Exploring the Relationship Between Tourism and Environmental Degradation in Pakistan's Economy: A Time Series ARDL Modelling Approach

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ABSTRACT

Tourism has received a lot of attention recently, particularly in developing nations that are already dealing with a variety of issues and difficulties. In many parts of the world, there has been a connection between rising tourism and environmental damage. Governments should use economic growth and human activities that increase CO_2 emissions, such as energy consumption and tourism, as a proxy for environmental harm in order to limit this. Travel is only one of the damaging behaviors that tourism may engage in that might affect the climate. Global warming and unhealthy air conditions can be exacerbated by networks of transportation. Transit's consequences include environmental disturbance, contamination of the environment, and breathing in pollutants. This study, which spans the years 1997 to 2022 uses Autoregressive Distributed Lag (ARDL) models to examine the long-term cointegrating causal connection among environmental deterioration and tourism. The projected results demonstrate how Pakistan's efforts to stop environmental deterioration are hampered by tourist. GDP and energy consumption are two other important variables that have a long-term, favorably biased connection with carbon emissions. The report advised that lawmakers create a model framework for rules that would oblige the federal government to spend its money in carbon-free or ecotourism enterprises in order to protect a sustainable environment. Moreover, tourism significantly affects the country's economy. Since tourism degrades the environment, regulators must consider both the sector's good and bad effects. In order to protect the environment and encourage sustainable tourism growth in Pakistan's economy, this paper proposes policy recommendations.

1. Introduction

Although it is thought that tourism helps to create new employment and investment possibilities, it also has a detrimental effect on the environment since it uses a lot of energy for things like food, transportation, and air travel, among other things, which results in significant CO2 emissions. As a result, some claim that while if tourism promotes growth, it might potentially harm the ecology in the host nations (Ravinthirakumaran & Ravinthirakumaran, 2023). They discovered that compared to the industry as a whole, tourism was less energy-efficient. The World Travel and Tourism Council 4 estimates that tourism brought in US$ 832.1 million, or 2.9% of Pakistan's total GDP, in 2017 and would grow by 5.9% in 2018. In a similar vein, the UNWTO estimates that 1.49 million jobs, or 2.5% of total employment, were generated by tourism in 2017 (Kimbu & Tichaawa, 2018). The capacity to sustain the environment is one of the major problems facing the planet today. Environmental degradation and climate change are some of its causes. However, Becken, Simmons, and Frampton (2003) hypothesized that tourism increases atmospheric CO2 levels, which raises a country's energy consumption Ragab and Meis (2016) study found that a nation's expanding tourism sector has a significant impact on the environment. The majority of developing countries see an increase in carbon emissions as a result of the development of their tourist infrastructure, according to (Nademi & Najibi, 2011). In terms of global carbon emissions, the transport sector is undeniably second only to the oil and gas sector.

Tourism increases job opportunities in a number of industries, such as hospitality, lodging, and catering, in both developed and developing countries like Pakistan and the Brics economies, which lowers unemployment and enhances the manufacturing and service sectors (Arshad, Iqbal, & Shahbaz, 2018). In 2021, tourism generated one out of every ten new employment globally (Pata, Dam, & Kaya, 2023; Sun, Sarfraz, Khawaja, Ozturk, & Raza, 2022). In order for the economy to recover from the consequences of COVID19, tourism must grow since it is essential to economic development. Even if tourism has certain economic advantages, Using each of the energy reserves for travel, accommodation in hotels, amusement park journeys, and other hobbies would probably result in significant negative environmental impacts such as higher carbon dioxide pollutants (Rahman et al., 2017). Although in case of high energy prices the tourism have negative effect in terms of economic growth as tourism have great power to boost the economy (Awan, Bibi, Bano, & Shoukat, 2023).

Additional climate change mitigation projects within Pakistan include the the refrigerator and Environmental Regulation Guidelines, Power The term effectiveness, National Renewable Energy Indicates National Energy Generation Plan, Global Climate Solutions Fund, and others (Scott, Gössling, Hall, & Peeters, 2016). The World Tourism Organisation asserts that tourism, which accounts for more than 10% of the global GDP, is one of the sectors with the fastest growth rates (Echtner & Prasad, 2003). The twenty-five million foreign visitors in the year 1950 increased to 166 million in 1970, 1.442 billion of dollars in 2018, and a staggering 1.8 billion by 2030, based on projections. It is predicted that organizing such a sizable visitor population will have both good and adverse effects on job creation, financial growth and development, and economic growth. Direct electrification is used in land transportation, manufacturing, mining, and residential and commercial construction to lessen the carbon footprint of energy generation (Okumus & Erdogan, 2021). The zero-emission technologies that Pakistan may readily adopt are renewable energy sources and electric cars (Zhan et al., 2021). To our knowledge, Pakistan's efforts to achieve zero environmental impact have not included promoting tourism.

