
| RESEARCH ARTICLE

Assessment on the Applicability of Environmental Kuznets Curve Hypothesis on the Macroeconomic Factors Driving Carbon Dioxide Emissions in the Philippines

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| ABSTRACT

Since there is a lack of empirical literature in the Philippines that focuses on studying the validity of the Environmental Kuznets Curve Hypothesis, this study aims to build on succeeding studies testing the validity of the EKC hypothesis in the country. In the current study, we empirically investigate the long-run relationship between the annual Philippine Carbon Dioxide (CO₂) emissions as the proxy variable for Environmental Degradation, Gross Domestic Product per capita, net inflows of Foreign Direct Investment, Renewable Energy per capita, specifically for the period of 1981 - 2019. This paper also observed the Johansen Cointegration results in critically assessing whether the variables were conclusive to test in the long-run measure. For that reason, we investigated the validity of the EKC hypothesis by utilizing the ARDL long bound approach. Thus, our results revealed that a long-run relationship exists, but interestingly, the Environmental Kuznets Curve Hypothesis does not exist in the Philippines.

| KEYWORDS

Environmental Kuznets Curve hypothesis, CO₂ emissions; Gross Domestic Product per capita; net inflows of FDI, Renewable Energy per capita; ARDL long bound approach

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1. Introduction

1.1 Background of the Study

Emphasis on the promotion of higher economic growth has remained an important goal of government policy since history. Interestingly, the mobility of economic growth concerning its relationship with environmental quality has had interesting debates involving whether economic growth does improve environmental quality. In contrast, other literature has also discussed continuous economic growth but fails to recognize the importance of environmental conditions towards a more sustainable economic development. As the Philippines continues to improve its economic growth, this also brings interest to us on what the country has characterized in mitigating environmental degradation.

Achieving higher growth could also mean using natural resources (i.e., energy resources), leaving some debilitating effects on the climate (Al-Mulali et al., 2016). In response, most research recognizes the need to fix the repercussions of the rapid increase of carbon dioxide (CO₂) emissions and suggests sustainable actions to reduce CO₂ emissions. Of particular interest, there have been empirical studies that have concluded that Environmental Kuznets Curve (EKC) hypothesis applicability does not necessarily imply to all economies. It is also interesting to note that previous studies concerning the existence of EKC are frequently based on developed countries. Although there has been attention paid to the ASEAN region, previous studies revealed that the Philippines' EKC hypothesis is still non-existent (Dy et al., 2016; Chng Z., 2019).

As of writing, many environmental actions are taking place in place of sustaining the environment and economic growth. For instance, members of the United Nations have rapidly adapted to the 2009 Kyoto Protocol, 2015 Paris Climate Change policies and integrated the 17 Sustainable Development Goals. These environmental steps are a global movement attempting to develop practical solutions for environmental degradation and at the same time maintain the goal of economic development globally. To

widen the field of investigation, examining the existence of the environmental Kuznets curve is also crucial to understand the effect of this on the scale of activity, given that there is a higher demand for environmental quality (Haseeb et al., 2019).

The relevance of this study is that it continues to build on the progression of sustainable development with the continuous enhancement of the current quality of life. This study aims to examine the validity of the Environmental Kuznets Curve in the Philippines by exploring other economic variables, specifically, Gross Domestic Product per capita, net inflows of Foreign Direct Investment, Renewable Energy per capita, and Carbon Dioxide (CO₂) emissions. More concretely, we are also looking at the existing literature that builds on the validity of the EKC hypothesis. As previously mentioned, the current empirical studies have confirmed that the Environmental Kuznets Curve validity is evident in high-income countries. In this case, we are adapting the methodologies used in previous literature to test the EKC hypothesis's applicability in the country. More importantly, we aim to provide an in-depth explanation of our results and recommendations if the Environmental Kuznets Curve is not valid in the Philippines within our time-series data (1981-2019).

1.2 Statement of the Problem

Since there are only a few empirical findings on the Environmental Kuznets Curve focusing in the Philippines, we attempt to further supplement existing studies on the Environmental Kuznets Curve. At the same time, it is also vital to economically analyze the relationship among our research variables, specifically the relationship between our independent variables represented by Gross Domestic Product per capita; net inflows of Foreign Direct Investments; Renewable Electricity per capita, and dependent variables represented by Carbon Dioxide (CO₂) emissions. In doing so, we establish the following research questions:

1. **Do gross domestic product per capita, net inflows of foreign direct investments, and renewable electricity per capita have a relationship with CO₂ emission?**
2. **Is there sufficient empirical data to suggest that EKC Hypothesis exists in the Philippines?**

1.3 Formulation of Hypothesis

The Environmental Kuznets Curve hypothesis could also assess the mobility of economic development and the status of environmental quality. As this study covers datasets from 1981-2019 with the variables that describe the impact of Foreign Direct Investments, Gross Domestic Product (GDP) per capita, Renewable Energy per Capita on Environmental degradation, therefore, it is pertinent to deem the following hypotheses:

Hypotheses for Research Question 1: Do gross domestic product per capita, net inflows of foreign direct investments, and renewable electricity per capita have a relationship with CO₂ emission?

Null Hypothesis (H₀): There is no long-run relationship between Gross Domestic Product, Foreign Direct Investments, Renewable Electricity per capita, and Carbon Dioxide Emissions.

Alternative Hypothesis (H_a): There is a significant long-run relationship between Gross Domestic Product, Foreign Direct Investments, Renewable Electricity per capita, and Carbon Dioxide Emissions.

Hypotheses for Research Question 2: Is there sufficient empirical data to suggest that EKC Hypothesis exists in the country?

Null Hypothesis (H₀): There is no sufficient evidence to suggest that EKC Hypothesis exists in the Philippines.

Alternative Hypothesis (H_a): There is sufficient evidence to suggest that EKC Hypothesis exists in the Philippines.

1.4 Significance of the Study

Promoting a green economy and green growth are required to achieve sustainable development. On the same note, there is also a need to address sustainability's political, social, and economic aspects in achieving green growth and a green economy (Mishra,2020). Since the remarkable effects of climate change have become increasingly severe, it has steadily attracted global attention to providing public policies to address the problem.

Chng (2019) identified that global warming continues to pose severe remarks of environmental degradation having to do with economic activities, all contributing to the increasing Carbon Dioxide (CO₂) emissions. With the emergence of different global actions to address environmental degradation, it is not surprising that environmental issues have been part of the attention of both public and private institutions in recent years. More specifically, developed countries have been integrating environmental protection into their economic mobility.

This study is significant because it continues to build on the progression of sustainable development by continuously improving the current quality of life at a lower rate of resource use without compromising future generations by continually adding studies concerning the impact of macroeconomic indicators on environmental quality. More importantly, this study also provides adequate empirical evidence to fully understand the country's environmental quality in future government policies in addressing environmental degradation and its relation to economic growth.

