Indian Journal of Economics and Business
Vol. 21 No. 2 (April, 2022)

http://www.ashwinanokha.com/IJEB.php

The Nexus between Environmental Policy Stringency, Climate Change, and Economic Growth: a case study of Pakistan

Naveed Ahmed
Student MPhil/PhD, Muhammad Ali Jinnah University, Karachi

Afaq Ali Khan
Assistant Professor, Muhammad Ali Jinnah University, Karachi

Mohammad Aslam
Student MPhil/PhD, Muhammad Ali Jinnah University, Karachi

Riaz Deen Sanjrani
Student M.Phil/PhD, Muhammad Ali Jinnah University, Karachi

Received date: 07th February 2022
Revised date: 28th April 2022
Accepted: 30th May 2022

Abstract: Analysis of the relationship between economic growth and climate change makes use of an environmental Kuznets curve (EKC). According to the EKC, environmental degradation is likely to be severe. Because of climate changes negative externalities, Pakistan's environmental policies are the subject of this inquiry. GHGs and per capita GDP create an inverted U-shaped EKC in response to a quadratic condition and an N-shaped EKC in a cubic form. Environmental policy is undergoing a radical shift toward strictness. The EPS index's coefficient has both negative and highly significant coefficient values. According to these figures, sound EPS policies may help mitigate the adverse effects on the environment that are often associated with economic growth. Research also examines the impact of urbanization and energy consumption on greenhouse gas emissions. The World Bank served as the primary data source for this study, using secondary sources. In this study, the ARDL method was used to investigate the cointegration of the variables across time. In addition, ADF unit root tests and residual diagnostics and stability diagnostics allowed us to confirm the stability of the model. In Pakistan, the data demonstrate that urbanization has both short- and long-term favourable impacts on GHG emissions, while energy consumption has both short- and long-term adverse effects. On the other hand, GHG emissions are significantly reduced in the long run. A range of factors, including GDP, substantially impacts the number of greenhouse gases emitted. Quadratic representation of the EKC's inverted U shape is possible. The cubic form may be used to depict EKC's N-shape. The stringency index has a significant impact on greenhouse gas emissions as well. Implementing Pakistan's EPS policy in conformity with global criteria is essential. A cap-and-trade emissions trading system is long overdue in Pakistan. India and the United States require Pakistan to adopt an emission-neutrality policy. Market and non-market means must be used to implement EPS policies in Pakistan.

Keywords: EPS. Environmental policy stringency, EKC. Environmental Kuznets curve, GHG. Greenhouse gases, S.I. Stringency index, GDP. Gross domestic product

INTRODUCTION

Climate change and environmental deterioration are becoming more intertwined. The OECD Albrizio Report, 2014: Environmental pollution is to blame for more than 80% of all serious diseases. When it comes to environmental degradation and human health, short-term sulphur dioxide emissions have an effect, while when it comes to climate change, long-term CO2 emissions have an impact. Volcanic eruptions, industrial production, and fossil fuel use are all factors that contribute to this emission. Zrelli is no longer a researcher as of this writing.

On the other hand, East Asia and the Pacific emissions are fast increasing due to China's growing emissions in East Asia, as seen in the graph below. A drop in carbon dioxide emissions was seen in North America, Central Asia, Europe, Asia, and the Pacific during the 2008 and 2009 financial crises. However, all of these countries re-emitted carbon dioxide after the financial crisis of 2008 and 2009, even though their growth curves ranged significantly.

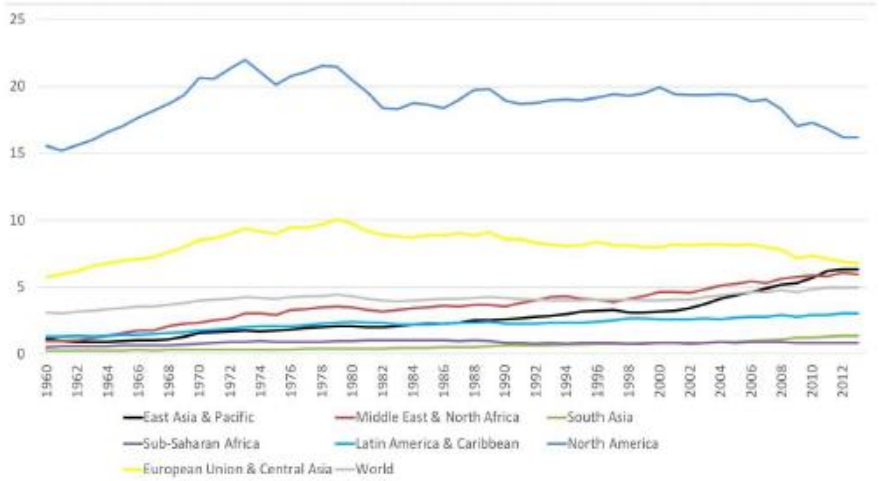


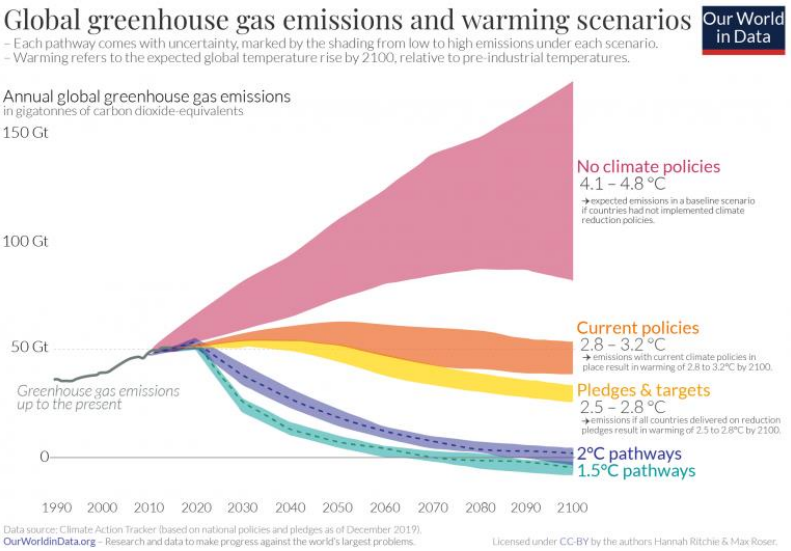
Figure 1: Carbon Emission Trend.