The historical connection between environmental deterioration and foreign travel to Pakistan is examined in this study. Using annual data from 1998-2022, effects of usage of the energy, GDP, & population size on the environmental degradation are also examined. By merging pollution and tourist growth into a unified framework that permits comparisons of the economic growth and pollution caused by tourism while also considering other aspects like energy, financial

development, capital, and population into consideration, this study delivers a unique contribution.

By applying the ARDL approach, This Research article is expanding body of information regarding the potential for decarbonization to help with emission reductions and to reach zero environmental deterioration. Our investigation's findings show that the variables in the research are cointegrated. The results of the ARDL study further demonstrate the journey has a substantial as well as favorable effect on CO_2 emissions. In order to attain carbon neutrality, the study's policy implications are discussed, including the necessity of promoting energy-efficient travel like hiking and scuba diving.

1.1. Evolution in Pakistan's Carbon Footprint and Numbers of Tourists

Due to the struggle against terrorism, both domestic and international tourism to Pakistan increased in the years 2016–2017 (Arshad et al., 2018). However, Most people agree that both energy use and tourists are harmful to the environment as a whole. The charts and tables underneath show how Pakistan's CO_2 emissions and tourist influx changed throughout 1990 and 2020. In Pakistan, CO_2 emissions have increased during the last 40 years. This number climbed gradually up to 2020, when Pakistan received five million tourists from other countries.

1.1.1. Tourist Arrival Trends in Pakistan is Shown in Below Chart. The Data of the Graph is Taken from World Bank
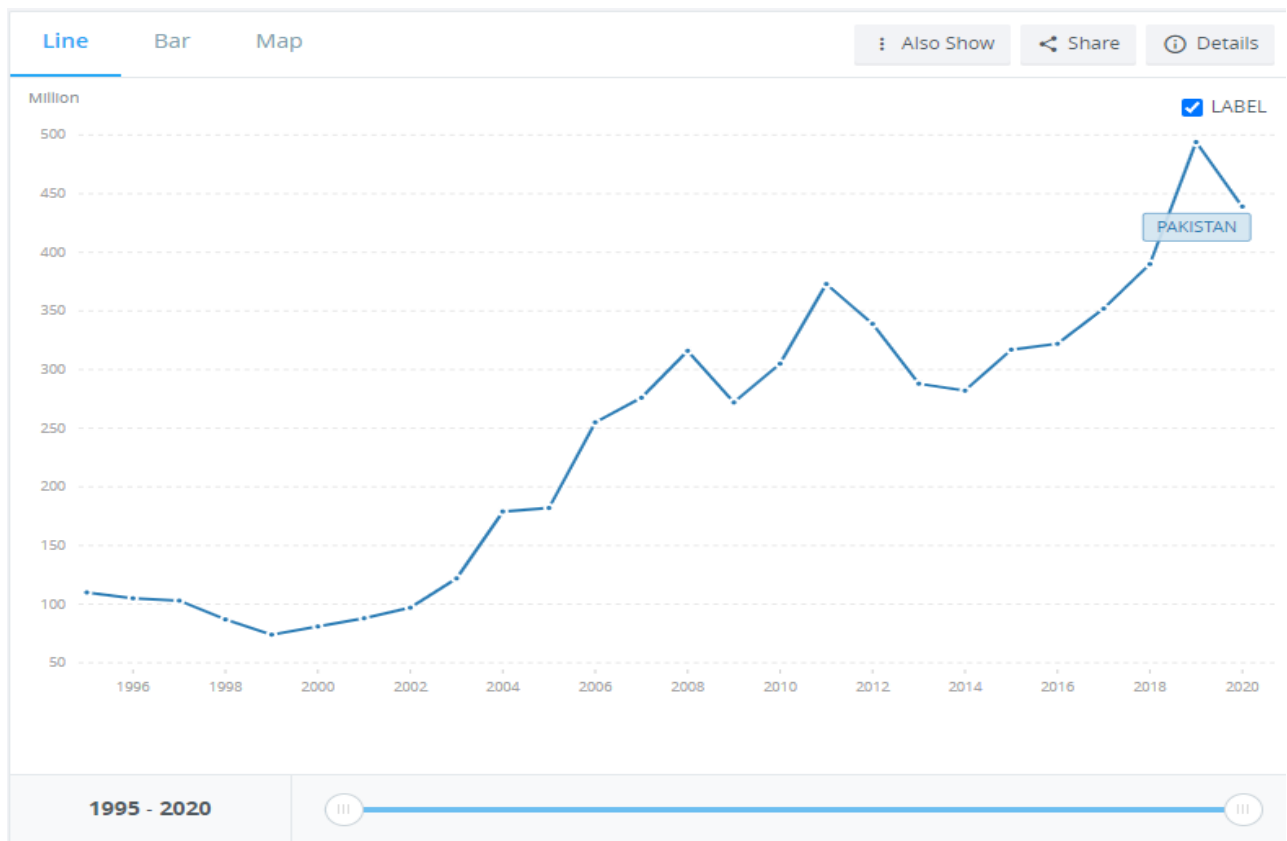