1.5 Scope and Delimitation

As previously mentioned, literature in the Philippines concerning the validity of the Environmental Kuznets Curve has still been inconclusive. Although studies have examined the inconclusive results of the EKC hypothesis in the country, it is also worth recognizing that there are also existing studies in the Philippines in the last few years that have reported the apparent absence of the EKC hypothesis in the country. That is why there is also a need to revisit the previous studies that have reported inconclusive results, and from there, we would be able to empirically determine the current impact of the country's economic growth on environmental quality.

In fact, Bilgili et al. (2018) emphasized that the validation of the EKC hypothesis is responsive to the sample of countries chosen, the sample size, and the econometric method used, and that is why it is also critical to note that in this case, we attempt to adjust various variables based on the variables observed in countries where EKC has been confirmed to exist and also concurrently deploying thirty-nine (39) observations dating from 1981-2019. By using balanced panel data methodology, a careful and systematic investigation in carrying out the applicability of the inverted curve in the Philippines using the most recent sample of Gross Domestic Product, Foreign Direct Investments, Renewable Electricity per capita, and Carbon Dioxide (CO₂) Emissions in the Philippine setting.

2. Review of Related Literature

2.1 Existence of Environmental Kuznets Curve

Grossman and Krueger's early 1990s study of the possible consequences of NAFTA popularized the notion that economic growth is needed to preserve or increase the quality of the environment. The EKC theory depicts an inverted U-shape in the relationship between actual growth and CO₂ emissions. It demonstrated an increase in environmental degradation as real production increases during the early stages of economic growth. There is a decrease in pollution as economic growth accelerates after a threshold is reached, owing to technological advancements, eco-friendly domestic and foreign legislation, and increased public awareness, all of which contribute to a decrease in environmental pollution. In fact, a substantial amount of research confirmed the presence of EKC in countries throughout the world.

In Pakistan, Javaid and Zulfiqar (2017) discovered long-term correlations between tourism arrivals and carbon dioxide emissions and unidirectional relationships between tourist arrival and carbon emissions. Additionally, the relationship between tourism and the environment varies by country; for example, Egypt's impact was negative, while Tunisia's impact was positive, implying that the EKC hypothesis is confirmed. Consequently, Xu, N. (2018) analyzed the correlation between environmental degradation and economic growth using cross-sectional data from 31 Chinese provinces, counties, and autonomous regions. It showed that while China's wastewater treatment is advanced and technologically mature, exhaust gas treatment remains in its infancy. The research established an inverted U-shaped relationship between wastewater and economic growth and an inverted U-shaped relationship between exhaust gas and economic growth.

Energy usage had a strong positive relation with carbon dioxide emissions, while trade openness was negatively related to carbon dioxide emissions. On the other hand, growth had a positive relationship with CO₂ emissions. According to Dhrifi et al. (2019), Asian economies exhibited inverted U-shaped relationships, particularly foreign direct investment and carbon dioxide emissions. Similarly, the EKC hypothesis for Canada's greenhouse gas (GHG) emissions remained valid. Specifically, the researchers noted that the EKC hypothesis was also valid in provincial territories using fixed effect model regression (Olale et al., 2018). The energy consumption coefficient was significantly positive in Vietnam, indicating a strong relationship between climate and energy consumption. The study recognized that the coefficient value becomes negative when GDP becomes statistically significant, but GDP squared remains significant. This relationship established the presence of the EKC hypothesis in Vietnam (Ahmad et al., 2019). Ozturk and Sarkodie (2019) examined the factors contributing to environmental pollution in Kenya to create a healthy atmosphere by addressing climate change and its consequences. Four models were tested using the ARDL, SIMPLS regression, and U-test approaches on data covering 1971 to 2013. Further evaluations of the EKC hypothesis' precision energy efficiency and consumption metrics were also conducted. As carbon dioxide emissions rose, the combined effects of GDP per capita, energy use, and urbanization caused it to decline to its equilibrium point. In Kenya, both the U-Test and ARDL model estimated an inverted U-shaped curve, corroborating the EKC hypothesis.

Beyene and Kotosz's (2020) primary objective in their study was to use the PMG approximation technique to test the EKC hypothesis in 12 East African countries between 1990 and 2013. Political variables such as GDP per capita, GDP per capita squared, globalization, foreign direct investment, and population density in East African countries were incorporated into the model to determine their impact on CO₂ emissions. The research found that the long-run relationship between economic growth and CO₂ emissions is not inverted U-shaped, as Kuznets predicted, but rather a bell-shaped relationship. This measured correlation between GDP per capita and CO₂ emissions was negative before GDP per capita exceeded a certain level, which reversed to a positive relationship. Koilo, V. (2019) examined the relationship between economic growth and environmental degradation in eleven developing Eastern European and Central Asian countries, which covered 1994 to 2014. The following conclusions were drawn from the data analysis: The findings supported the Kuznets curve hypothesis for carbon emissions in Eastern Europe and Central Asia. Carbon emissions and economic growth appeared to be linked through an inverted U-shaped Kuznets curve.

Additionally, the projected income elasticities of carbon dioxide emissions varied in Eastern Europe and Central Asia countries. The authors concluded that, of the surveyed nations, Ukraine and Kazakhstan exhibited the most vulnerable economic growth responses to carbon dioxide. The following conclusions can be drawn based on the findings of both studies extracted from the analysis: in the long run, strategic policies such as environmental protection, the implementation of new pollution-reducing technologies, and the modernization of emerging firms are needed to ensure that countries' economic growth is effective in reducing CO₂ emissions (Demissew B. et al., 2019; Koilo, V. 2019).

The fluctuation of fossil fuel energy prices and the world's growing environmental pressures posed a significant challenge for the poor in developing countries, jeopardizing the world's solid foundation of energy stability, economic development, and sustainability. The results indicated that nonrenewable energy use, renewable energy consumption, and technological innovation played a significant role in determining Malaysia's carbon emissions (Jabarullah et al., 2018). Additionally, the findings suggested that economic growth and the use of nonrenewable resources had a beneficial impact on Malaysia's CO₂ emissions, meaning that nonrenewable energy sources and economic transition increased carbon dioxide emissions. Additionally, one could argue that all factors, including technological innovation, renewable energy use, and the square of economic growth, all contribute significantly to Malaysia's carbon dioxide emission reduction, suggesting the existence of an inverted U-shaped EKC curve in Malaysia. Anh et al. (2019) examined the relationship between CO₂ emissions, energy consumption, and renewable energy use (Indonesia, Malaysia, Myanmar, Philippines, and Thailand) in five nations. As is customary in the literature, the study employed both the standard Johansen cointegration approach and the bounds-testing approach to cointegration and ARDL bounds-testing, emphasizing the long-run coefficients. Surprisingly, the EKC hypothesis has been observed only in Myanmar and has a one-way effect on renewable energy adoption when GDP growth, energy consumption, and population are considered. Adebayo (2020) established in Indonesia that the EKC hypothesis is valid.

