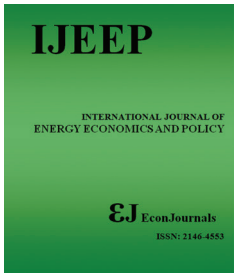

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Unbridling the Economic Growth and Environmental Nexus in Pakistan

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ABSTRACT

The Kuznets Curve framework is used in this study to examine the complex relationship between economic growth and environmental impact in Pakistan. The study employs descriptive statistics, pairwise correlations, and regression analysis to uncover intricate relationships among crucial variables such as pollution, environmental performance, GDP, income, and taxation fort he period of 1980-2022. The results underscore the complex trade-offs and non-linear connections that exist within these relationships, underscoring the importance of informed policy choices in order to attain sustainable development that effectively reconciles economic advancement and environmental preservation within the specific context of Pakistan.

Keywords: Kuznets Curve, Air Pollutants, Economic Growth, Environmental Performance
JEL Classifications: Q56, Q59, B22

1. INTRODUCTION

A lot of research has recently been done on the connection between environmental quality and economic development (Choudhury et al., 2023; Kayani et al., 2022; Xie et al., 2023). Numerous empirical investigations have indicated a curvilinear association, specifically an inverted-U pattern, between economic growth, typically quantified as per capita income and the state of the natural environment (Kayani et al., 2023; Mumtaz et al., 2023). On the contrary, in the early phase of economic advancement, there exists a positive association between the deterioration of the environment and per capita income. There exists an inverse relationship between the level of contamination and the increase in per capita income. The phenomenon under discussion is commonly known as the Environmental Kuznets Curve (EKC), as evidenced by the works of several scholars such as Bradford et al. (2005a) and Cole (2004).

The EKC theory posits that economic development has the potential to serve as a future resolution for environmental concerns. The clarity of the announced experimental results and objectives is lacking. From a particular perspective, numerous empirical investigations have substantiated the presence of an EKC across various indicators of environmental deterioration. Nevertheless, it has been contended by certain academics that the EKC hypothesis lacks adequate evidence to substantiate its claim of a consistent association between pollution and per capita income (Day and Grafton, 2003; Lindmark, 2002). A considerable portion of these empirical investigations focuses on utilising cross-national panel data to evaluate the correlation between economic growth and environmental indicators.

The practice of comparing the findings of a single nation's study to cross-country research is increasingly prevalent among scholars in the field of the EKC. The utilisation of this methodology has the potential to effectively tackle the obstacles linked to cross-

national data and facilitate a more extensive examination confined to a singular nation (Ansari et al., 2020; Saboori and Sulaiman, 2013). Scholars have proposed that conducting investigations on specific nations may offer a potential advantage over cross-sectional approaches in order to align the examinations more closely with the kinetic aspect, which constitutes the fundamental principle of the EKC model (Jalil and Mahmud 2009; Zambrano-Monserrate and Ruano 2019). The primary objective of this study is to examine the correlation between environmental degradation and economic development within the context of a developing nation. The present assessment is in accordance with the previously mentioned objectives.

The adverse atmospheric conditions in Pakistan have played a significant role in its classification as one of the most forsaken nations on the planet. Ahmed and Long (2012) have posited that there is a projected escalation in temperature rise that surpasses the mean global temperature. The primary foundation of Pakistan's economic framework is predominantly rooted in the agricultural sector. Nasir and Rehman (2011) project a 4°C increase in temperature by the year 2100. The atmospheric composition is impacted by the emission of detrimental gases, including carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM10), and sulphur dioxide (SO_2). These emissions play a substantial role in the occurrence of anthropogenic climate variations. Moreover, it is worth noting that greenhouse gases (GHGs) have a significant impact on the retention of solar radiation within the Earth's atmosphere, impeding its dissipation into the higher layers of the atmosphere (Antweiler et al., 2001; Dinda and Coondoo 2006). The rise in the concentration of greenhouse gases in the environment is being ascribed to human activities, particularly deforestation, as indicated by several studies (Managi and Jena, 2008; Nasir and Rehman, 2011; Shahbaz et al., 2011; Song et al., 2013). The incidence of respiratory ailments, such as asthma, tends to increase in individuals, especially children, who are exposed to environmental factors resulting in higher levels of SO_2 and particulate matter with a diameter of 10 μm or less (PM10) (Aqeel and Butt, 2001). To mitigate the adverse consequences of emissions, it is crucial for the country to proficiently administer its energy and industrial domains, thus fostering a more resilient economic framework (Lotfalipour et al., 2010).