To help countries decrease their carbon emissions, worldwide cooperation has issued a set of guidelines. The United Nations Framework Convention on Climate Change (UNFCCC) assembled 154 countries in Rio de Janeiro in 1992 to decrease greenhouse gas emissions. The conference's primary goal was to reduce carbon dioxide emissions, and governments from both developed and developing countries attended. In addition, climate change forecasts made during the Conference of the Parties (COP) meetings in Berlin in 1995, Geneva in 1996, and Kyoto in 1997 all had a high priority.

One hundred ninety-two countries ratified the Kyoto Protocol in February 2005. Sulfur hexafluoride, nitrous oxide, and methane, four of the most dangerous greenhouse gases (GHGs) that contribute to global warming, were the core targets of the Kyoto Protocol. In addition, they've presented strategies such as the Joint Implementation (J.I.), Clean Development Mechanism (CDM), and International Emission Trading to lower greenhouse gas emissions. However, these strategies may create cap and trade and credit trading systems. Consequently, developing countries were excluded from discussions about setting a price on carbon emissions. Furthermore, the United States and Canada walked away from the agreement because of their opposition to carbon pricing.

Global environmental objectives have finally taken hold after the 2015 Paris Agreement on Climate Change. Global warming must be kept below 2 degrees Celsius over pre-industrial levels to meet the goal of 1.5 degrees Celsius established by the Paris agreement. Governments must enact aggressive and

consistent policies with a predetermined threshold to fulfil their climate change objectives. The nations that signed on to the Paris Climate Accord have agreed to change their economy to achieve these objectives. In addition, for the first time, the Paris agreement states that all governments would undertake some climate change mitigation plan.



Using data from the graph above, the temperature in the atmosphere climbed from 4.1 to 4.8 degrees Celsius due to countries without climate laws. A rise in temperature of 2.8 to 3.2 degrees Celsius may be seen in the orange zone of the graph. According to the Paris Agreement and the Kyoto Protocol, the countries in the orange zone have adopted the current policies. Even though the yellow area of this graph indicates the aims of the Paris Agreement, at this temperature, the limit will be lowered to 2.5 to 2.8 degrees Celsius. These targets will be achieved by the year 2100.Countries are taking a wide range of steps worldwide to minimize pollution and eradicate environmental issues following international agreements. In this study, EKC's data from 1992 to 2012 shows that greenhouse gas emissions are linked to economic growth. Uniquely, Botta and Kozluk's stringency index was used to evaluate the effectiveness of Pakistan's environmental policies, which were put into place to limit greenhouse gas emissions.

We are trying to determine how much of impact environmental policies have on EPS. After establishing the stringency index, the field of EKC literature began to pay more attention to it. Furthermore, we will argue that strict environmental policies may cut greenhouse gas emissions. However, no matter how these rules are implemented, their effect on those impacted matters most. As a result of both its declared intention to increase the literature's impact on environmental policy and reservations about its efficacy (Porter and Linde, 1995; Awan, Abro, & Mustafa, 2021, wahid et al., 2019 and; Ambec et al., 2013).

This study will investigate how climate change affects Pakistan's economy and how EPS environmental policy stringency helps the country prosper economically. This study will use the aggressive EPS environmental policy stringency index, which measures the magnitude and sign of variables.

Research Questions

- Is economic progress being hampered by environmental policy restrictions?
- In the near term, would environmental measures impact the economy?
- Do long-term environmental initiatives have an impact on economic growth?
- To what extent is global warming affecting economic development?
- Economic growth may be affected by greenhouse gas emissions.

There hasn't been any analysis of how environmental regulations affect economic growth since 2013. With the EPS environmental policy stringency index, we want to look at an additional connection between greenhouse gas emissions and economic development in this research project. we also created a gas index as part of my endeavour to evaluate the entire economic cost of climate change.
Part of the extensive literature evaluation is included in section 2.Detailed information on the model's construction and theoretical underpinnings may be found in section 3.Analytical responses to the acquired findings will be provided in section 4.Towards the end of the concluding section, there will be policy recommendations.

LITERATURE REVIEW

(Chaido and Dritsaki, 2014). In the evolution of economies, global energy plays a significant role. The rise in energy use has increased atmospheric carbon dioxide CO2 emissions. This rise in CO2 emissions has prompted scientists to call on the governments of emerging nations to enact more stringent environmental regulations. Some study has focused on CO2 emissions, GDP, and energy consumption in developing nations; this is especially true for such countries. However, there is only unidirectional causation between CO2 emissions and energy use and GDP in the near term. Still, there is bidirectional causality between energy consumption and GDP economic growth, according to the findings of Chiado Dritsaki. Short- and long-term means that energy transportation from economic expansion is a primary driver of the economy's long-term growth.
(Rabiul Islam et al., 2017). Three nations' energy use was studied in detail by Rabiul Islam in this article. Another study by him looked at how energy use affects GDP, poverty and population and how CO2 emissions are affected by forest areas. While other characteristics were unrelated to CO2 emissions, the paper's findings show that poverty has a one-way relationship with that gas. Economists have established that GDP and energy consumption have a beneficial impact on CO2 emissions via econometric testing. While the population has only a minimal influence on CO2 emissions, Deforestation and poverty have a detrimental effect on CO2 emissions. He said that if Malaysia, Indonesia, and Thailand want to increase their economic development over a longer time, renewable energy and energy efficiency may help reduce CO2 emissions.
(Alkhathlan et al., 2012). According to this study, the Saudi Arabian economy's growth, energy consumption, CO2 emissions, and employment ratio were examined using the ARDL and VECM econometric approaches. The results of his research revealed that the factors he studied have a short- and long-term relationship. The long-term impact of the elasticity coefficients of CO2, energy, and the employment ratio on GDP is considerable but positive. According to the findings of causality tests, economic growth per capita is not caused by CO2 emissions per capita or energy consumption per capita. However, employment ratios do so over a shorter period. The Saudi Arabian government has implemented policies to conserve energy and reduce CO2 emissions. However, the income elasticity of CO2 emission over the long term is higher than the income elasticity of CO2 emission over the short period, indicating that the country will have higher CO2 emissions in a long time due to higher long-term incomes.
(Yazdi and Khanalizadeh, 2017). This study looked at how health care spending in the Middle East and North Africa is affected by the environmental quality and economic development (MENA). They analyzed data from 1995 to 2014 using the ARDL econometric method. Their study found that CO2 emissions, income, and PM10 had a favourable but substantial impact on health expenditures over more extended periods. Furthermore, their findings demonstrated that health expenditures in MENA nations are not affected by changes in income or income adjustments due to inelastic income elasticity.