Figure 1: Tourist Arrival Trends in Pakistan

1.1.2.Co2 Trends in Pakistan is Shown in Below Chart. The Data of the Graph is taken from World Bank
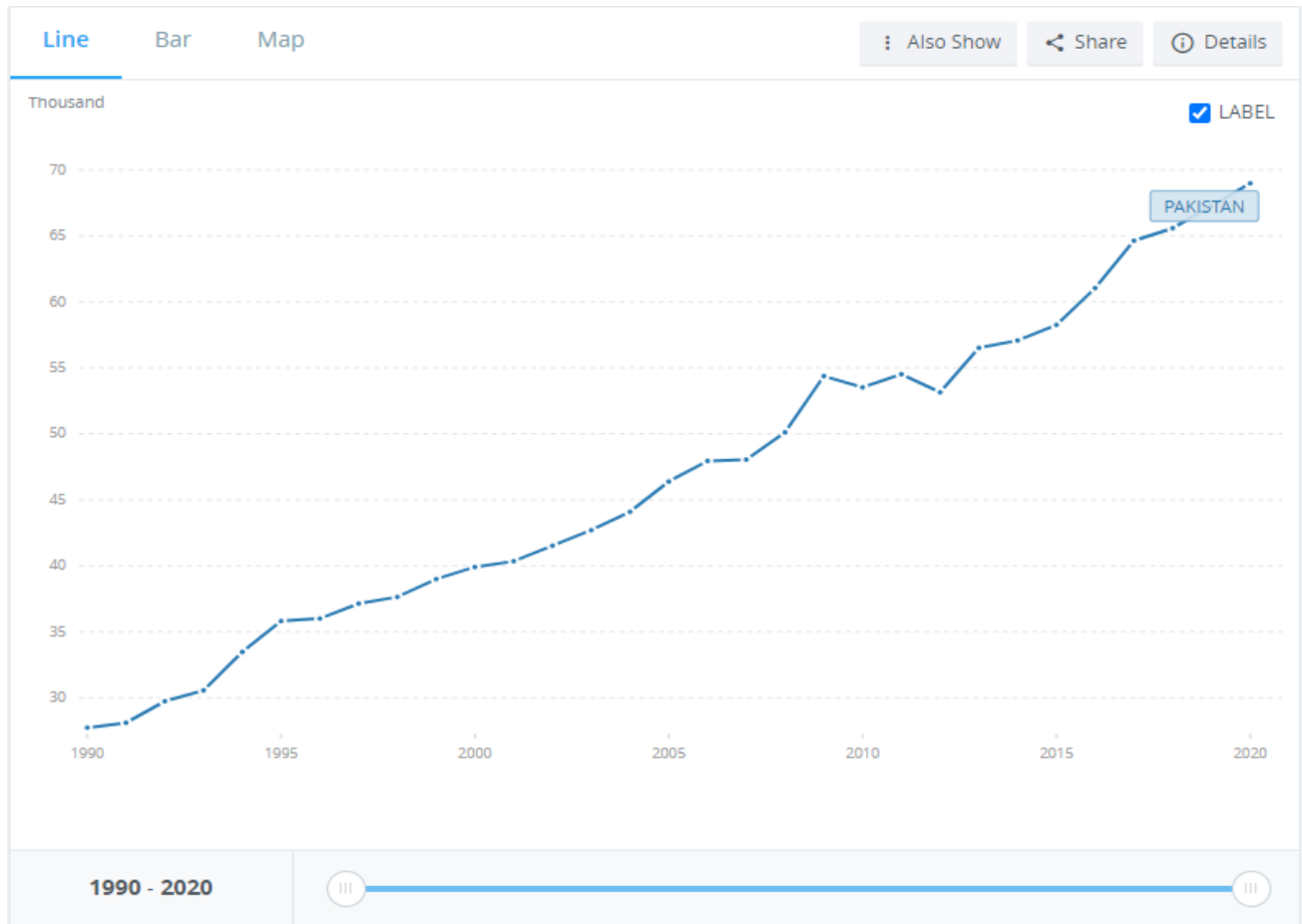

Figure 2: CO2 Trends in Pakistan

This study explores an important but little-known relationship between environmental deterioration and tourism, which is a major economic sector in Pakistan. With the potential for wider applicability, the research presents a methodological novelty by using sophisticated Time Series ARDL modelling approaches. The results of this study can help policymakers create evidence-based policies and incentives that strike a balance between economic growth and environmental preservation by educating them about the negative effects of tourism on the ecosystem. This study adds to the continuing efforts to attain sustainability at the nexus of economic prosperity and environmental well-being in light of the global Sustainable Development Goals (Un & Asakawa, 2015). This research offers potential for directing Pakistan's growth as well as developing methods for other nations with comparable difficulties, particularly as tourism-related concerns continue to get worldwide attention.