Energy consumption (EC) is a fundamental requirement for the advancement of economic development, as it is intricately interconnected with all manufacturing and consumption endeavours (Kayani et al., 2023; Sheikh et al., 2023; Shaik et al., 2023; Saleem et al., 2023). Fossil fuels serve as the principal energy sources that undergo conversion processes to facilitate gradual transformation. The efficient deployment of these energy sources to promote advancement has resulted in a significant rise in global emissions from various potentially harmful activities (Aysan et al., AF., 2023; Iqbal, U., 2023; Kayani et al., 2023; Nasim et al., 2023). The release of noxious substances into the Earth's atmosphere has a substantial influence on the well-being of the human population (Khan, et al., 2023). Air pollutants present a substantial risk to both human well-being and the natural environment. Nevertheless, it is important to highlight that CO_2 plays a significant role in the phenomenon of global warming, as it is responsible for more than 60% of greenhouse gas emissions (Birdsall and Wheeler, 1993).

The industrial sector in Pakistan presents a substantial challenge in terms of diverse forms of pollution. In addition to the substantial contribution of vehicular emissions, industrial pollutants are also playing a significant role in environmental degradation. The global environment has experienced degradation as a consequence of the drive for economic development through industrialization. Saboori and Sulaiman (2013) have observed that the impact of industrialization on the natural environment is a noteworthy concern in both developing and developed regions. The predominant sources of pollution in Pakistan encompass the agricultural, textile, oil, and gas sectors. According to Usman et al. (2022), the adoption of cleaner technologies and the implementation of robust governmental policies have the potential to effectively address and reduce contamination resulting from manufacturing operations.

During the past twenty years, Pakistan's economy has experienced substantial growth. Nevertheless, the escalation in EC, specifically within the industrial domain, has led to the emergence of environmental pollution (Kayani et al., 2023; Farrukh and Sadiq, 2022). Natural gas is responsible for the majority of CO_2 emissions, constituting approximately 50% of the overall emissions (Farrukh and Sadiq, 2022). CO is typically formed as a result of incomplete combustion, whereas NOx are frequently generated due to the high temperatures present in heavy vehicles and industrial operations. According to Coondoo and Dinda (2008), PM10 is composed of particulate matter consisting of dust particles that originate from various sources such as construction sites, landfills, agricultural activities, and industrial sources. The transportation industry is currently undergoing significant expansion as a result of the escalating presence of both personal and commercial vehicles. The process of natural degradation was further intensified due to an escalation in popularity and a dearth of innovative practises. The importance of individual countries' demand remains crucial in addressing the problem of the condition, despite its global nature.

The government of Pakistan, in its capacity as a developing nation, has made substantial endeavours in the pursuit of sustainable development. Pakistan is one of the nations that enacted a national environmental policy (NEP) in the year 2005. The main goal of this undertaking is to protect the natural ecosystem and ensure the highest possible air quality for the residents. The rapid growth of the economy in different sectors, especially in recent times, has resulted in an increase in energy usage (Coondoo and Dinda, 2002).

The theoretical framework underpinning our research is based on the EKC theory. To investigate the topic, we utilise time series data and employ cointegration analysis techniques. The primary aims of our investigation are to evaluate the notion of a sustained relationship between per capita income and environmental degradation in Pakistan, and to determine if improvements in income are associated with decreases in environmental degradation.

Currently, there exists a scarcity of scholarly articles that exclusively concentrate on Pakistan and undertake an analysis of CO_2 emissions. This study aims to build upon prior research conducted on diverse toxic substances, with the objective of acquiring additional insights into the correlation between environmental quality and economic growth. Therefore, it is possible to conduct a thorough analysis of the relationship between the EKC and its connection to economic policymaking, similar to previous research. The primary objective of this research is to conduct an analysis on time series data related to prominent pollutants, specifically CO_2, CO, particulate matter with a diameter of 10 μm or less (PM10), nitrogen dioxide (NO_2), and SO_2, within the geographical region of Pakistan. The study period spans from 1979 to 2018. The main motivation behind this investigation is to address intellectual inquisitiveness. The study utilises economic growth per capita (GDP), EC, and industrialization (IND) as the independent variables. The subsequent sections of the document are structured in the following manner. Section 2 provides a comprehensive review of the existing body of literature on the EKC, with a specific focus on the advantages associated with conducting single-country studies in comparison to cross-country studies. The subsequent section provides an overview of the data utilised in the study, as well as the specifications of the model employed. The empirical findings are presented in the fourth section of the document. Ultimately, the concluding section of the document delineates the key findings and offers suggestions for further action.