(Al-Mulali et al., 2012). Using data from seven areas of the globe, this study analyzed the relationship between factors such as energy use, CO2 emissions, and urbanization. FMOLS, a fully modified ordinary least squares econometric approach, was utilized. Eighty-four percent of nations have favourable long-term variable relationships in energy consumption, emissions of CO2, and urbanization; just 16 percent of countries have mixed findings. Some nations have had poor relationships for a long time. Urbanization does not correlate with CO2 emissions or energy use in low-income nations.

(Amri, 2017).Between 1980 and 2011, researchers examined Algeria's CO2 emissions, revenue, renewable energy use, and nonrenewable energy use. To evaluate the environmental Kuznets curve hypothesis, an econometric approach known as ARDL used the breakpoint technique. According to the data, nonrenewable energy has a favourable effect on CO2 emissions. However, even renewable energy has little impact on environmental improvement. Therefore, although research suggests the environmental Kuznets curve concept exists, He proposed that Algeria should depend less on imported fossil fuels and more on renewable energy sources (nonrenewable consumption).

(James, 2007). As part of this study, researchers looked at the link between energy use, production output, and pollution. He employed VECM and cointegration as econometric techniques. These factors have a longer-term relationship, according to this study. Long-term increases in energy consumption and pollution are directly linked to increases in economic production. He offered a short-term outcome of unidirectional causation from an increase in energy consumption to a rise in GDP.

(Nicholas and Ames, 2010). Analysis of CO2 emissions, energy usage, and real GDP was carried out using the PVECM econometric model. The quantity of energy utilized has a long-term and considerable impact on CO2 emissions. According to the EKC hypothesis, the inverted U-shape of economic growth is the hallmark of genuine economic development. Therefore, energy use and CO2 emissions are linked in the long run. When it comes to energy consumption and actual economic growth or production over shorter periods, however, there is a bidirectional link between CO2 emissions and natural economic development or output.

(Azlina et al., 2014). This research examined the link between CO2 emissions, energy use, and income in Malaysia using a time series analysis of data from 1975 to 2011. It confirms EKC's theory. Furthermore, empirical data confirms the finding of a cointegration study that there is a longer-term variable association when using an econometric multivariate model. However, the hypothesis's inverted U-shape differs from the theory supported by the findings. At the same time, causality tests show that GDP/output and CO2 emissions are linked individually. On the other hand, the Granger causality test shows that emission Granger affects income, energy consumption, and energy use (renewable). In addition, they discovered that energy consumption and the use of energy (renewable) Granger are both influenced by the operational variation and Granger's use of money.

(Azomahou et al., 2006). The authors of this research used data from a panel of 100 nations to determine the pragmatic relationship between emissions of CO2 per capita and GDP per capita between 1960 and 1996. According to the results, this relationship is ascending. On the contrary, the monotonicity of the EKC is not rejected by nonparametric description tests, but the polynomial functional form that leads to the EKC is rejected.

(Chang, 2010). Chang published a new book. A multivariate cointegration Granger causality test will be used in this research to assess the link between the variable's CO2 emissions, energy consumption, and GDP in China. He said that only an increase in GDP would increase energy consumption and CO2 emissions and that this increase will harm global climate change.

(Goodness and Prosper, 2017). They are utilizing the dynamic panel threshold framework to examine the influence of GDP on CO2 emissions in this research. This research shows that GDP harms CO2

emissions when growth is low, but GDP growth positively affects CO2 emissions when growth is high since the marginal impact is more significant when growth is high. Therefore, the EKC theory cannot be supported by their findings. Emissions of CO2 are positively impacted by energy use and population growth, although this effect is not overwhelming. The impact of the EKC hypothesis is not affected by the inclusion of the indicator of financial gain in the model. There was a strong correlation between the emission of CO2, GDP, energy consumption, and financial development when panel causality methodologies were used. They proposed that a path to long-term economic prosperity might be found by lowering CO2 emissions via the transformation of carbon technologies. Energy efficiency and the transfer from nonrenewable to renewable energy might be part of this change.

(Rui et al., 2018).Four criteria layers may be used to evaluate the low-carbon economic estimating arrangement, including energy consumption, economic level, society development, and environmental quality. They assessed the city of Harbin's low-carbon economy using 18 different variables. The findings were thorough. The AHP-entropy approach is used in their study. Harbin's low-carbon economy was higher than the national average and the province of Xi'an between 2013 and 2016. Harbin's low-carbon economy should be improved by increasing energy consumption and enhancing Harbin's social and economic growth. The quality of the environment should improve as a result of these changes.

(Feng, 2005). This research evaluated the macroeconomic factors that influence the emission of CO2 from Canada's fossil fuels. They said three things would impact CO2 emissions: GDP per capita, population, and technological progress. Although an inverted U-shaped association appeared with population and technology, there was no correlation between GDP per capita and CO2 emissions. Therefore, even with these adjustments, the EKC hypothesis suggests an inverted U-shaped relationship between environmental degradation and GDP/capita, which impacts Canada's output of CO2 from fossil fuels.