It is widely accepted that the primary cause of global warming is the rise in carbon dioxide emissions (Fong et al., 2019). According to a World Bank survey, global CO₂ emissions increased dramatically during 1960 and 2014, from 9385.8 million tons to 36,138.3 tons (World Bank, 2018). Construction and manufacturing industries, in particular, are significant economic sectors and significant contributors to global CO₂ emissions. Chen et al. (2019) used the EKC model to determine the three-CO₂ emission characteristic turning points in 121 countries between 1960 and 2014. 95 out of 121 countries were found to accept the EKC hypothesis.

Additionally, the researchers discovered that the higher the income level, the more significant the proportion of nations in which the EKC hypothesis is verified and the turning point is reached. In contrast to the results of the ARDL panel of Zhang, J. et al. (2020), the EKC hypothesis continues in Asia's underdeveloped emerging economies. In this case, both the economic growth indicator and its squared term exhibited positive and negative signs, consistent with EKC's validation claim. Amisshah et al. (2019) examined the relationship with trade and a proxy for environmental pollution, carbon dioxide emissions by integrating growth in the economy, and energy use as major determinants of this relationship for 49 high-emission countries in the Belt and Road regions from 1991 to 2014. The researchers separated these countries into income panels (high, middle, and low) and regions (East Asia, Southeast Asia, Central Asia, South Asia, the Middle East/Africa, and Europe) for a more in-depth study. Panel cointegration experiments showed that the independent factors were stationary in the long run. Comparably, the panel findings showed that trade openness had both beneficial and detrimental effects on environmental emissions. Still, the impact differed between these different groups of countries, with the environmental Kuznets curve (EKC) indicating an inverted U-form relationship between trade and carbon emissions.

Following the EKC hypothesis introduction, several observational studies were conducted using observations of countries of different sizes and with distinct types of contaminants assessed over various periods, yielding various findings regarding the EKC's validity. According to Fang et al. (2018), who used industrialized wastewater and sulfur dioxide as indicators of environmental pollution in cities throughout the People's Republic of China from 2004 to 2013, the EKC hypothesis holds only for areas with a greater degree of transparency; cities with a greater degree of openness produce less industrial wastewater but more SO₂.

Similarly, in their 2020 study, Fong et al. (2020) analyzed the income and pollution trajectories of three air pollutants—nitrogen oxides (NO_x), sulfur dioxide (SO₂), and fine particulate matter (PM_{2.5})—used standard EKC frameworks that equated per capita emissions with a range of macroeconomic variables. The quantitative study used data spanning 1993 to 2012 for nine Southeast Asian countries at different stages of economic development. An inverted U-shaped curve is discovered for all pollutants, suggesting the existence of an EKC.

In conclusion, some research indicates a positive correlation between economic growth and carbon emissions, whereas others showed a negative correlation. Similarly, one can say the same thing about energy, carbon emissions, and economic growth. Most of the research studies examined the EKC hypothesis by assembling a group of developing and developed countries. Policy guidelines for countries are often necessitated by introducing new enabling policies to implement renewable energy and energy-efficient projects on these mixed results. Developing economies promoted the growth and adoption of reduced carbon concepts and systems and established a renewable energy system. More attention must be paid to implementing efficient innovations and environmentally friendly policies that will boost the manufacturing sector while mitigating the negative environmental impact of CO₂ and other GHG emissions (Zhang, J. et al., 2020).

2.2 Non-existence of Environmental Kuznets Curve

The existing literature on the Environmental Kuznets (EKC) curve in high-income economies has extensively focused on carbon dioxide emissions. Several studies have had significant attention on carbon dioxide emissions as the explanatory variable. In recent years, emphasis has also been placed on empirical evidence on other macroeconomic indicators representing environmental degradation. However, it is worth noting that research is underway to determine whether the Environmental Kuznets Curve (EKC) hypothesis does not hold in particular economies.

Meanwhile, the ASEAN region has not included foreign direct investment in their variables, at least in the period covered, similar to the study. Since the researchers have adopted Hossain's research, which deployed the Pollution Haven Hypothesis, the study also included FDI, where authors also assumed the Pollution Haven Hypothesis. That means the Philippines is augmented to increase the carbon dioxide emission, confirming the pollution haven hypothesis. Thus, the authors stated that high-income economies practice polluting industries with countries with inconclusive environmental measures. Apart from energy consumption as the primary contributor to carbon dioxide emissions, it is believed that FDI impacts carbon dioxide emissions.

Concerning the Association of Southeast Asian Nations (ASEAN) region, which includes the Philippines, the findings were critical in defining the relationship between energy consumption and economic development. Renewable energy and agriculture based on carbon dioxide revealed the absence of EKC in selected four countries in the region (Indonesia, Malaysia, the Philippines, and Thailand) (Liu et al., 2017). Additionally, in the same ASEAN region, findings indicated that economic development, energy consumption, renewable energy use, and environmental pollution all have a cointegration relationship in Indonesia, Myanmar, and Malaysia. Additionally, the authors discussed that cointegration does not occur in the Philippines (Anh et al., 2019). It is interesting to note that EKC existed in Myanmar, in contrast to Indonesia, Malaysia, the Philippines, and Thailand, where EKC was invalid. In light of the ASEAN region's recurrent emergence of sustainable development goals, findings had consistently indicated that the EKC is inconclusive in Indonesia (Galuh Nuansa & Widodo, 2018). Although these studies disproved the absence of EKC in these ASEAN countries, the authors also demonstrated the consistency of methodology used in the current literature. The empirical results were evaluated using cointegration measures, the ARL model as a Granger Causality Measure, and the vector error correction model autoregression (VECM). Indeed, this also substantiated the argument that knowing whether researchers' results were indicatively dependent on the Granger-causality test's singularity was insufficient. Rather than that, the authors realized that it was more fitting to perform a short-run Granger-causality test if the model's recurrent equation lacked cointegration. In contrast, the long-run causality test was unfamiliar. Additionally, it included a vector autoregression (VAR) system in which the emphasis is on the difference between the variables, equating to static analysis of the variables used.

Similarly, high-income countries in Asia have shown that the EKC hypothesis was inconclusive (Ota, 2017). What appeared to be the difference in the supposed inverted U-curve was the irregularities surfacing in the changing relationship of the carbon emissions (CO₂) and income per capita. For South Asian economies, in terms of environmental degradation, it was also clear that the authors have also incorporated the emerging variables adapted by existing literature: renewable energy use, foreign direct investment (FDI), financial development, and institutional quality. That focus area emphasized the level of economic development occurring in South Asian countries. As highlighted by the authors, it further supported in-depth empirical findings on the EKC analysis (Xue et al., 2021). Despite the resemblance of estimation models used in the study (Panel Unit Root Analysis, Panel Cointegration Analysis, and Panel Regression Analysis), the authors have further asserted that environmental policy was insignificant to countries with a low level of industrialization. The same sense for financial development and institutional quality highlighted the importance of stringent ecological policy. Simultaneously, the authors had also recognized the technological and

infrastructural constraints that limited the enhancement of sustainability when it comes to renewable energy; however, that, in essence, altered the result of the non-existence of the EKC hypothesis in Asian countries.