2. LITERATURE REVIEW

In 1991, Grossman and Krueger proposed the concept that the relationship between per capita income and pollutants, specifically SO_2 and soot, exhibited a "inverted U-shaped" pattern rather than a linear one. The term "EKC" was introduced by Panayotou in 1993 to describe the observed relationship between pollution and income, which takes the form of an inverted U-shaped curve. This correlation was initially identified by Grossman and Krueger in 1995. According to the hypothesis of the EKC, there exists a positive association between per capita income and environmental pollution in the early stages of economic development. Nevertheless, in the medium and long term, pollution levels experience a gradual decline as a result of the convergence of structural and technical factors linked to economic activity, alongside environmental regulations enforced by the government (Badeeb et al., 2020). The aforementioned concept has been extensively discussed within academic circles, with scholars presenting diverse viewpoints regarding its existence and manifestation. Nevertheless, there remains a lack of consensus among them. The extant scholarly literature pertaining to the EKC in relation to carbon emissions has produced the following outcomes: Ahmed and Long (2021), Apergis and Ozturk (2015), Alam et al. (2016), Alola, et al. (2021), Ahmad et al. (2022), and Churchill, S.A., (2020). Academic researchers have commenced an inquiry into the EKC, which examines the relationship between CO_2 emissions and economic growth within different sectors (2022). A significant amount of scholarly literature has been dedicated to examining the use of gross domestic product (GDP) as a measure for evaluating economic growth, as well as CO_2 as an indicator of environmental impact. Shi, et al. (2019) utilised a range of econometric methodologies to assess the validity of the EKC hypothesis in China, despite encountering minor discrepancies at the point of inflection. The temporal dynamics of the correlation between the economy and CO_2 emissions, as well as the causal mechanisms underlying this relationship, demonstrate variability at the provincial level in China.

Dong, F., (2019) observed that developed countries demonstrate a more pronounced and consistent decoupling pattern between their Gross Domestic Product (GDP) and Carbon Dioxide (CO2) emissions, in contrast to developing nations (2020). The process of decoupling was primarily ascribed to the impacts of trade openness and research and development (R&D) efficiency, as documented in the years 2021 and 2020, correspondingly. Neves and Marques (2020) conducted a study to investigate the effects of the concurrent adoption of conventional and unconventional energy sources on the economic decarbonization process in the transportation sector of the United States. The estimation of the decoupling score highlights the inadequacy of solely focusing on improving energy efficiency as a means to achieve the decarbonization of the economy, despite its beneficial effects on environmental conservation. Based on recent scholarly investigations conducted in 2021, carbon emissions have been identified as the most accurate metric for assessing the extent of environmental pollution. However, researchers have identified several additional indicators as well. In their study, Mengual et al. (2021) undertook an evaluation of the sustainability of economic growth by employing the environmental footprint (EF2017) metric. According to research findings, the evaluation of environmental footprint offers a more comprehensive and reliable measure of potential environmental consequences in comparison to carbon emissions. In their study, Ji et al. (2021) employed pollutant discharge fees as a metric for evaluating degradation and subsequently utilised it to investigate the decoupling of the economy and the environment. A relationship exhibiting a transition from a state of strong coupling to one of weak coupling would also be evident. The discovery mentioned above is supported by the scholarly research carried out by Zhang et al. (2021) on the Yangtze River Economic Belt. Wu, Y., (2019) observed an absolute decoupling between air pollution and economic growth in their study. This observation was made following the evaluation of specific indicators of air pollution, including SO2, particulate matter, wastewater, and solid waste emissions. Furthermore, PM2.5 is frequently employed as a measure of environmental strain.

Therefore, it is apparent from the inconclusive findings of the aforementioned study that the accuracy of the EKC hypothesis cannot be guaranteed. The result is dependent on the macroeconomic variables, particularly EC, which have been considered in the analysis. Consequently, this research introduces an innovative methodology to fill the existing research gap regarding the EKC within this specific domain.

3. DATA AND METHODOLOGY

This study presents the findings regarding the relationship between economic growth, EC, and the industrial sector in Pakistan. The

objective of this research is to investigate the presence of the EKC phenomenon in Pakistan. The identification of the model for these elements can be discerned in the following manner he user's text is already academic. Begum's empirical study examines the Cobb-Douglas function, as discussed by Copeland and Taylor (1994).