(Albrizio et al., 2014). As part of our research, we looked at how the EPS environmental policy stringency index may impact productivity growth in OECD nations. Multifactor productivity growth is estimated by using EPS indicators. Because of the severity of pollution in various sectors and the rapid growth of technology, the effects of environmental legislation on different nations vary. The multi-layer analysis provides a holistic view of the economy, both at the business and industry level. They went on to say that the policy change had a detrimental influence on productivity growth a year before the aggregate level of the economy. This negativity will dissipate within three years of putting the plan into action. For country-industry couples that deploy advanced technology, tighter environmental regulation at the industry level is connected to increased industry productivity growth in the near term. When distances get greater, this influence will go away. Firm-level productivity growth or economic growth is achieved only by enterprises with the most advanced technology, whilst the remaining third of firms are less productive and face productivity declines.

METHODOLOGY

The definition and source of variables are given in this section and the methodology.

Econometrics Model Development

The Kuznets curve characterizes GDP and greenhouse gas emissions as an inverted U-shape. EKC, on the other hand, is often measured by GDP. lENUSE, URB, and S.I. stringency are the three variables we used to build my regression model. Explanatory variables, or right-hand side variables, are employed in conjunction with the country's fixed effects to account for a country's time-invariant distinguishing traits. As a result, the regression equation will be,

$$lGHG=\beta 0+\beta 1lGDP+\beta 2lGDP2+\beta 3lENUSE+\beta 4URB+\beta 5SI+\varepsilon \quad (1)$$

Environmental Kuznets curves, according to the literature, are highly variable, and this variation may be attributed to the wide range of pollutants that have been examined in the samples that we have selected. With the inclusion of the new variable lGDP3, the function may now have two turning points, with the lowest and highest values occurring at each of the two points.

$$lGHG=\beta0+\beta1lGDP+\beta2lGDP2+\beta3lGDP3+\beta4lENUSE+\beta5URB+\beta6SI+\varepsilon \quad (2)$$

Using this equation, we will be able to examine the influence of the different responsibility principles, as defined in the international agreement, on the decrease of greenhouse gas emissions and the reverse relationship.

Theoretical Framework

Since its inception in 1955 (Kuznets, S., 1955), the Kuznets curve has investigated the relationship between earnings and income inequality. It can be seen from the Kuznets curve that the rapid rise of income disparity is responsible for the initial increase in income. However, after a breakeven threshold or a specified quantity of money has been reached, distinctions will begin to lessen as revenue continues to rise. It was (Grossman and Kreuger, 1991 and 1995) were the first to use EKC and were the ones who established an inverted U-shaped association between environmental degradation and economic progress (GDP). However, when GDP per capita is lower than the optimal level, carbon emissions rise with GDP growth, resulting in a carbon emissions spiral. However, once the ideal level of carbon emissions per capita is reached, carbon emissions begin to drop as GDP per capita continues to develop continually, resulting in a reduction in carbon emissions.

The EKC, on the other hand, is based on a formal theory, which may be utilized to enhance the concept further. After reaching a maximum or turning point in industrialization, (Grossman and Kreuger 1991 and 1995) asserted that the quality of the environment should improve as economic growth continues to rise. (Grossman and Kreuger 1991 and 1995) announced that as industrialization grows in tandem with the economy, the amount of pollution per capita increases initially. As illustrated by the two-fold effect, it also reflects a two-sided curve, with economic development being helpful to the environment in the long run but potentially destructive to the environment in the short run. For the sake of my research, we will focus on the quantity and significance of the proxies, which we will use as a guarantee for the stringency of EPS environmental policy in the coming years. Long-term reductions in greenhouse gas emissions are expected to occur due to the implementation of strict environmental policies by the EPS, and it is my belief.

In our research, we took into account greenhouse gas emissions, GDP, energy consumption, urbanization, and the stringency index, among other things. GDP, lGDP2 and lGDP3 are the factors on my right-hand side, also known as explanatory variables, while GDP, lENUS, URB, and S.I. are the elements on my left-hand side known as dependent variables. Using the environmental Kuznets curve EKC (as seen in Figure 1), (Grossman and Kreuger 1991 and 1995) proposed that the link between GDP and climate is inverted U-shaped, as shown in Figure 1. Because this explanation accounts for the vast majority of GDP created by the main urbanized cities and the vast majority of greenhouse gas emissions produced by the large urbanized cities, we have added urbanized population as an explanatory variable alongside these two other variables. This is because the main urbanized centres generate the vast majority of the world's GDP and the vast majority of greenhouse gas emissions.

The fact that energy consumption resulted in the emission of GHG greenhouse gases prompted me to choose energy consumption as my explanatory variable following this empirical hypothesis. One of the study's distinguishing characteristics is that it investigates the influence of environmental laws on reducing global warming. we utilized the S.I. stringency index to assess the stringency of environmental legislation as a consequence of this experience.

When computing the dependent variable, lnGHG, we take the logarithm of CO2 emissions per capita represented in metric tonnes and multiply it by the number of people in the population. The GDP, energy consumption, urbanization, and, most crucially, the S.I. are the essential explanatory factors to consider. With data from the World Bank's World Development Indicators in 2010, the logarithm of GDP per capita (lnGDP) is calculated at constant prices in 2010. This specification comprises the squared component (lGDP2), while the cubic specification includes both the lGDP2 and the lGDP3 features, and the quadratic specification includes just the lGDP2 part. When expressed as several logs of kilogrammes of oil equivalent per person, it measures energy consumption. Based on the literature, we predict that a rise in energy consumption will increase carbon dioxide emissions during the next several decades. In addition, as expected, the urbanization rate, abbreviated as URB, will be positive shortly. Almost all of these variables are taken from data included in World Bank databases (lnGHG, lGDP, lENUSE, and URB).

We used three alternative GDP measures as part of our analysis: nominal GDP (GDP), nominal GDP 2 (lGDP2), and nominal GDP 3. In this case, wefirst examining the influence of real economic growth on greenhouse gas emissions. Then, in line with the EKC environmental Kuznets curve theory, we are exploring the impact and connection of an inverted U-shaped EKC on greenhouse gas emissions. Third, we want to look at the maximum and minimum points of the EKC environmental Kuznets curve, and we want to use the cubic form of GDP to figure out where the maximum and minimum points are. After applying cubic form to the EKC environmental Kuznets curve, we will acquire an N-shaped EKC environmental Kuznets curve, giving us the first maximum point and the second minimum point, respectively. Finally, we shall evaluate the local and worldwide influence of environmental policy stringency on global warming using these maximum and minimum points.