Concerning the 26 high-income countries of the Organisation for Economic Co-operation and Development (OECD) for the period between 1980 and 2010, the study has shown that EKC does not hold in these countries (Özokcu & Özdemir, 2017). The authors argued that the panel data results resulted in an inverted N-shape, which significantly explains the insufficient improvements in mitigating environmental degradation. The authors needed to reiterate the appearance of the N-shape curve for 26 high-income countries in OECD. This study used two analyses to distinguish the added per capita energy use used as an explanatory variable aligned with previous literature. Specifically, that is to determine the movement of energy, environment, and economic growth in line with EKC.

Moreover, they highlighted the consequences of energy use inclusion in the research domain. From the study's findings, the increase and decreases of CO₂ emissions were inconclusive. In fact, they also explained that N-shape has an irregular cycle, Carbon emissions decrease and increase inconsistently. However, they also acknowledged that previous studies used polynomial regression to test the hypothesis. Furthermore, this substantiated the claim of the EKC's invalidity since the focal point of the study's methodology was the use of a different econometric model, in this case, the cubic term.

The most striking pattern characteristics of this existing literature were that even when it comes to the Group of Seven (G7) countries, the EKC hypothesis was still invalid. For one, EKC is non-existing in Canada alongside Germany, Italy, Japan, the United Kingdom, and the United States of America (Isik et al., 2020). While the attention has been given to developed countries, particularly the G7 countries, it was also apparent that for the low globalized countries (LGC), EKC was also non-existent. Relevant to previous literature, the study has also utilized cross-sectional time-series data (CD) approach, incorporating a panel bootstrapping cointegration approach. However, the study conducted by (Isik et al. (2020), contrasting with existing literature, demonstrated a different estimation model using the covariate-augmented Dickey-Fuller (CADF). The study asserted that this allowed to have an increase in the efficiency regarding the regression tests' and, at the same time, allowed to have concise assumptions after the result of findings. From these empirical findings, it is interesting to note that these studies revealed slope heterogeneity in their research domain. In contrast, the process of contextualizing that the parts are cross-dependent to each other, the null hypothesis at a 1% significance level, makes it very clear that no cross dependencies (CD) are strongly rejected. Furthermore, despite the conformity with the estimation models (cross-dependence testing), the authors asserted that renewable energy, in the long run, does not necessarily influence the mitigation of CO₂ emissions (Leal et al., 2020).

Taking into account what was previously mentioned, these studies proved that the EKC was non-existent. The authors have also argued that necessarily was not conclusive with the explanation that as income increases, carbon emissions also increase, vice-versa. In contrast to the existing literature on EKC income increases, carbon emissions also increase, but the decline has reached the turning point. Interestingly, the authors have asserted that EKC is only valid for high-income regions with access to renewable energy. More importantly, renewable energy played a pivotal role in substantiating whether the EKC exists (Isik et al., 2020; Leal et al., 2020)

2.3 Criticisms of Environmental Kuznets Curve

As a result of the EKC, numerous economic development experts concluded that environmental concerns associated with growth are resolved expeditiously during later phases of economic development. Proponents of the EKC agreed that the hypothesis that expanding economic activities degrades a country's environmental resources holds only if a nation's preferences, tastes, technology, and investment in the environment remain constant. Nonetheless, technological advances and consumer tastes turn toward a more environmentally friendly climate in a competitive economy. As a result, economic development is a way of achieving a livable environment rather than a challenge.

Before the EKC hypothesis, the controversy centred on the planet's finite capacity to absorb industrial and urban waste. Nonetheless, the EKC moved the focus away from the shortage of environmental resources and the inevitability of economic development to solve pollution problems (Gill et al., 2017). Specific objections seemed to oppose the findings of the current literature validating the Environmental Kuznets Curve (EKC) theory. After decades of existence, critics have noted that changes in development policies have been focused on pro-growth, oblivious to other environmental destruction that could arise during periods of rapid economic growth (Gill et al., 2017).

Nnyeneime U. (2018) asserted that an EKC pattern was suitable only for large countries before the 1970s oil crisis. One explanation for this is that, after the oil crisis, only a tiny proportion of rich countries increased their energy consumption while the rest of the world's output fell. The majority of developing countries could not expand due to historical entanglements such as rural exploitation, persistently low export rates, unfavourable relationships with international companies and banks, and a lack of geopolitical power (Gill et al., 2017). As a result, many developing countries cannot match the growth rates of developed countries,

owing to the existence of these world powers. Similarly, the Pollution Haven Hypothesis (PHH) asserted that developed countries have made sufficient progress and will face significant environmental damage in the future. Indeed, they would almost certainly replace domestic polluting manufacturing with imports from developing countries with laxer environmental protections (Chen et al., 2019). As Gill et al. (2017) pointed out, developing countries would not import polluting products from additional countries in our finite world. Under specific scenarios, developing economies would be wise to reduce their consumption of polluting goods at the expense of economic growth rather than exporting them to those other nations.

Australia emits 17.27 tons of carbon dioxide per capita, the United States emits 16.6, Canada emits 15.69 tons, and South Korea emits 12.7 tons, according to the International Energy Agency (2019). Japan emits 9.09 tons per capita, the European Union emits 6.7 tons, and China emits 7 tons per capita. These developed countries' economic activities need such high environmental costs that the rest of the world will not afford them in the future. Comparatively, emerging countries that have pursued industrial growth vigorously now face severe water and air pollution problems. Additionally, Gill et al. (2017) noted that given the current pattern of the wealthy consuming more oil, increased wealth would increase environmental resources consumption. It will be a little practice in which we increase wealth on the one hand while depleting the resources of the earth on the other. For developing nations, emission control technologies are prohibitively costly. Pollute first, then clean up with expensive technology. Due to the high level of mass consumption at the early stage of development, various types of emissions continue to increase, implying that this growth model may create environmental problems (Haseeb et al., 2019). Economic growth that was capable of rapidly reversing patterns comes at a high social and environmental cost. As a result, one can conclude that EKC's strategic objective of "grow now, clean later" might not be the most resource-efficient. According to Gill et al. (2017), some argued that these extraordinary environmental losses could be avoided by concurrently addressing climate change and economic development. As per Gill et al. (2017), environmental protection during the early stages of economic growth will result in a 1% loss of global GDP, while environmental neglect will result in a 5–20% loss of global GDP. Among the casualties are decreased agricultural productivity, coastal erosion and flooding, extreme weather events, and a food production attack. It is fair to say that progress has taken place at this stage. Purification of water was not a Pareto-efficient strategy. Environmental losses may be reduced when both climate and economic development are prioritized.