2. Exiting Literature
2.1. Theoretical Framework

The Tourism-Induced Environmental Stress Model is a significant theoretical framework that has been employed in previous research to elucidate the intricate relationship between tourism and environmental degradation. Rooted in this model, research such as that conducted by Gössling and Scott (2012) has examined how various tourism activities and developments,

such as infrastructure expansion, increased resource consumption, and waste generation, can act as stressors on the environment, leading to heightened environmental degradation. The model emphasizes that these stressors can significantly impact the ecological and social dimensions of destinations, often necessitating a careful balance between tourism-driven economic growth and environmental sustainability. Therefore, this model is instrumental in understanding how specific tourism-related actions contribute to environmental stress, and thus forms a crucial foundation for addressing the potential environmental effects of tourism in contemporary contexts (Gössling & Scott, 2012).

Two of the most important problems facing the globe now are climate change and ecological destruction. To limit further damage, several scholars have studied various carbon emission sources. Little is known about how human activities like tourism and the erratic nature of economic decisions effect a carbon operation, despite the fact that the link among consumption, greenhouse gases, and economic development has been thoroughly researched in the literature, with Pakistan making a good case for themselves. Tourism is one of the causes that scholars believe significantly contributes to environmental deterioration. Recent interest from academics and policymakers in researching how tourism impacts the environment. For instance, Danish and Wang (2018) examined the connection between tourism and the environment and discovered that it may affect environmental quality in three distinct ways: favorably, considerably unfavorably, and favorably. Numerous research have shown that tourism affects CO_2 emissions in a favorable and significant way (i.e., increases CO_2 emissions) (Alam & Paramati, 2017; León, Arana, & Hernández Alemán, 2014; Paramati, Alam, & Lau, 2018; Shakouri, Khoshnevis Yazdi, & Ghorchebigi, 2017).

2.2.   Tourist Arrival and Environmental Degradation

It has been shown The tourism industry has a negative impact on the environment in countries according to Agyeman et al. (2022) who studied the variables that influence Emissions of carbon dioxide, having a focus on a rise in tourism. According to research on cointegration and causality, a 1% increase in financial development results in a 0.19% increase in releases of carbon dioxide (CO_2) over the long run, A one percentage point rise in visitors causes a 0.22% rise in polluted air. Similar to this, Katircioglu, Feridun, and Kilinc (2014) ARDL and variable breakdown, and reaction times were used to study the steady-state link between tourist attractions, energy consumption, and emissions of carbon dioxide. Spontaneous reactions and variation decompose technique demonstrated that the increase of human population has greatly impacted the CO_2 emissions over the short- and long-term as a result of the expansion of the tourism sector. More evidence for this was presented via Katircioglu et al. (2014), who looked at Cyprus's tourist industry's long-term links to releases of carbon dioxide (CO_2). They discovered that from 1970 to 2009, visitor numbers and carbon emissions were cointegrated using limits analyses. This illustrates how tourism affects releases of carbon dioxide (CO_2) throughout time. They came to the conclusion that there was a statistically significant and positive influence of tourism on releases of carbon dioxide (CO_2).

Similar to additional economic growth, tourism gives an immediate impact on Sustainable development for the environment since Tourism raises CO_2 emissions by using more Power and Transport. From 1998 to 2006, León et al. (2014) looked into the relationship among travel and carbon dioxide emissions in 15 industrialized and 32 developing nations. According to the findings, affluent and less developed nations had CO_2 emissions increases of 0.13% and 0.04%, respectively, for every 1% rise in tourist arrivals. The findings also showed that rising populations boosted CO_2 in the both rich versus emerging countries, with a one percentage increase the populace leading to increases CO_2 emissions of 0.87% in developed nations and 0.49% in less developed nations (León et al., 2014). Similar research was conducted by Durbarry (2004) who looked at how the sector of tourism affected Mauritius' changings in the environment and climate. They discovered that a one percentage enhancement in visitor numbers was linked to a 0.08

percentage rise in CO2 emissions over time. the immediate as well as long-term outcomes of the ARDL model demonstrated suggesting a rise in visitor numbers had a large, advantageous impact on CO2 emissions.