Data Sources and variables

As Ragab and Arisha (2018) point out, the legitimacy and reliability of the acquired data and discoveries are critical in establishing whether or not the experimental results are relevant, authentic, and trustworthy enough to warrant further investigation. To ensure authenticity and reliability of the information received, it is necessary to get it from sources that are original, unedited, and authentic, as well as from sources referred to as actual information banks of the country for which it is being gathered. In addition, auxiliary quantitative research is sometimes required when situations and logical consequences linkages are broken down using past time-series or fixed data. This is done to find the illustrative and influencing connection between the superior and dependable components (Abutabenjeh and Jaradat, 2018).

Almost all of the data utilized in this study, such as GDP, greenhouse gas emissions, energy consumption, and urbanization, were collected from the World Bank's World Development Report. In addition, the stringency index was derived from the World Competitiveness Index, which is issued yearly by both the World Bank and the World Economic Forum and measures how competitive countries are in the world. The period is covered by the data I've gathered from 1990 to 2016, and the data type is time series with annual updates.

RESULTS AND DISCUSSIONS

Here we will detail the tests, we have conducted as part of my research and what we learned from them. In addition, the further discussion has been provided on the relevance of many tests, including the ADF unit root and other diagnostic tests, and the results tables are presented in the appendix.

We must do diagnostic tests since they not only uncover defects that need model definition and information, but they also instill confidence into our judgements, which may be valuable to strategy consultants in the future. Following that, we employed a range of analytic techniques to establish the

connection between the variables, including the sequential relationship test, functional structure test, heteroscedasticity test, and residuals ordinariness test.

In addition to the Ramsey RESET test, which assesses if the suitable model type we built is correct or incorrect, there are other symptomatic tests to consider. This test, also known as the Breusch-Godfrey sequential relationship L.M. test, is well-known and valuable for detecting whether or not there is a sequential connection between two occurrences in a specific period. In addition, the Jarque-Berra test was used to establish whether or not the residuals were typical of the sample. Finally, the ARCH test is performed on the data to assess whether or not there is heteroscedasticity in the data.

Table 1: ARDL Results

ARDL cointegrating and long run form. Short run analysis.			
Variables	coefficients	t-value	p-value
lnGHG	-0.451794	-5.212	0.0034
lnGDP	0.128385	2.999	0.0301
GDP2	-0.008891	-2.042	0.0966
GDP3	0.000756	-2.197	0.0793
lnEnUse	-0.572407	-6.555	0.0012
lnUrb	1.738631	-5.047	0.0039
SI	-0.006016	-5.030	0.0040
Long run analysis			
lEnUse	0.693512	6.317	0.0015
lnGDP	-0.289341	-2.418	0.0602
GDP2	0.029785	2.326	0.0675
GDP3	-0.002503	-2.022	0.0991
lnURB	0.436965	3.696	0.0140
SI	-0.016281	-6.904	0.0010
coint eq	-0.959073	-9.748	0.0002

The table above shows both short-term and long-term influences. Although short-term energy usage is insignificant and does not fit the theory's sign, all other factors are essential. The -0.572407 number illustrates that as energy consumption grows, so do GHG emissions soon. Therefore, energy consumption has a significant but short-term negative impact on GHG emissions. In theory, it's just not conceivable owing to the pollution generated by fossil fuel usage, industrial waste, and the deterioration of air quality as a consequence of energy use since GHG emissions grow with it. Emission neutralization has been widely adopted in Japan, China, and the majority of European countries, therefore it's possible that it will happen elsewhere. With this method, they may be able to eradicate the emission. Due to its high level of CO2 emissions, China has started planting trees on the roofs and walls of apartment buildings to reduce those emissions. As a result, Pakistan has embraced increasing the number of trees planted around the country to keep the environment more stable. For the time being, however, Pakistan's emissions of greenhouse gases are expected to decrease due to the country's 2014 launch of the billion-tree project. As energy consumption rises, so does the country's energy consumption in the long run, with a coefficient value of 0.693512. Long-term research also supports this hypothesis.

Urbanization has both short- and long-term beneficial impacts on GHG emissions. There are short-term and long-term urbanization coefficients of 1.738631 and 0.436965, respectively. According to the short-term value of urbanization, which is 1.73, urbanization has a four times bigger impact in the near term. Urbanized communities in Pakistan suffer from a severe lack of infrastructure and forethought. Rural

inhabitants have flocked to urban areas searching for better work possibilities and better living circumstances without any previous planning. Since they're spending less time in the countryside, the ecology suffers. People choose to live in slum areas because they can save money and don't have sufficient housing; consequently, the slum areas of major cities will continue to grow faster, causing environmental harm. There is still a positive impact in the short term, although it is less prominent than long. To be precise, we are looking for the amplitude and sign of the variables in question. Due to their migration patterns, long-term migrants are less influenced by urbanization than those who cannot live in planned cities and must return to their native places.

This research focuses on the shape of the EKC curve. GDP gives me greater power over the EKC's appearance. According to my model's evolution, the EKC should have an N-shaped shape. There are three long-term signs for economic growth coefficients: Negative, Positive, and Negative. With this inverted N-shape form, we get EKC (see above). Using GDP, GDP2, and GDP3 is a second argument for doing so because: I'd want to look at the local and worldwide impacts of the EPS. We'll examine the effect of EPS on a global scale at the maximum and a local scale at the lowest, as stated in the model development. According to the results, international regulations have been implemented and positively impact lowering GHG emissions throughout the globe. Although the coefficient value is at its lowest point in negative territory, short-term GHG emissions are negatively affected. GHG emissions are growing each year due to this increase in greenhouse gas (GHG). But it has been shown, in line with prior results, that EKC is an inverted N-shape and an inverted U-shape. EKC was discovered by (Angelis et al., 2019) to be inverted U-shaped and N-shaped.