A trend of EKC can be adequately explained by structural shifts, technical advancement, and international commerce. However, these primary drivers refer only to the production side of an economic system and do not take the consumption side into account (Gill et al., 2017). Economic activity is often influenced by manufacturing and consumption processes, and demand drives all related products' production, acquisition, and selling. If imports were essential to meet domestic demand, this effect was ignored in an EKC study solely concerned with domestic production. As a result, EKC tests should account for shifts in the income elasticity of hazardous chemicals. If the price elasticity of production remains constant, aggregate demand in developed economies can be satisfied by developing-country output (Nnyeneime, 2018).

Additionally, suppose final economic consumption continued to be polluting. In that case, any possible benefits of increased production on emissions (via structural changes or technological progress) will be cancelled out by an increase in demand for polluting products. As a result, economic consequences outweighed environmental degradation. Despite substantial strides in sustainable growth, developed countries continue to engage in harmful consumption practices, as shown by household waste and CO₂ emissions. Developed nations may have increased their energy use, while polluters may have migrated to create nations. They have not changed their tastes, and they continue to consume energy-intensive products (Gill et al., 2017). Attempting to disentangle the relationship between economic growth and environmental degradation can require detaching consumption and economic activities. All patterns must be considered in EKC studies; otherwise, results can be incomplete and misleading.

Furthermore, as (Haseeb et al., 2019) pointed out, if developed countries can satisfy their demand for polluting products by imports, the latter would not pass on environmental harm development to all other emerging economies. As a result, it is unlikely that existing global conditions and interactions will continue in the future. There is no guarantee or guideline that the historical background of today's developed countries will be replicated or followed shortly by today's developing countries. Nothing else indicated that emerging economies followed the same growth trends as developed economies and will inevitably collapse into the EKC trend's downside section.

What appeared to be the bottom line of Gill et al. 's (2017) criticism is that the EKC relationship emphasizes the importance of economic growth in developing countries regardless of the environmental costs. It critically highlights the primary goal of countries being economically stable. Later on, it will discuss the environmental repercussions since it is believed that economic growth compensates for the recurring damages. That means policies being developed are not solely about environmental policies but more about resisting the economy's slowdown. It is also worth mentioning that regardless of the empirical findings showing the existence of EKC in developed and developing countries, such critics have also questioned the environmental costs that economic

growth brings. Furthermore, Gill et al. (2017) also argued that these policies are mainly based on the priority of conclusive economic growth.

Interestingly, it also raised another concern that existing empirical findings of EKC failed to. For one, to date, no country has been successful in regulating these emissions, whether the study deals on "sulfur dioxide (SO₂), carbon monoxide, nitrogen oxides (NOs), particulate matter, urban garbage, and water pollution" (Gill et al.,2017). In other words, empirical studies on the validity of EKC failed to provide concrete answers to counter the magnified environmental degradation.

Since technological advancements significantly contributed to environmental improvement, Gil et al. (2017) also specified that developing economies faced difficulties in technological progress, which substantially supported the suggested recommendations of the present studies that developing countries were still finding economical solutions to adapt to technological changes advancement. The economic development scheme stressed that the most significant contributors to climate change and global warming are not underdeveloped and developing countries. Instead, it highlights the importance of finding the balance between environmental improvement and economic development. Although there were relevant criticisms of the EKC's arguments, the authors have also recognized the importance of economic growth. In assessing environmental improvement progress, the study has also identified that refuting to promote economic growth has a financial consequence. It emphasized the importance of technological advancements in achieving economic development and environmental improvement.

As previously mentioned, there are empirical studies on EKC that have a wide range of research domains. However, the problem surfaced on limited pollutants of datasets representing environmental degradation (Gill et al.,2017). Most studies have covered panel data from 1970 until the existing data is readily available, highlighting that this data set is already invalid (Gill et al.,2017). In line with the group of data being used in the existing studies, the authors have also indicated that many environmental problems have yet to be uncovered in future empirical studies on EKC, which explains why most studies have solely focused on carbon emissions.

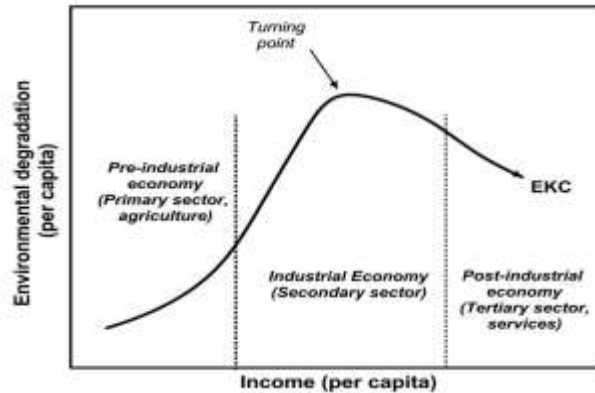
2.4 Synthesis

Based on the previous studies, there was inconclusiveness in the validity of the Environmental Kuznets Curve. It was very apparent in our literature review that not much attention has been given to the Philippines. Although we previously mentioned that there is a study by Anh et al. (2019) focusing on the ASEAN region that has included the country. However, net inflows of Foreign Direct Investments and Renewable Electricity per capita are not part of the research domain, and this builds on the studies by Koilo (2019) and Xue et al. (2021). Of particular interest, however, it should also be noted that existing studies on EKC have used different proxies on environmental degradation (Isik et al., 2020; Xue et al. 2021; Zhang et al.,2020). Moreover, studies presently underscored previous criticisms aiming to cover the lack of data regarding environmental degradation. Emerging studies seek to have a broader area of coverage. It is not surprising that local and international efforts are geared toward fostering complete data sets from a specific time of period, and at the same time, specifying different environmental variables that support the Environmental Kuznets Curve hypothesis validity.

2.5 Theoretical Framework

The Kuznets Curve depicts the changing relationship between income quality and per capita income, which can be observed empirically and figuratively using the most recent economic analysis techniques. The theory's supporters believed that income distribution is unequal at various stages of income growth. On the other hand, income distribution appears to become more balanced as the economy expands. According to Simon Kuznets, as income per head (per capita) increases or rises, income inequality will rise initially after a maximum point starts to decline. More economic development, services, improved technology, and knowledge dissemination limit an economy's material base and result in less environmental.