Mehmood, Mansoor, Tariq, and Ul-Haq (2021) employed methods using pooling median groups and cointegration of panels to assess the connection among the sector of tourism and CO2 release in the research conducted in Southeast Asia. The cointegration of the two variables revealed that tourism is ultimately to blame for rising CO2 emissions. Furthermore, a one percentage increase in visitors results 0.14 percent increase in long-term emissions, This is having a significant influence on the release of carbon dioxide (Balsalobre-Lorente, Driha, Shahbaz, & Sinha, 2020a). Research on the linkage of Arriving tourists and emissions of carbon dioxide is routinely done in Turkey. Three testing methods for cointegration were used (Pata & Balsalobre-Lorente, 2022). A one percent rise in tourism and Economy led to rising carbon dioxide emissions of 0.099% along with 0.766%, correspondingly. The majority of nations' tourist industry have been shown to greatly increase economic development while negatively impacting the environment. According to one research, more visitors are harming the environment.

According to a recent study by Koçak, Ulucak, and Ulucak (2020) visitor arrivals are having a bigger environmental effect in terms of CO2 emissions while the environmental impact of tourist money is decreasing. Data from 31 OECD countries between 1995 and 2016 were utilized by Saint Akadiri, Alola, and Akadiri (2019) to demonstrate that the arrival of foreign visitors had a large and negative impact on environmental quality. They achieved this by employing a panel quantile strategy. Contrary to what the results of the earlier study indicated; tourism really reduces CO2 emissions. The tourism industry's impact on GDP and emission of carbon dioxide was evaluated by Lee and Brahmasrene and Lee (2017) done study on European countries from 1988 to 2009.They determined about the CO2 emissions fell by 0.105 percent for every 1% increase in visitor volume. The study asserts that tourism directly affects CO2 emissions and EU economic growth. More proof for this was supplied by Khan, Khan, Naseem, and Faisal (2023) which included 12 countries in the Asia-Pacific between 1995 and 2013. Using the generic method of moments (GMM) on a panel, tests for causality by Granger revealed that the arrival of visitors in these Asia-Pacific countries end conclusion a reduction in discharges of the carbon dioxide.

Additionally, Ozturk, Aslan, and Altinoz (2022) The panel's data were utilized It is crucial to include energy consumption, a cross-sectional dependence, and heterogeneity when analyzing the relationship between CO2 emissions, real GDP, and tourism in the EU and candidate countries. decreased travel Group-mean estimates, fully modified OLS (FMOLS), dynamic OLS method (DOLS), and conventional least squares approaches (OLS) with fixed effects were all used to quantify the carbon dioxide emissions. According to Balsalobre-Lorente, Driha, Shahbaz, and Sinha (2020b) he examined the long-term connections between economic growth, internationalization, energy use, carbon dioxide emissions in affluent countries, and international cooperation Once economics in the tourist industry have reached a certain stage of development, travel encourages ecological improvements.

Some study investigate the effect of tourism sector on the growth nexus of carbon emissions, despite the fact that many have examined the connection among the carbon dioxide, the tourism industry, economic development, energy, and environmental concerns (Dogan, Seker, & Bulbul, 2017; Selvanathan, Jayasinghe, & Selvanathan, 2021). As was already said, Pakistan receives a lot of visitors and produces a lot of CO2s (see Table 1). It is essential to investigate the interlink among the foreign tourism as well as the environment and climate.

This study differs from previous research in two ways that help us fill in information gaps. This study, is the initially, to the extent of our understanding, to use the ARDL method approach to investigate the variables affecting Pakistani tourism-related CO2 emissions with the aim of

having no adverse environmental effects. By employing ARDL modelling to analyse the relationship between carbon emissions, tourism, energy, economic growth, and overall population, this work is novel and makes significant scientific advances. The findings of this article will be useful to policymakers as they evaluate energy and tourism projects from a broader environmental viewpoint.

However, despite this existing body of research, there remains a conspicuous gap in our understanding of their combined effects in the current era. Many of the previous studies are now outdated and may not accurately represent the contemporary situation in Pakistan, which has witnessed substantial shifts in its economy, energy policies, and demographic trends.