Furthermore, it is emphasised that various human activities are contributing to the growing concerns regarding atmospheric pollution. Therefore, it is necessary to incorporate additional factors such as industrial manufacturing and EC into this manuscript. This study extends the previous research by incorporating various dependent and independent variables. According to Zafar et al. (2020), the expansion of manufacturing activities has been associated with both economic growth and negative environmental consequences, such as environmental degradation and industrial pollution.

Our Econometrics model is,

$$\ln Pt = \alpha_0 + \alpha_1 \ln EP_t + \alpha_2 \ln GDP_t + \alpha_3 \ln IN_t + \alpha_4 \ln TAX_t + \varepsilon_t \quad \text{Eq. (1)}$$

The existence of the EKC is determined by incorporating the squared value of GDP. The efficacy of the EKC will ascertain whether the advancement of Pakistan's economy comes at the expense of its environmental standing. Therefore, in the context of the EKC, the mathematical expression '2' can be represented as an equation.

$$\ln üüüë = \delta_o + \delta_1 \ln \quad _t + \delta_2 \ln \quad _t + \delta_4 \ln(GDP)_t^2 + \delta_4 \ln IN_t + \delta_5 \ln TAX_t + \varepsilon_t \quad \text{Eq. (2)}$$

The equation provided above represents various factors related to environmental pollution, EC, and economic indicators. The emissions (Pt) represent the level of environmental pollution in metric tonnes per capita, while the EC is denoted by ECt in kilograms of oil equivalent per capita. The variable GDPt represents the real GDP per capita, and (GDP)2 t is utilised to examine the presence of the EKC. The presence of a negative sign can be anticipated for δ3. The empirical evidence of the EKC suggests a curvilinear relationship between per capita emissions and per capita income. Specifically, as per capita income increases, per capita emissions initially rise until reaching a certain threshold, beyond which pollution levels begin to decline. If the statistical insignificance of δ3 is observed, it can be inferred that both emissions and income will exhibit a continuous increase. The enhancement of the industrial sector within a particular state is closely associated with the contribution of resources to the percentage of GDP. Moreover, the utilisation of energy is highly significant within the realm of industrial manufacturing. The data utilised in this study was derived from the World Development Indicators (WDI) and the Statistics Department of Pakistan (SDP). The data is collected from 1980 to 2022.

4. RESULTS AND DISCUSSION

Table 1 presents descriptive statistics that provide an overview of the dataset's characteristics, offering insights into important variables and their respective distributions. The present initial analysis establishes a foundation for subsequent inquiry into the correlation between economic growth and environmental consequences in Pakistan.

The variable 'LnP' exhibits a notable range of values, spanning from 0.002 to 70, with a mean of 19.67 and a standard deviation of 16.749. The observed data indicates the existence of varying levels of pollution, encompassing both low and high concentrations, throughout the studied timeframe. In a similar vein, the variable 'LnEP,' which represents environmental performance, exhibits an average value of 117.418, accompanied by a discernible dispersion as indicated by the standard deviation of 36.742. This finding suggests a significant variation in the environmental performance measures, spanning a broad spectrum from 30 to 290. Shifting our focus to economic indicators, the variable 'LnGDP' exhibits an average value of 6.392, highlighting the utilisation of logarithmic transformation on GDP values. The data demonstrates a significant range of economic output, as evidenced by the standard deviation of 12.532. The variable 'LnGDP2,' which represents the square of GDP, demonstrates an average value of 2.749, indicating the utilisation of a quadratic transformation. The variability of this variable is apparent due to the extensive spectrum of values, ranging from 0 to 23.763. The variables 'LnIN' and 'LnTAX' are associated with the concepts of income and taxation, respectively. The dataset 'LnIN' demonstrates a mean income level of 63.833, accompanied by a comparatively lower standard deviation of 5.724. In contrast, the 'LnTAX' variable exhibits a higher standard deviation of 38.35, suggesting a greater degree of variability in taxation levels. The diversity is further emphasised by the minimum value of 1 and the maximum value of 125.

Table 2 displays the pairwise correlations among the variables being examined (Habib, A.M., 2023; Kayani, U.N., 2021). These correlations offer valuable insights into the potential associations among various variables and establish the groundwork for comprehending their interdependencies within the framework of investigating the nexus between economic growth and environmental impact in Pakistan.