Figure 1: Environmental Kuznets Curve (as adapted by Kaika & Deitra, 2013)



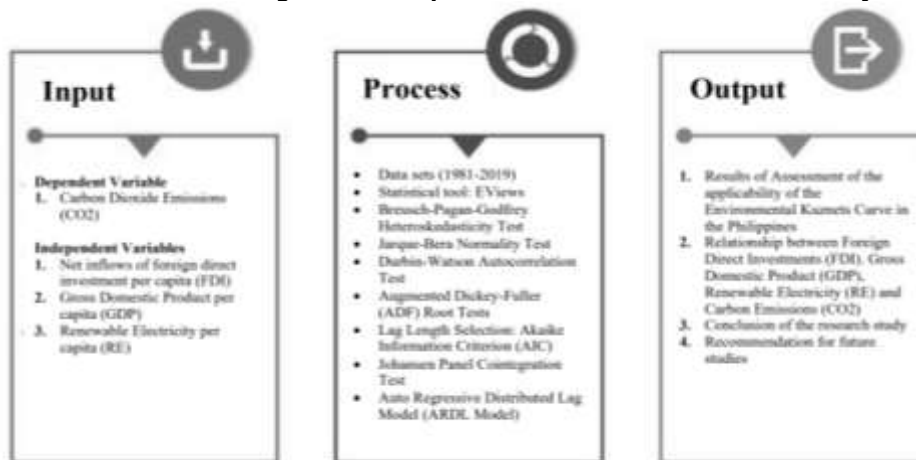
Numerous studies have attempted to test the theory using various indicators of environmental depletion. Still, substantial literature has examined the importance of variables other than income that might also contribute to an EKC pattern. Foreign trade (the pollution haven hypothesis), income distribution equity, economic developments, technological progress and advances in energy conservation, organizational structures and governance, and, ultimately, consumers' preferences are all examples of such causes. The significance of these factors can suitably or partly account for a possible EKC pattern (Beck, K & Joshi, P., 2017).

Grossman and Krueger discovered evidence in 1991 that, although some pollutants increase with income at low-income levels, a tipping point is reached at higher income levels, and continued income growth results in decreased pollution where it is illustrated. Similarly, the World Bank's 1992 World Development Report noted that "as incomes increase, so does the demand for environmental quality improvements, as well as the resources available for investment" (Karsch, 2019). Additionally, this seeks to establish an inverted U-shaped relationship between per capita income and environmental degradation.

It argues that environmental deterioration accelerates during economic growth and development's early stages. Nonetheless, after each economic development threshold, the co-movement appears to reverse. The Kuznets curve is referred to as the Environmental Kuznets curve (EKC) in the following analysis when it is used to examine the relationship between climate, wealth, and emissions (Chen et al., 2019). According to Bansal et al. (2019), a society must use natural resources, which may have some residual effects on the environment, to achieve prolonged and sustainable development. That results in people becoming insensitive, which results in them becoming more concerned with financial gain than with the environment in which they live.

2.6 Conceptual Framework

Figure 2. Conceptual Framework of the Research Study



Based on the variables from our literature review, we identified that carbon dioxide emission (CO2) is the dependent variable and foreign direct investments (FDI) and Gross Domestic Product (GDP) respectively as our independent variables in the research domain. That means we are to test the causality relationship between the variables, specifically, whether FDI and GDP impact CO2

emissions, and in particular, we are deploying several econometric techniques. More precisely, the economic techniques involve data sets from 1981-2019 with 39 observations. In doing so, our empirical content will be run by the Autoregressive Distributed Lag regression model. Subsequently, we will also apply the Durbin-Watson Test, Heteroskedasticity Test: Breusch Pagan-Godfrey and Jarque-Bera Normality Test. At the same time, we are also considering the possible multicollinearity; that is why it is also essential to also use the Variance Inflation Factors in the study. From this point, we can determine the assessment on the applicability of the Environmental Kuznets Curve in the Philippines and provide recommendations for future studies building on the EKC literature in the country.

3. Research methodology

3.1 Data Gathering and Model Specification

The dataset used in this analysis is obtained from the Our World in Data (OWID) database and spans 1981 to 2019. The dependent variable, CO₂ emissions (CO₂), is estimated in metric tons per capita. It is also worth noting that GDP per capita constant 2011 US\$ is used to measure economic growth, and net inflows of foreign direct investment and electricity per capita will also be included. Moreover, Our World in Data is a Science online journal that focuses on major global issues, including poverty, disease, hunger, climate change, war, existential threats, and inequality, based at Oxford University. It is a Global Change Data Lab project, an English and Welsh registered charity created by Max Roser, a social historian and development economist.

The study uses software programs such as MS Excel and Eviews in presenting the findings. The natural log of all the series will be deployed to confirm the normality. In this case, the study will have a representation of the regression model stated as:

$$\log\text{CO}_2t = \beta_0 + \beta_1\log\text{PGDPPCt} + \beta_2\log\text{PFDIt} + \beta_3\log\text{PREPC} + \epsilon t$$

Equation 1. An empirical model of the study

In the empirical model of the study (**Equation 1**), **CO₂** is the carbon dioxide emission level in period *t*, measured by metric tons per capita, and it also acts as a proxy for environmental deterioration. To interpret the elasticity of the parameters, both dependent and independent variables are translated into logarithmic form. **PGDP** denotes per capita income in constant 2011 US dollars. **PFDI** is the net inflow of foreign direct investment measured in constant 2011 US dollars. Furthermore, **PREPC** is the annual average renewable electricity per capita, measured in kilowatt-hours (kWh) per year. Lastly, ϵt is the standard error term. GDP per capita (PGDP) and net inflows of foreign direct investment (PFDI) are all projected to affect CO₂ emissions positively. CO₂ emission level (CO₂), whereas renewable electricity per capita (PREPC) is negatively linked to CO₂ emissions.

3.2 Research Design and Approach

This study utilizes a correlational-quantitative approach for assessing the applicability of the Environmental Kuznets Curve Hypothesis on the Macroeconomic Factors Driving Co₂ Emissions in the Philippines. More concretely, this study also deploys the following:

3.2.1 Correlational Analysis

The correlational analysis utilizes statistical evidence to determine the strength of the association among two or more variables. This type of analysis detects trends and patterns in data and therefore does not prove the causes of the observed patterns. This type of observational study is not causal in nature. Only each variable, relationship, and distribution of parameters are examined. Rather than manipulating variables, they are identified and observed in their natural state. Furthermore, this study will employ an autoregressive distributed lag model (ARDL) long bound testing approach to ascertain the long-term relationship between our study variables. Four variables are used in this case: carbon dioxide (CO₂) emissions, gross domestic product (GDP) per capita, net Foreign Direct Investment (FDI) inflows, and renewable energy consumption per capita.

3.2.2 Time-Series Analysis

A time sample is a set of daily time-ordered observations made at consecutive, generally central, points in time of a quantitative property of an entity or collective phenomenon. Specifically, this study will cover the data sets of our variables of interest from 1981-2019.

3.3 Statistical Tool

Since this study requires time series analysis, this study uses Eviews in computing the diagnostics and tests. EViews is a Windows-based statistical package that is used mainly for time-series oriented econometric analysis. Specifically, EViews assists this study in locating problems or violations in our data series.