Research on the impact of environmental degradation on tourism in Pakistan is an area of growing concern and significance. While prior studies have examined the effects of environmental degradation on the tourism industry in various contexts, there remains a notable research gap in the Pakistani context. Existing research, such as the work of Khan et al. (2020) on sustainable tourism development, often focuses on broader environmental and economic issues, rather than the specific dynamics between environmental degradation and tourism. With Pakistan experiencing rapid economic growth, increasing energy consumption, and a growing population, understanding the specific consequences of environmental degradation on tourism in this new era is crucial. Moreover, as highlighted by Ali et al. (2019) in their study on the environmental impacts of tourism, the rapidly changing landscape of tourism in Pakistan demands a fresh examination of how environmental degradation affects this industry. Thus, this research aims to address this research gap by conducting a contemporary analysis of the intricate relationship between environmental degradation and tourism in Pakistan. This study will not only contribute to our understanding of the local tourism industry but also provide valuable insights for policymakers and stakeholders to implement sustainable practices and policies in this evolving context, aligning with the global emphasis on responsible and eco-friendly tourism. By addressing this research gap, we can more effectively design policies that promote environmental conservation and sustainable development within the specific context of Pakistan, acknowledging the latest developments and trends in these key independent variables (Khan & Tahir, 2019).

3.   Methodology
3.1.   Econometric Model and Data source

The authors of this econometric analysis use time-series data for the Pakistani economy from 1998 to 2022.To calculate the interlink of Environmentalism and tourism, the variables GDP, total population, and energy use are all kept under control variable in this study. As a stand-in for environmental pollution, we employed CO2 as dependent variable per person as well as Tourism is taken as independent variable. So, the details were provided by the WDI. In pragmatic research, the variables are transformed into natural logarithms. The variable descriptions are presented in Table 1.

Table 1
Variable Description and Data Source

Symbol	Variable	Source	Measurement of the Variable
CO2	Environmental degradation	WDI	Total greenhouse gas emissions (kt of CO2 equivalent)
TA	Tourism	WDI	International tourism, number of Arrivals
GDP	Economic Growth	WDI	GDP (current LCU)
EC	Energy consumption	WDI	GDP per unit of energy use (PPP $ per kg of oil equivalent)
TPG	Total population Growth	WDI	GDP (current LCU)

Note: WDI=WORLD DEVELOPMENT INDICATORS

3.2.   Theory and Model
3.2.1.Theoretical Background

Large sources of carbon emissions may emerge near tourist gateways, according to the key theoretical premise of this study. Numerous studies have demonstrated that energy consumption and GDP both have a significant role in climate change. Time series model shows a relationship between Emissions of carbon dioxide and energy utilisation, GDP, and Tourist Arrival .The formula for the interaction between tourism, energy, growth, and the environment frequently is follow as :

$$CO_2 = f(TA, EC, GDP, TP) \qquad (1)$$

where TP represents the total population, TA the number of visitors, EC the amount of energy used, and GDP the gross domestic product per person. To ascertain the growth effects of the regressors on the dependent variable, all variables are employed in the aforementioned econometric analysis in their logarithmic form in eq (2):

$$logCO_2 = f(logTA, logEC, logGDP, logTP) \qquad (2)$$

We use the following equation to investigate the long-term link between dependent variable and independent variable.

$$CO2_t = \beta0 + \beta_1 TA + \beta_2 EC_t + \beta_3 GDP_t + \beta_4 TP_t + \varepsilon_t \qquad (3)$$

In order to identify the best time series models from Equation (4), the estimate process is smoothed and the direct elongations of the coefficients are determined using the logarithm of each variable:

$$logCO2_t = \beta0 + \beta_1 logTA + \beta_2 logEC_t + \beta_3 logGDP_t + \beta_4 logTP_t + \varepsilon_t \qquad (4)$$

where error term is t over the specified time duration, logarithm function is and the β_0 presents the constant. The slope coefficients here are β_1, β_2, β_3, and β_4.

One way to express the CO2 is as follows: The overall population, GDP, energy use, and visitor count are the primary factors that affect CO2.

3.3.   Unit Root test

To ensure sure the model is suitable for the task, the stationarity properties of the given data should be evaluated prior to analysis. We do the Augmented Dickey-Fuller (ADF) Tagaya et al. (1989) and Phillips-Perron (Cheung & Lai, 1997) . The test that is called unit root test used to determine whether the data are stable. The null hypothesis is the alternative of stationarity, which occurs when an array is devoid of a unit root. To figure out the highest quantity of integrates, we use this ADF unit root test. This unit root test might not be reliable; thus, a second unit root test and the PP test is performed to establish confidence in the stationarity of the variables. The PP test is robust to heteroscedasticity and may be used to in time series analysis, take more complex serial correlations into consideration. Also permitted are weaker assumptions about the distribution of mistakes. As a consequence, we check to verify if our variables are stationary using both the Philips-perron and Augmented Dickey-fuller test.

The unit root is tested using the ADF paradigm as follows:

$$\Delta y_t = \mu + \delta y_{t-1} + \beta_t + \sum K \ i = 1 \ di\Delta y_t - i + \in_t \qquad (5)$$

In above equation The Number of Lags are represented by K, $t - i = 1$ and k, $\delta = \alpha^-1$ $\alpha = coefficient\ of\ yt - 1$, $\Delta y_t = First\ Difference\ of\ yt\ and\ et = white\ noise\ disturbance$ .Null hypothesis for Augmented Dickey-fuller test is that = 0, not the alternative hypothesis is zero. Then we refuse the null, the progression is stationary; if not, it is non-stationary.