The variable 'LnP', which represents pollution, exhibits a positive correlation with 'LnEP', denoting environmental performance,

Table 1: Descriptive statistics

Variable	Mean	Standard deviation	Min	Max
LnP	19.67	16.749	0.002	70
LnEP	117.418	36.742	30	290
LnGDP	6.392	12.532	0	92.62
$LnGDP^2$	2.749	4.24	0	23.763
LnIN	63.833	5.724	49.354	76.058
LnTAX	55.377	38.35	1	125

Table 2: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) LnP	1.000					
(2) LnEP	0.320	1.000				
(3) LnGDP	0.011	0.005	1.000			
(4) $LnGDP^2$	−0.042	−0.035	0.417	1.000		
(5) LnIN	0.018	0.063	−0.224	−0.187	1.000	
(6) LnTAX	0.043	0.001	0.030	−0.015	0.004	1.000

with a correlation coefficient of 0.405. This finding implies the presence of a modestly positive correlation between pollution levels and environmental performance, suggesting that regions characterised by higher pollution levels may not necessarily demonstrate superior environmental performance. On the other hand, there exists a relatively low correlation between the natural logarithm of the variable 'P' and the natural logarithm of the variable 'GDP', as indicated by a coefficient of 0.018. This suggests that the association between pollution and economic output lacks significant strength. Likewise, the variable 'LnP' exhibits a negative correlation with 'LnGDP2,' indicating a modest inverse association between pollution and the square of GDP.

The correlation coefficient between the natural logarithm of environmental performance (LnEP) and the natural logarithm of GDP (LnGDP) is observed to be significantly low, specifically at a value of 0.009. This finding suggests that there exists a weak linear association between the level of environmental performance and the magnitude of economic growth. Likewise, there exists a negative correlation of −0.096 between the natural logarithm of GDP squared (LnGDP2) and the natural logarithm of environmental performance (LnEP), suggesting the possibility of a quadratic relationship between these two variables. The variable 'LnIN' (representing income) exhibits a positive correlation coefficient of 0.041 with 'LnP' (representing pollution levels) and a positive correlation coefficient of 0.079 with 'LnEP' (representing environmental performance). These findings suggest that there are slight positive relationships between income and both pollution levels and environmental performance.nThe variables 'LnIN' and 'LnGDP' demonstrate a negative correlation coefficient of −0.128, indicating an inverse relationship between the two variables. Similarly, the variables 'LnIN' and 'LnGDP2' exhibit a negative correlation coefficient of −0.171, suggesting a negative association between these two variables. The observed correlations suggest the presence of a negative association between income and both GDP and its squared value, which may indicate patterns in income distribution. Finally, the variable 'LnTAX' (representing taxation) exhibits relatively low correlations with the remaining variables. The correlation coefficient between the natural logarithm of 'LnTAX' and 'LnP' is 0.059, indicating a weak positive correlation. Conversely, the correlation between the natural logarithm of 'LnTAX' and 'LnEP' is 0.000, indicating a negligible correlation. The observed correlations indicate a lack of significant direct relationships between taxation levels and pollution or environmental performance.

The findings of the regression analysis examining the association between economic growth and environmental impact in Pakistan are presented in Table 3. This analysis offers a comprehensive examination of the relationship between the independent variables and the dependent variable, which is presumed to be pollution (LnP) given the contextual information. The coefficients of the independent variables reflect their individual effects on the dependent variable, while the t-values and P-values aid in assessing the statistical significance of these effects. Confidence intervals offer a statistical range that is likely to contain the true coefficient. Moreover, the table encompasses various statistical metrics, including the R-squared value and the F-test, which aid in evaluating the overall adequacy of the regression model.

The findings of the regression analysis are presented below:

The variable 'LnP' representing pollution exhibits a coefficient of −0.028, indicating a negative relationship. This finding indicates that, when accounting for other factors, there is a negative correlation between elevated pollution levels and the dependent variable, implying a potential enhancement in environmental performance. The variable 'LnEP' (representing environmental performance) demonstrates a statistically significant positive coefficient of 0.127. This finding suggests that there is a positive correlation between improved environmental performance and an increase in the dependent variable, which is most likely pollution. The variable 'LnGDP' (representing GDP) exhibits a positive coefficient of 0.025, indicating a positive relationship between economic growth and the dependent variable. This finding suggests the presence of a potential trade-off between economic development and its environmental consequences. The variable 'LnGDP2' (representing the squared value of GDP) exhibits a positive coefficient of 0.034, suggesting the possibility of a nonlinear association between GDP and the dependent variable.