3.4 Statistical Treatment

The following experiments are carried out to analyze further and interpret the collected data and knowledge. This study uses statistical techniques, especially regression analysis and multiple regression, in explaining the relationships between variables. At the same time, this study uses various regression in establishing a self-weighting estimation equation for predicting Co2 emissions from the gross domestic product, foreign direct investments and renewable energy. More importantly, it keeps track of the confounding variables to help assess their contribution.

3.4.1 Diagnostic Tests

In our research, diagnostics is a subset of regression analysis wherein the main purpose is to determine whether the model and the underlying presumptions about the data and the model are consistent with the observed data. Such diagnostics include graphical and numerical tools for determining the suitability of our model's assumptions in relation to the data and its form, identifying outliers that may dominate the regression and thus distort the results, and determining whether strong relationships between the independent variables which affect the results.

3.4.2 Augmented Dickey-Fuller Unit Root Tests

Our study uses Augmented Dickey-Fuller root tests, and this enables the determination of the stationary features for a long-term relationship of the time series data. The existence of a unit root in our variables, namely, carbon dioxide emissions, gross domestic product, foreign direct investment, and renewable energy, is determined using the augmented Dickey-Fuller technique. The test's null hypothesis is whether the variable has a unit root, implying that it is not stationary. The H0 is rejected if the variables' parameters do not have statistical significance. At the level of the I(1) process, all of our variables are projected to be non-stationary but will become stationary after conversion to the I(0) process.

3.4.3 Vector Autoregression

Prior to doing the ARDL bound test to determine whether or not there is cointegration within carbon dioxide emissions, gross domestic product, foreign direct investment, and renewable energy, it is critical to choose an acceptable lag order for our variables. The optimal lag order of the vector autoregression (VAR) model was used in our investigation to determine the suitable lag order.

3.4.4 Johansen Panel Cointegration Test

Johansen cointegration test is done to examine the cointegration among our variables. The Johansen test and estimation technique are helpful in this study since we have multiple variables that maximize the probability. In this case, this allows for the estimation of all cointegrating vectors in the research domain. Our study employs cointegration to examine the robustness of existing long-run connections among CO2 emissions, GDP, foreign direct investments and renewable energy.

3.4.5 Autoregressive Distributed Lag Model

To examine the role of gross domestic product, foreign direct investment, and renewable energy in the Philippines' EKC, we employ Pesaran et al. (2001) ARDL's technique for long term relationships. Using the ARDL approach, the current study first estimates the F-statistics significance using the appropriate ARDL frameworks. This method eliminates the typical endogeneity problem (where an independent variable and an error function have a relationship), enables continuous computation of short and long-run parameters, and permits analysis on the estimated long-run coefficients. In our work, we used the bound testing method to detect a long-run link between our variables in the model by running a free regression equation.

4 Findings and Data analysis

4.1 Unit Root Test Results

The non-stationarity of the data set generates a major issue. Non-stationary series in a data set prevent regression from estimating and interpreting relationships. Most economic variables are non-stationary—the unit root test checks stationary. Individual parameters are assessed here by Augmented Dickey-Fuller (ADF) test, and thus the results are summarized in Table 1. The variables under study are trended at their level, as unit root results indicate that the PCO2, PGDP, PFDI and PREPC are not stationary. On the other hand, the findings show that at the first level of differentiation, all criteria are relevant. This indicates that the null hypothesis of the unit root can be ruled out. As a result, the variables are held constant at the first difference.

Table 1: Results of Augmented Dickey-fuller Unit Root Tests

Variables	Level		First Difference	
	Intercept	Intercept and trend	Intercept	Intercept and Trend
PCO2	0.9979	0.9371	0.0009	0.0018
PGDP	1.0000	0.9245	0.0089	0.0030
PFDI	0.0478	0.0691	0.0000	0.0000
PREPC	0.0456	0.1789	0.0000	0.0001

Note: The length of the lag was determined automatically using the Akaike Information Criteria (AIC).

Table 1 shows that all variables of interest, specifically CO₂ emissions, gross domestic product, the inflow of foreign direct investments, and renewable energy per capita, have indicated a unit root test at the level difference. In other words, at the level difference, the variables are non-stationary, which is evident in the values of intercept and intercept and trade, which is all greater than the 0.05 p-value. However, it is surprising that in the study of Anh et al. (2019), at the level difference, all variables of their interest in the ASEAN region have already indicated that the variables are stationary. To see whether the variables are cointegrated, we must consider the results of the ADF unit-root test at the first difference. It was apparent that all values were lower than 0.5.; that means at the first difference, the values have indicated that it is stationary across all variables concerned. Meanwhile, it is essential to note that we disregard the unit root test for the level difference as it appears that there is a unit root test. Therefore, at the first difference, the CO₂ emissions, gross domestic product, the inflow of foreign direct investments, and renewable energy per capita have no unit root test at a statistical significance of 5 %.

4.2 Cointegration Results

After determining that the indicators are stationary at 1st difference using the ADF Unit Root test, the Johansen cointegration test is used to evaluate the parameter settings' long term relationship. Each variable in the model should be constant, and there should be no cointegration between the variables. The Johansen cointegration test was performed to evaluate to see if the variables were cointegrated. We employ the lag length determined by the information criterion below to measure the cointegration relationship. Table 2 presents the results of the Johansen cointegration test. The lag identified is one that can be quantified using criteria such as the Akaike information criterion (AIC), the Hannan-Quinn information criterion (HQ), or the Schwarz information criterion (SIC).

Table 3 shows the Johansen cointegration test results. The results indicate that the trace statistics and max-eigenvalue show the existence of two cointegrated equations.

Table 2: Results of Information Criterion

Lag	AIC	SC	HQ
0	13.98373	14.15789	14.04513
1	7.247943	8.118710*	7.554929*
2	7.199547*	8.766926	7.752121

Note: * lag order selected by the criterion

That is in accord with both trace and max-eigenvalues, greater than its critical value. In this case, we reject the null hypothesis of no cointegration. In the study conducted by Liu et al. (2017) on renewable energy, agriculture, and carbon dioxide emissions in the ASEAN region, it emerged that there is cointegration among the variables of interest at a 1 % significance level.

Table 3: Results of Johansen Panel Cointegration Test

Hypothesized No. of CE(s)	Trace Statistic	Critical Values	MaxEigen Statistic	Critical Values
None *	61.19146	47.85613	32.05088	27.58434
At most 1	29.14058	29.79707	18.30111	21.13162
At most 2	10.83948	15.49471	6.382601	14.2646
At most 3 *	4.456876	3.841465	4.456876	3.841465

Note: At the 0.05 level, the trace and maxeigen tests suggest the presence of one cointegration equation.

Although Liu et al. (2017) have focused on other variables such as renewable energy and its impact on CO2 emissions, there is still a common trend that we need to note, specifically, renewable energy and CO2 emissions in the region. Since the findings typically imply that a long-run relationship exists among the variables of interest. That being the case, it is appropriate to test further the long-run relationship of variables for the consistency of the results, considering that there is a confirmation of cointegration in the f-statistics.

