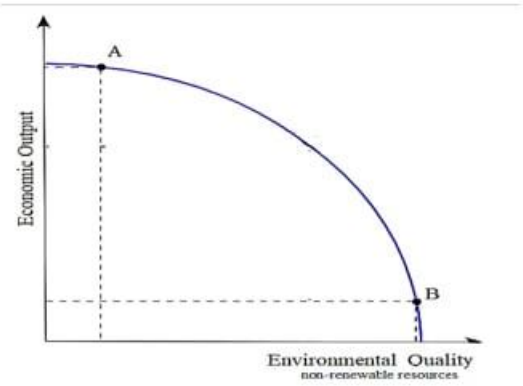


Figure1.7: PPF curve of non-renewable resources and consumption. (Tejvan Pettinger, 2019)

At one extreme, at the point A, a country would be selecting a high level of economic output but very little environmental non-renewable resources. At the other extreme, at a choice like B, a country would be selecting a high level of environmental non-renewable resources but little economic output. Globalization also has led to an increase in transportation and cement production, which increases CO2 emissions; also, the production cycle needs CO2 emissions and subtracts pollutants.

[1] Aisha Shahzad, What is Globalization - Historical Background, Jadavpur Journal of International Relations,2006, 10(1), p230.

Figure 1.8: World CO2 emissions from 1920 to 2019. (Our world in data)

This chart shows the growth of global emissions from 1920 until the present. between1920and 1940, CO2 emissions were low, also, in 1950 the world-emitted gasses were just over 5 billion tons of CO2. However, in 1990, it had quadrupled to 22 billion tons.

The CO2 emissions have continued to grow rapidly; nowadays, the world emits over 36 billion tons. (ourworldindata.org). Lv and You(2018) investigated the influence of globalization on CO2 emissions between 1985 and 2013 for eighty-five countries.

The results of the study indicated that economic globalization positively influences CO2 emissions; when the global economy increase, CO2 emissions increase instead so economic globalization negatively influences environmental quality.[1]

3. The Environmental Kuznets Curve (EKC) Hypothesis:

The Environmental Kuznets Curve (EKC) hypothesis explains an inverted U-shaped relationship between economic growth and environmental degradation (Figure: 1.9).

[1] Arifur Rahman , al, Evaluating the EKC Hypothesis for the BCIM-EC Member Countries under the Belt and Road Initiative, Sustainability Journal, 2020,12(4), P144.

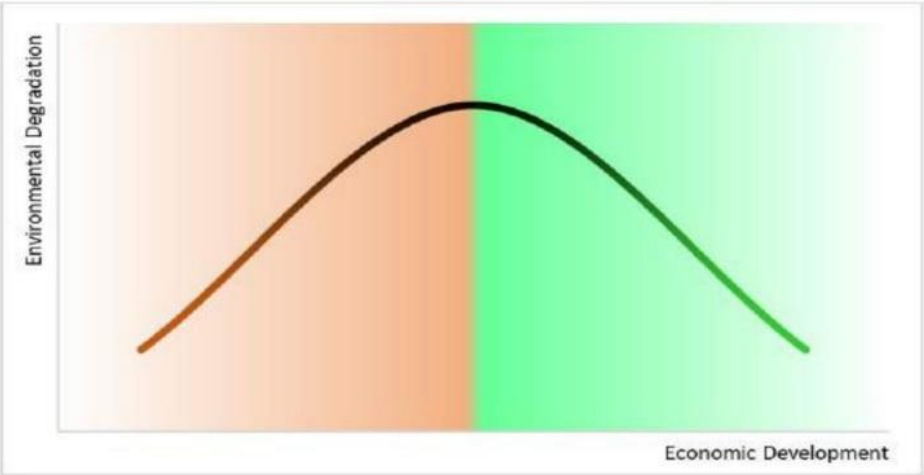


Figure1.9: The Environmental Kuznets Curve (EKC) (Nutnaree Maneejuk et al, 2020).

The environmental pressure increases in the early stages of economic growth due to the increased release of pollutants. Co2 is considered as a major greenhouse gas that has a huge effect on the environment; it was estimated at 76% of the total emission.

As CO2 emissions include emissions from all uses of fossil fuels for energy purposes, it is the primary gas emitted from human activities. The CO2 emissions do not only include emissions from buildings and household uses, but also industrial processes are the major factor of CO2 emissions.