However, the stringency index has both a short- and long-term detrimental impact. Theoretically, stricter regulations in a country should lead to a decrease in GHG emissions. GHG emissions in Pakistan are less affected by the short-term effects of S.I. than they are by its longer-term effects. Therefore, adopting EPS policies might pave the way for a more promising future for Pakistan's economy.

There has been controversy concerning the presence of a unit root in economic and financial time series since (Nelson and Plosser's, 1982). This could influence a wide variety of economic and financial ideas. The traditional concept of the business cycle suggests that an economic shock has only a temporary impact. A unit root in real GNP, on the other hand, undermines this legal perspective (Campbell and Mankiw 1987). (Campbell and Mankiw 1987). (Murray and Nelson 2000); (Papell and Prodan 2004); (Darné 2009); (Luo and Startz 2014) present different and inconclusive evidence on the presence of a unit root in U.S. real GNP, for example (Rudebusch 1993); (Diebold and Senhadji 1996) Real interest rates and purchasing power parity (Lothian and Taylor 1996; Papell 1997) are two more areas where it is questioned whether there is a unit root in these two empirical studies (Rose 1988; Rapach and Weber 2004). (Rose 1988; Rapach and Weber 2004). When a unit root is present, there are consequences for the economy, for additional information (Choi, 2015). Unit root testing suffers because the test's power falls as the sample size drops (see McCallum 1986, Schwert 1989; DeJong et al. 1992). However, low power consumption is not completely considered (Cochrane 1991, p. 283). (Cochrane 1991, p. 283). Furthermore, the test's power and other parameters are never addressed when it is done at the industry standard significance level (usually 0.05). (Generally 0.05). Several publications have harshly condemned the disrespect for test power by empirical researchers to attain this aim (Arrow 1960; Hausman 1978; MacKinnon 2002, p. 633; Ziliak and McCloskey 2008; Startz 2014). (Arrow 1960; Hausman 1978; MacKinnon 2002, p. 633; Ziliak and McCloskey 2008; Startz 2014). Traditional significance levels may lead to erroneous conclusions, as has been pointed out (Davidson and MacKinnon 1993, p. 79; Keuzenkamp and Magnus 1995; Lehmann and Romano 2005, p. 57).

(Davidson and MacKinnon 1993, p. 79; Keuzenkamp and Magnus 1995; Lehmann and Romano 2005, p. 57). Maddala and Kim (1998) argue against adopting an usual significant level in unit root testing.
(Using the unit root results in Table 1, we selected to apply the ARDL approach as my variables are in mixed forms, such as me (0) and me (1). When results of the unit root become stagnate at a specific level, I (0) or at the first difference, I (1), then employ the OLS approach. Accordingly, based on the outcomes of the unit root tests, we have selected the ARDL approach to assess long-run cointegration among variables and the reliability of the long-run cointegration relationship.
Table 2: Unit Root Test Results

Variable	P-Values	T-statistics	Order
lnGHG	0.0652	-1.609	1 (1)
lnGDP	0.0090	-3.711	I (0)
GDP2	0.0594	-2.632	I (1)
GDP3	0.0538	-2.632	I (0)
lEnUse	0.0174	-3.658	I (0)
URB	0.0862	-1.608	I (0)
SI	0.0298	-3.595	I (0)

There is a change in the unit root table between GHG and GDP2, but they remain fixed there while GDP, GDP3, EnUse, URB, and S.I. remain static at the same level. As a result of the mixed results, the ARDL approach was selected.

Descriptive Results

The techniques of descriptive statistics are used to classify and describe the characteristics or features of a specific sample. Descriptive statistics. Descriptive statistics, such as "variance" or "distribution," may be used to describe central tendency and dispersion. Before diving into the specifics of the statistics, it's essential to take a step back and look at the overall picture of what's going on in the data. When determining which statistical techniques to use, it is common to practice to start with the degree of measurement. Variables' mean, median, highest and lowest values, and standard deviation are summarised in Table 2, as are other descriptive statistics. The standard deviation, or standard error, measures how far our data differs from the mean. In addition to Jarque-Berra and probability values, descriptive statistics also depict these methods' data.

Table 3: Descriptive Statistics

	LNGHG	LOG(GDP)	GDP2	GDP3	LNENUSE	LNURB	SI
Mean	-0.136647	1.322413	20.24048	109.2432	5.973796	1.133194	5.624737
Median	-0.14087	1.480799	19.32883	84.97837	5.979879	1.078171	6.057997
Maximum	0.002987	2.041986	59.38086	457.5828	6.316892	1.327939	11.90000
Minimum	-0.30216	0.014293	1.028999	1.043813	5.625577	0.978334	3.410000
Std. Dev.	0.078315	0.498036	15.34650	118.8356	0.163299	0.125517	2.140838
Skewness	-0.175364	-0.865156	1.015908	1.704480	-0.05544	0.256863	0.847407
Kurtosis	2.177912	3.220164	3.629097	5.417091	2.514953	1.431930	3.659087
Jarque-Bera	0.898694	3.422762	5.089542	19.64626	0.278511	3.063104	3.720138
Probability	0.638045	0.180616	0.078491	0.000054	0.870006	0.216200	0.155662
Sum	-3.689475	35.70514	546.4930	2949.567	161.2925	30.59624	151.8679
Sum Sq. Dev.	0.159465	6.449046	6123.390	367169.4	0.693334	0.409617	119.1629
Observations	27	27	27	27	27	27	27

Bound Test Result

Pesaran and Shin (1999) and Pesaran et al (2002). It has developed the ARDL cointegration technique. It has three benefits over other approaches of cointegration. First, because the ARDL does not require that all variables be integrated in the same order, it may be used with variables combined in order zero, order one, or fractionally. The ARDL test, on the other hand, is more efficient when working with small and limited sample numbers. Finally, the fact that we can get unbiased estimates of the long-term model using ARDL is a significant benefit (Harris and Sollis, 2003).