The equation for PP-Test test is below

$$\Delta y_t = \mu + \delta y_{t-1} + \beta_t + e \tag{6}$$

3.4. Cointegration tests

This research examines the tourism industry's long-term connection with the environment using the ARDL limits test.

3.4.1. ARDL Model

The ARDL limits test method is used to ascertain whether there is Co integration of variables in a long-term perspective correlations among the various variables once the stationarity properties of the series have been established. (Pesaran & Weeks, 2001) two asymptotic critical value boundaries are created. ARDL limits test when I (0) or I (1) are the independent variables. Since we both agree that the test values are greater than the UCB values .we come to the conclusion that the variables are connected over the long time period. To determine the variables' cointegration, use the equation below:

The first difference when the best lags are selected with the AIC are displayed is εt, which stands for white noise. The limits test approach is according to the combined the F-value and determines the entire importance associated with the lags parameters coefficients. So in this scenario the Null hypothesis $Ho: \beta1 = \beta2 = \beta3 = \beta4 = 0$, But against this the alternative hypothesis can be H$_1$: β=0, So r=1,2,3,4,

$$\Delta logCO2_t = \beta_0 + \beta_1 logCO2_{t-i} + \beta_2 logTA_{t-i} + \beta_3 logEC_{t-i} + \beta_4 logGDP + \beta_5 logTP_{t-i} + \sum_{i=1}^{p} \beta_1\ \Delta logCO2_{t-i} + \sum_{i=1}^{p} \beta_2\ \Delta logTA_{t-i} + \sum_{i=1}^{p} \beta_3\ \Delta logEC_{t-i} + \sum_{i=1}^{p} \beta_4\ \Delta logGDP_{t-i} + \sum_{i=1}^{p} \beta_5\ \Delta logTP_{t-i} + \varepsilon_t \tag{7}$$

3.4.2. Test of Lag Length

The Author utilizes the criteria of AIC to identify the ideal approach since they were thought to be appropriate to determine a lag duration provided the circumstances of our inquiry.

3.4.3. Mechanisms in the Long- and Short-runs

We use ARDL approach is used to examine the short term and long-term coefficients immediately following evaluating the series' stationarity traits and cointegration method. The cointegrating vector(s) are found using the ARDL cointegration method. That is, a different long-run connection equation can be used to describe each of the underlying variables If just one cointegrating vector is recognized, the cointegrating vector's ARDL model is reparametrized into the error corrections modelling (ECM). The reparametrized result provides both short-run period and long-run interactions between the variables that are included in an instrumental framework. Following confirmation of the cointegration between the variables, the equations no. 8 is used to calculate according to the ARDL criteria, both short- and long-term results.

3.4.4. Long-run ARDL

$$logCO2_t = \beta_0 + \sum_q i = 1 \beta_1\ logCO2_{t-i} + \sum_q i = 1 \beta_2\ logTA_{t-i} + \sum_q i = 1 \beta_3\ logEC_{t-i} + \sum_q i = 1 \beta_4\ logGDP_{t-i} + \sum_q i = 1 \beta_5\ logTP_{t-i} + \varepsilon_t \tag{8}$$

Here, t i stands for The AIC chooses the best lags for long-term assessments based on the variation in the long-term factors. The short-run ARDL model employs a subsequent ECM.

3.4.5. Short Run

$$logCO2 = \alpha_0 + \sum_q i = 1 \, \alpha_1 \, \Delta logCO2_{t-i} + \sum_q i = 1 \, \alpha_2 \, \Delta logTA_{t-i} + \sum_q i = 1 \, \alpha_3 \, \Delta logEC_{t-i} +$$
$$\sum_q i = 1 \, \alpha_4 \, \Delta logGDP_{t-i} + \sum_q i = 1 \, \alpha_4 \, \Delta logTPG_{t-i} + \mu ECT_{t-1} + \varepsilon_t \qquad (9)$$

In this case, the ECM coefficients presented by μ , which shows how quickly the variables are adjusting to the long-run convergence, is supplied by and The short-term determinants' variance is represented by α. The optimal lags for the patterns of the short-term AIC criteria are likewise captured in t− i.

4.   Estimation of Results

For each of the factors taken into account in this analysis, 44 yearly observations were made from 1998 to 2022. The variables' descriptive statistics, expressed in natural logarithms, revealed that they were normally distributed within acceptable bounds (see Table 2). Therefore, it is unlikely that the data will result in erroneous inferences. Every series has a zero mean and a finite covariance, according to Jarque-Bera statistics. Heteroscedasticity was eliminated prior to estimate, and elasticities were determined by converting all variables to logarithms. Prior to estimating, heteroscedasticity was removed, and elasticities were calculated by converting all variables to logarithms.