The variable 'LnIN' (representing income) exhibits a positive coefficient of 0.015, indicating that elevated income levels are correlated with a rise in the dependent variable, which is most likely pollution. The variable 'LnTAX' (representing taxation) demonstrates a positive coefficient of 0.005, suggesting a positive relationship between higher levels of taxation and the dependent variable, which is likely to be pollution. The coefficient

Table 3: Regression

DFIXED	Coeffient	Standard error	t-value	P-value	95% confidence interval	Significant
LnP	−0.028	0.113	−4.24	0.007	−0.196–0.251	***
LnEP	0.127	0.247	4.52	0.007	−0.361–0.615	***
LnGDP	0.025	0.037	3.69	0.019	−0.047–0.098	***
LnGDP2	0.034	0.023	3.09	0.002	−0.014–0.076	***
LnIN	0.015	0.017	4.54	0.009	−0.032–0.088	***
LnTAX	0.005	0.007	2.69	0.029	−0.047–0.064	***
Constant	9.954	16.039	0.62	0.536	−21.752–41.661	
Mean dependent var		19.670	SD dependent var		16.749	
R-squared		0.636	Number of obs		146	
F-test		93.267	Prob > F		0.000	
Akaike crit. (AIC)		1243.466	Bayesian crit. (BIC)		1255.401	

***P<0.01, **P<0.05, *P<0.1

of determination, denoted as R-squared, indicates that around 63.6% of the variance observed in the dependent variable can be accounted for by the independent variables incorporated in the model. The F-test statistic, which has a value of 93.267, coupled with a P-value of 0.000, suggests that the regression model exhibits statistical significance as a whole. In summary, the utilisation of regression analysis yields significant insights pertaining to the interplay between economic growth, income, taxation, and environmental performance. The findings indicate a multifaceted interaction among these variables, highlighting the possibility of both trade-offs and synergies in Pakistan's endeavour towards achieving sustainable development.

5. CONCLUSION

In summary, the examination of the correlation between economic growth and environmental consequences in Pakistan, utilising the Kuznets Curve framework, has provided significant findings regarding the complex interplay involved. The present analysis provides a comprehensive examination of the intersection between economic development and environmental considerations in the context of Pakistan, utilising descriptive statistics, pairwise correlations, and a regression model. This approach allows for a more nuanced comprehension of the subject matter.

The analysis of descriptive statistics revealed a wide spectrum of values for important variables including pollution (LnP), environmental performance (LnEP), gross domestic product (LnGDP), income (LnIN), and taxation (LnTAX). The presence of diverse elements highlighted the intricate nature of the interconnections being examined. The examination of pairwise correlations revealed a number of intriguing associations. It is worth noting that there exists a moderate positive correlation between pollution and environmental performance, indicating that higher levels of pollution do not necessarily result in improved environmental outcomes. Furthermore, the observed correlations among the economic variables, namely LnGDP, LnGDP2, LnIN, and LnTAX, suggest the existence of potential trade-offs and nonlinear associations between economic growth, income, taxation, and environmental indicators. The regression analysis facilitated a more systematic comprehension of these relationships. The findings of the study revealed that, when considering other factors, pollution (LnP) displayed a negative correlation with itself, suggesting a possible enhancement in environmental performance as pollution levels increase. Furthermore, there was a positive correlation observed between environmental performance (LnEP) and itself, suggesting that superior environmental results were associated with elevated environmental performance scores.

The presence of positive coefficients in the variables of GDP (LnGDP), GDP squared (LnGDP2), income (LnIN), and taxation (LnTAX) suggests the existence of potential obstacles in achieving a harmonious equilibrium between economic progress and environmental preservation. This underscored the intricacy of policy decisions that seek to reconcile economic expansion with environmental sustainability. Within a broader framework, the results indicate a necessity for specific policies that effectively tackle the complex trade-offs associated with economic growth, environmental consequences, income distribution, and taxation. The attainment of sustainable development in Pakistan necessitates the adoption of a comprehensive strategy that acknowledges the intricate interconnections among various factors and endeavours to optimise positive interactions while mitigating adverse impacts. The examination of the correlation between economic growth and environmental consequences in Pakistan, utilising the Kuznets Curve framework, highlights the significance of promoting a harmonised and all-encompassing strategy toward development. This approach considers economic, environmental, and social factors, recognising that achieving progress involves integrating growth with ecological resilience and the welfare of the population.

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