The limits test is based on an asymptotically non-standard joint F-statistic distribution under the null hypothesis of non-cointegration. The ability to provide two sets of crucial values with varying degrees of relevance (Pesaran et al., 2001). Assuming that each variable is integrated to order zero, the first and second levels are calculated using this assumption, and so forth. The null hypothesis of no cointegration is rejected if the test statistic value exceeds the higher critical boundaries value. Still, it is accepted if the F-statistic value is smaller than the value of the lower critical border. The cointegration test has several unclear features. Because of the limited quantity of data that may be saved, this approach must be employed. According to the Akaike information criterion, the maximum lag order of the ARDL vector error correction model is two (AIC).

Table 4: Bound test Results

Null Hypothesis. No long run relationship exists		
test statistics	value	k
F-Statistics	54.36684	6
Critical value bounds.		
Significance	I0	I1
10%	2.12	3.23
5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43

Bound test results suggest that our model is stable, and the critical value is somewhere between the lower and higher limits. The F statistic value is also significant from a statistical standpoint.

Serial Correlation L.M. Test

In empirical studies, A.R. (l) alternatives such as Durbin and Watson (1950) and restricted ARC41 or ARC51 models have long been well-known, and they've even been put to the test against one-sided A.R. (l) alternatives. Therefore, a p-value greater than 0.05 implies that the variables in Table 3 do not have a serial link, as was previously stated in the normality test.

An F-statistics value of 4.309887 demonstrates the model's stability and importance, as well as its absence of serial correlation, as evidenced by a p-value of 0.1883.

Table 5: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistics	1.571	Probability F (2,3)	0.3413
obs*R-squared	12.719	prob chi square	0.0017
R-square	0.511		

The serial correlation L.M. test, which yielded a P-value of 0.3413, revealed that the model lacked autocorrelation. The model has no association if the P-value is more significant than 0.05.

Predictors for linear regression are examined for their validity, in addition to the possibility of data anomalies. Current diagnostics research focuses on identifying significant findings. What (Cook and Weisberg1982) have to say is well worth your time. However, instead of focusing on the validity of certain assumptions, researchers have paid far less attention to diagnostics that might be as important. For example, diagnostic tools given in this paper may be used to evaluate a common assumption regarding homoscedasticity when there is little or no replication.

Many homoscedasticity tests exist based on an alternative heteroscedasticity model (Anscombe, 1961) and logical but unorthodox reasoning (Bickel, 1978). (Anscombe, 1961; Bickel, 1978). Glejser (1969), Harrison & McCabe (1979), and Horn (1981) (1979). See Hammerstrom (1981) and Carroll & Ruppert (1981) for more stringent testing of homoscedasticity. " (1981). Tests' diagnostic usefulness might vary, and some are completely useless. Anscombe's test must be eliminated from regular usage if all matrix components that project into a column of explanatory variables are calculated. Bickel's test is an excellent option if you are looking for a quick and easy way to diagnose an issue. An explanatory factor and other relevant variables may influence heteroscedasticity variances, such as time and location. According to Anscombe and Bickel's analysis method, disagreement seems to be proportional to the predicted response.

Table 6: Hetro Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-Statistics	0.688	Prob F (19,5)	0.7485
Obs*R-Squared	18.087	prob chi square 19	0.5166
Scaled explained SS	0.810		
R-Square	0.723		

As seen from the Heteroscedasticity table above, the p-value of 0.7485 indicates that the model does not include any heteroscedasticity.

Correlation Matrix

An essential tool in multivariate analysis is a correlation matrix that records the degree of relationship between random vector components. For example, Principal Component Analysis (PCA) and Factor Analysis (F.A.) provide results quite different from those derived from a covariance matrix. One way to utilize it is to determine the independence of other variables or sets thereof.

Table 7: Correlation Results

	LNGHG	LOG(GDP)	GDP2	GDP3	LNENUSE	LNURB	SI
LNGHG	1.000000	-0.044883	-0.092543	-0.1117	0.901715	-0.82482	-0.57807
LOG(GDP)	-0.044883	1.000000	0.872991	0.776511	0.120177	-0.10236	0.190589
GDP2	-0.092543	0.872991	1.000000	0.982432	0.099972	-0.03412	0.333379
GDP3	-0.111695	0.776511	0.982432	1.000000	0.072723	-0.01132	0.368534
LNENUSE	0.901715	0.120177	0.099972	0.072723	1.000000	-0.91061	-0.50853
LNURB	-0.824821	-0.102361	-0.034118	-0.01132	-0.91061	1.000000	0.546233
SI	-0.578073	0.190589	0.333379	0.368534	-0.50853	0.546233	1.000000

RECOMMENDATION, LIMITATION, FUTURE SCOPE AND CONCLUSIONS

We conducted this research to evaluate the relationship between Pakistan's economic growth and GHG emissions. According to the results, economic development and GHG emissions are intertwined. GHG emissions first increase along with GDP, as seen by the EKC's inverted U shape at GDP square form, but after GDP hits its peak, GHG emissions begin to drop along with GDP. It is clear from the cubic record of GDP that we have studied both domestic and international policy to some extent, as shown by EKC's N-shape. EPS has a more substantial impact on lowering GHG emissions. It becomes more rigorous, even when local policies were not efficiently implemented; international policies were successfully implemented and positively impacted global warming gas emissions. However, Pakistan's application of EPS guidelines had a limited impact since they were poorly executed.

Policies suggest that Pakistan abide by international standards to improve the economy and reduce GHG emissions. Emission permits and tariffs are needed in Pakistan's emissions trading system, which is based on the issue of licences to emit GHGs. With this method, industries will lower their GHG emissions, and the government will collect more money through licencing fees. Pakistan must adopt emission neutralization measures, and if Pakistan suffers an increase in greenhouse gas (GHG) emissions, Pakistan must discover new ways to absorb the GHGs. My short-term energy usage is negatively correlated with my GHG emissions due to a 2014 programme to plant a billion trees. As a result, Pakistan must employ both market and non-market approaches to implement its programmes. Taxes on CO2 emissions, water consumption, pesticide use and fuel excise are examples of market-based strategies. Non-market instruments such as pollution permits and licences are examples. They are forced to either find the most cost-effective ways to pollute or create a secondary market for pollution because of these restrictions (Angelis et al.).