4.3 Autoregressive Distributed Lag Model Results

Prior to doing the ARDL, the following diagnostic tests are conducted. Since the null hypothesis of normality could not be denied at the 5% level of significance, the Jarque-Bera test indicates that the residuals of the model are normally distributed. The Durbin-Watson test confirms these findings since all statistical values fall within the no serial correlation zone of 1.7 to 2.3. At the 5% level of significance, the Breusch-Pagan-Godfrey test proved that the model is homoscedastic.

Upon performing the ADF test, it becomes evident that neither of the given variables is I. (2). As such, using ARDL bound analysis to determine the cointegration of PCO2, PGDP, PFDI and PREPC are acceptable. The Akaike criteria (AC) is used to select adequate lags since the F-statistic is particularly dependent on the number of lags applied in the equation. It selects the smallest lag for the model. Table 4 summarizes the results of the ARDL cointegration testing. At the 5% level of significance, the F-value surpasses the upper bound values, showing that cointegration exists in the Philippines.

The results of ARDL estimation in the long and short runs, along with the diagnostic tests such as the Jarque-Bera (JB) normality test, the Breusch-Pagan-Godfrey heteroskedasticity test, the Durbin-Watson test, are summarized in Table 5. The long-run ARDL analysis demonstrates that PGDP per capita has a statistically significant relationship with CO2 emissions at a 10% level of significance. PFDI and PREPC, on the other hand, have a positive and negative correlation with PCO2, respectively.

In the near run, PGDP also gained significance in CO2. Short-run FDI and trade flows were relatively changed in comparison to long-run outputs. PFDI has a positive coefficient; however, it is statistically insignificant. Additionally, the forecast of energy consumption in the Philippines demonstrates a significant negative relationship in both the long and short run.

Table 4: Results of ARDL Cointegration Test

Max. lags imposed	2, 2	
SC selected lags	1, 0, 2, 0	
F-stat selected lags	7.391242	
Cointegration	Yes	
Critical values	Lower Bound I (0)	Upper Bound I (1)
10%	3.74	4.45
5%	4.01	5.07
1%	5.17	6.36

Since it appears that there is a cointegration test in the Philippines, we used the Autoregressive Distributed Lag model to investigate further the impact of gross domestic product, the inflow of foreign direct investment, and renewable energy per capita. Table 5 illustrates the estimation results, specifically for the long-run relationship. It is entirely evident that our findings do not support the existence of EKC in the Philippines, as the results for the long-run relationship of PGDP and CO2 emissions are statistically significant only at 0.000143 %. In other words, as the GDP increases at 1 %, the CO2 emissions also increase at 0.0043. However, the rule of thumb under the EKC hypothesis is that when GDP increases, the CO2 emissions must decrease in the long run-up to a particular turning point which in this case, EKC remains inconclusive. The said claim supports the strands of EKC literature in the Philippines of Anh et al. (2017) and Liu et al. (2017). It is critical to consider that the PFDI and PREPC are also statistically significant in the long run at 0.178 % and -1.22 %, respectively

Table 5: Results of Long- and Short-run ARDL Estimation

Dependent variable: PCO2		
Variables	Long-run estimates	Short-run estimates
PGDP	0.000143*	4.050005*
	7.400005	2.090005
PFDI	0.177504***	0.008755
	0.041711	0.009802
PREPC	-1.215229*	-0.344111**
	0.612326	0.131417
Diagnostic Test		
R2	0.973090	
Adjusted R2	0.966595	
Jarque-Bera	0.749955	
Breusch-Pagan-Godfrey	0.5136	
Durbin-Watson	2.200581	

Note: *, **, and ***, denotes a level of significance of 10%, 5%, and 1%, correspondingly.

Furthermore, the inflow of foreign direct investments in the short run has no impact on the CO2 emissions. Still, there is a conclusive impact on the long-run contrary to the GDP, which impacts the short-run and also impacts the long-run relationship. Although

the renewable energy per capita in the country is statistically significant in the long run under the significance level of 10 %, it is interesting to note that renewable energy per capita has a negative relationship with the CO₂ emissions in the country.

The study's findings reveal that CO₂ emissions, foreign direct investment, renewable energy, and income are all predictors of the degradation of the environment in the Philippines. Income is proven to have a direct and strong impact on the environmental decline, which is similar to Anh et al. (2017) and Chng (2019), who have both determined that income has a positive and significant effect on carbon emissions in the Philippines. When the economy shifts from agricultural to manufacturing and service-based sectors, increased output degrades the ecological environment, and even the economy, in general, contributes to environmental damage. Growth in terms of GDP signifies increased production - considering that GDP is measured as the total worth of all finished goods and services produced in a given period. Whenever production intensifies, by-products and contamination levels rise.

It is possible to assert that trade promotes economic development (GDP per capita), therefore exacerbating the Philippines' environmental degradation through higher CO₂ emissions. These findings are similar to the study of (Chng 2019). In terms of foreign trade, it contributes to carbon dioxide emissions. Higher CO₂ releases might indeed generate the notion of a scarcity of pollution restrictions. It thus creates an appealing environment for foreign investment, which may result in a boost in FDI. The Philippines has made remarkable economic gains over the past few decades; increasing energy demands essential for growth. Unfortunately, it appears as though the Philippines is inefficient with energy use, and the percentage of energy output from renewable energy is insufficient to create an existence of the inverted-U relationship.

5 Conclusions and Recommendations

To summarize the main results of this study, it was evident that the long-run relationship exists. While the study implies a long-run relationship exists, it does not guarantee the EKC hypothesis in the country since the coefficients of gross domestic product and foreign direct investment per capita is still positive in the long run, which needs to be decreased to improve environmental settings. Furthermore, whether there is sufficient empirical data to suggest that EKC Hypothesis exists in the country, it should be on the premise that when the country's GDP increases, the CO₂ emissions should have a negative coefficient. In this case, the coefficients of CO₂ emissions were conclusive to be positive. In other words, there is no sufficient empirical data to suggest that the EKC Hypothesis exists in the country.

As of writing, the Philippines Gross Domestic Product (PGDP) does not improve our country's environmental quality since it has yet to reach its turning point in the inverted U-shaped function. Aside from testing the validity of the EKC hypothesis in the country, one focus area that the future investigation can focus on is to look into other economic policies as to why the previous literature, including our current study, does not conclude the validity of the EKC hypothesis. More importantly, such future study might be able to further provide a practical explanation to the claim that despite the mobility of our GDP growth in recent years, we still have yet to see an improvement in our environmental quality.

The findings of this study imply that aside from including renewable energy per capita, future investigation on this topic may also include energy consumption per capita and other macroeconomic indicators such as population growth. In addition, the current study had 39 observations from 1981 to 2019, which also opens a pivotal point to improve the time-series data of the study. With this, testing the causality might also be a significant factor in testing the validity of the EKC Hypothesis in the Philippines.

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