Numerous studies have been done to prove the existence of the EKC hypothesis. Most findings of these studies are supporting the hypothesis that the U-curve relationship between economic growth and environmental degradation exists.[1]

For instance Rahman (2020) conducted a study, using the environmental Kuznets curve (EKC) hypothesis for the BCIM economic corridor (Bangladesh–China–India–Myanmar) under the Belt and Road Initiative (BRI) of China. (Arifur Rahman et al, 2020). Muhammad Bilal Khan et al (2021) also analyzed the relationship between globalization, energy consumption, and economic growth among selected South Asian countries. The study showed a causal association between energy consumption growth, CO2 emissions, and employed the premises of the EKC framework.

[1] Nutnaree Maneejuk , al, Does the Environmental Kuznets Curve Exist? An International Study, Sustainability ,2020, 12(21), P 91.

Also, the study indicated that there was a relationship between GDP growth and CO2 emission, as well as bidirectional causality between economic growth and energy use.[1]

Results show a significant impact on the CO2 emissions and destroying the level of environment regarding non-renewable energy and globalization index. However, negative and positive growth levels (GDP) and square of GDP confirm the Environmental Kuznets Curve EKC hypothesis in the region of South Asia.

However, there are also many studies that failed to approve the EKC hypothesis, as Muhammad Azam and Abdul Qayyum Khan (2016) who did not provide any evidence to support the validity of an EKC hypothesis for the countries investigated in their study.[2]

Conclusion

The global industrialization process has brought out the rapid economic growth in all countries. The continuous improvement of energy consumption, rapid economic growth leads to the rise of CO2 emissions. Therefore, the problem of global climate change was caused by the aggravation of CO2 emissions, which is threatening the survival and development of human beings and has become a worldwide concern.

To explain the relationship between CO2 emission and economic growth, various studies have been conducted throughout the last decades. Most of the latest analytical research, at the regional and global level, applied either explicitly or implicitly. One of the paradigms that focused on addressing the relationship between economic growth and CO2 emission is the EKC model. This model has linked CO2 emission to the rapid economic growth through the process of industrialization.

With the high energy consumption model of economic growth, many countries have become more fossil energy consumption, such as China's per capita carbon emissions is increasing rapidly. Facing such problems,

[1] Arifur Rahman et al, Evaluating the EKC Hypothesis for the BCIM-EC Member Countries under the Belt and Road Initiative, Sustainability Journal, 12(4),2020, P. 147

[2] - Nutnaree Maneejuk et al , Does the Environmental Kuznets Curve Exist?,opcit,p99

governments should make great efforts to take measures to reduce carbon emissions and advocate the development concept of "Green GDP."

Therefore, it is very important to develop a low-carbon economy and study the nexus among energy, environment, and economy. Many strategies might be adopted by countries to reduce the CO2 emission without affecting the level of economic growth, such as:

- Carbon Tax:

A carbon tax is the amount of money is paid as a fee imposed on the burning of carbon-based fuels (coal, oil, and gas). Moreover, a carbon tax is the most important policy used to reduce and eventually eliminating the use of fossil fuels, which causes combustion, destabilizing and destroying the climate.

- Renewable Energy

Renewable energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon-neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy should make up at least 50% of total global electricity generation. It is advised to turn to Green Energy as a source of energy, that because it would reduce the dependence on fossil energy.

- Transportation

Electric vehicles should be encouraged worldwide. Therefore, Countries should produce electric vehicles, at least 50% of the new car sales globally which is only 1% today. Also, It was suggested to double the mass-transit utilization in cities.

-Infrastructure

Countries should invest more to help cities to become fully decarbonize buildings and infrastructure. Countries should decarbonize cities and upgrade their building conditions to zero- or near-zero emissions structures.

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5-Betul Yalcin, (2018), what is globalization? Essay was written for the consideration of Prof. Peter A. Kemp during MSc. on Comparative Social Policy Programme at University of Oxford, 2008-2009 academic year. Published in Research-Gate website on April 2018. Visited on 01 April 2021.

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8-Eyup Dogan and Roula Inglesi-Lotz, (2020), The impact of economic structure to the environmental Kuznets curve (EKC) hypothesis: evidence from European countries, Environmental Science and Pollution Research, Springer Nature. https://link.springer.com/article/10.1007%2Fs11356-020-07878-2. visited on 04/04/2021.