My key results reveal a cubic relationship between GDP and GHG emissions across the whole case. Unusually, since its primary defining moment (top) nearly matches its pinnacle in the N-shaped relationship, an upset U shape bend with an N-shape connection does not entirely depart from quadratic determination. In addition, it should be noted that the pivotal point in the cubic. The N-shaped reference occurs at high GDP levels. The fact that this conclusion is so widespread in financial literature on natural catastrophes is comforting, even if the environment continues to decline. A crucial result is that the rise in financial resources cannot be understood as both a means of arranging and a cause of natural corruption. The government must be involved; therefore, wild arrangements must be tested. Specifically, we use two S.I.s to evaluate our Kuznets curve evaluations. As we've learned, more severe intercessions lower GHG emissions. As a result of the absence of information on market and non-market instruments in Pakistan, we had to end our investigation. Market and non-market-based tools will be more relevant to policymakers if data on these variables can be gathered.

References

Ahmed and Ahmed, 2018. A predictive analysis of CO2 emissions, environmental policy stringency, and economic growth in China, Environmental Science and Pollution Research https://doi.org/10.1007/s11356-018-1849-x

Ahmed, 2020. Environmental policy stringency, related technological change and emissions inventory in 20 OECD countries, Journal of Environmental Management 274 (2020) 111209

Albrizio et al., 2014. Empirical evidence on the effects of environmental policy stringency on productivity growth, economics department working papers no. 1179

Al-Mulla et al., 2012. Exploring the bi-directional long-run relationship between urbanization, energy consumption, and carbon dioxide emission, Energy 46 (2012) 156e167.

Amri, 2017. In Algeria, carbon dioxide emissions, output, and energy consumption categories, DOI 10.1007/s11356-017-8984-7, Environ Sci Pollut Res.

Awan, N. W., Abro, A. A., & Mustafa, A. R. (2021). Do environmental degradation and agricultural accessories impact on agricultural crops and land revenue? Evidence from Pakistan. Sarhad Journal of Agriculture, 37(2), 639-649.

Azlina et al., 2014. Dynamic linkages among transport energy consumption, income and CO2 emission in Malaysia, Energy Policy73(2014)598–606.

Azomahou et al., 2006. Economic development and CO2 emissions: A nonparametric panel approach, Journal of Public Economics, 90 (2006) 1347– 1363.

Chaido Dritsaki and Melina Dritsaki, 2014. Causal Relationship between Energy Consumption, Economic Growth and CO2 Emissions: A Dynamic Panel Data Approach. Vol. 4, No. 2, 2014, pp.125-136, International Journal of Energy Economics and Policy.

Chang, 2010. A multivariate causality test of carbon dioxide emissions, energy consumption and economic growth in China, Applied Energy, 87 (2010) 3533–3537.

Charles and Louise Travers Department of Political Science at University of California, Berkeley, 2354 Virginia St, Berkeley, CA, 94709, USA

Destek and Sarkodie, 2018. Investigation of environmental Kuznets curve for ecological footprint: The role of energy and financial development, Science of the Total Environment 650 (2019) 2483–2489

development goals: Implications for sustainability, Journal of Cleaner Production xxx (XXXX) xxx

Enrico Botta and Tomasz Koźluk, 2014. Measuring Environmental Policy Stringency in OECD Countries-A Composite Index Approach, ECO/WKP(2014)73 2 OECD

Goodness C. Aye & Prosper Ebruvwiyo Edoja, 2017. Effect of economic growth on CO2 emission in developing countries: Evidence from a dynamic panel threshold model, Cogent Economics & Finance.

Hasan et al., 2018. The synergy between climate change policies and national

James B. Ang, 2007. CO2 emissions, energy consumption, and output in France, Energy Policy 35 (2007) 4772–4778.

Khalid et al., 2012. Carbon Dioxide Emissions, Energy Consumption and Economic Growth in Saudi Arabia: A Multivariate Cointegration Analysis, 2(4): 327-339, 2012, British Journal of Economics, Management& Trade,

Malzi et al., 2020. Environmental policy effectiveness on residential natural gas use in OECD countries, Resources Policy 66 (2020) 101651

Mirza and Kanwal, 2017. Energy consumption, carbon emissions and economic growth in Pakistan: Dynamic causality analysis, Renewable and Sustainable Energy Reviews 72 (2017) 1233–1240

Nicholas Apergis, James E. Payne, 2010. The emissions, energy consumption, and growth nexus: Evidence from the commonwealth of independent states, Energy Policy 38 (2010) 650–655.

Ouyang et al., 2019. Environmental regulation, economic growth and air pollution: Panel threshold analysis for OECD countries, Science of the Total Environment 657 (2019) 234–241

Qian et al., 2020. Does carbon performance matter to market returns during climate policy changes? Evidence from Australia, JCLP 121040, Journal of Cleaner Production.

Rabi ul Islam et al., 2017. Carbon Dioxide Emission, Energy Consumption, Economic Growth, Population, Poverty and Forest Area: Evidence from Panel Data Analysis, 2017, 7(4), 99-106, International Journal of Energy Economics and Policy.

Rui Shi et al., 2018. Evaluation of Low-carbon Economy Development Level in Harbin, IOP Conference Series: Materials Science and Engineering.

Samuel Trachtman, 2020. What drives climate policy adoption in the U.S. states?

Sarkodie et al., 2020. Foreign direct investment and renewable energy in climate change mitigation: Does governance matter? Journal of Cleaner Production 263 (2020) 121262

V. Lantz, Q. Feng, 2005. Assessing income, population, and technology impacts CO2 emissions in Canada: Where's the EKC? Ecological Economics 57 (2006) 229– 238.

Wahid, N., Ahmed, R., Channa, Z. H., Saleem, A., Metlo, W. A., Hafeez, M., ... & Awan, M. W. (2019). The influence of climatic change on major agricultural crops: a case study of Sindh, Pakistan. International Journal of Biosciences, 15(6), 342-353.

Yogesh Hole et al 2019 J. Phys.: Conf. Ser. 1362 012121

Yun Wang et al., 2019. Environmental regulation and green productivity growth: Empirical evidence on the Porter Hypothesis from OECD industrial sectors, Energy Policy 132 (2019) 611–619