4.1.   Descriptive Statistics

Table 2
Descriptive Statistics

Variables	CO_2	TA	GDP	EC	TPG
Mean	3.506903	7.143909	0.807074	6.688978	1.344799
Median	3.506903	7.555515	0.848882	6.708166	1.421345
Maximum	6.862021	9.848047	1.718487	6.827324	2.595001
Minimum	0.213828	4.490595	0.113711	6.299071	0.213828
Std. Dev.	2.058906	1.533027	0.431766	0.130197	0.565607
Skewness	-0.004305	-0.189598	0.286486	-1.518453	-0.072672
Kurtosis	1.803064	1.984059	2.378588	4.944172	2.823431
Jarque-Bera	1.492427	1.224922	0.744219	13.54438	0.054481
Probability	0.474159	0.542015	0.689279	0.001145	0.973127
Sum	87.67258	178.5977	20.17685	167.2245	33.61997
Sum Sq. Dev.	101.7382	56.40414	4.474120	0.406831	7.677883
Observations	25	25	25	25	25

4.2.   ARDL Bounds Test

This study employs both the cointegration test (ARDL limits test) and (ADF and PP) test by unit root as will be discussed below.

4.3.   ADF and PP Unit Root

Two new unit root test kinds were thought to be the ADF and PP test types. The Outcomes from the unit root testing is presented are shown in Table 3 and table 4. The parameters are stable at baseline distinctions, according to the results of the ADF and PP analyses as illustrated in I (1). Using the AIC as well as Newey-West delays, the lag times of the ADF & PP were determined. These findings allow us to reject the unit roots null at the 1% level of significance. The variable's values aren't consistent as the level's computed the t-stat value is less than the

crucial criterion. After the first variation, all t-statistics values above the critical threshold exhibit stationarity. This page displays the table.

Table 3
ADF Unit Root Test

Variables	I(0)	I(1)
CO_2	1.786*	1.976
TA	1.985	2.095*
GDP	1.218*	1.678
EC	1.722*	1.932
TPG	1.652	1.824*

Table 4
PP Unit Root Test

Variables	I(0)	I(1)
CO_2	1.986	1.571*
TA	1.885*	1.195
GDP	1.478	1.678*
EC	1.522	1.132*
TPG	2.052	1.536*

The ARDL limits test is used to look at the cointegration of variables. AIC, which we also use to evaluate, the series' long-standing connection with one another, so in this way the lag time for the variables can be determined , the result are given below. (See Table 5).

Table 5
Results of the Selection Criterion for Lag Sequence

Lag	LL	LR	AIC	HQIC	SBIC
0	681.51	NA	-33.77	-33.66	33.47
1	1034.81	564.14**	-48.49	-48.13	-46.63**
2	1077.62	64.83	-48.13	-47.13	-43.69
3	1245.80	52.28	-49.48	-47.48	-43.09
4	1154.78	60.06	-52.69**	-49.50**	-43.12

Note: * shows the sequence of lags that was chosen at a threshold for significance of five percent. The abbreviations LL, LR, HQIC, SBIC, as well as HQIC, respectively, stand for likelihood, probability ratio, and Schwartz Bayesian information criteria.

4.4.   Co-integration Bound test

Using the ARDL limits test, lag (4), and the AIC standards, we evaluate the cointegration between the variables (see Table 6). Statistics for F has a value that exceeds its upper bound. The null hypothesis that there is no association is rejected in light of the fact that those variables have exhibited an extended correlation.

Table 6
Bond Test

Results of F-Statistics	Values	K
F-Statistics	2487.135	7.25
Critical Values		
Significance	I (0)	I (1)
10%	1.71	2.91
5%	2.12	2.54
2.5%	1.91	1.92
1%	1.72	1.72

Table 7
ARDL Long-Term Results

Variables	Coefficient	T-statistics	Prob.
LogTA	0.13	3.33	0.00*
log GDP	0.46	2.56	.00*
logEC	0.51	2.01	.05**
logTPG	0.04	0.73	.47

Note: * indicates significance at 1%, ** indicates significance at 5%, while *** indicates 10% level of significance.

The ARDL (1, 3, 1, 2, 0) technique with ECM is used for estimation the long run equilibrium interlinkage among the variables.it was used to estimate the long-run equilibrium connection between the variables, which is shown in the following table. Assuming a one percent threshold of relevance, the long-run coefficients estimate show a strong and favourable association between tourism and discharges of carbon dioxide, A one percentage point rise in tourists being linked to a 0.13% increase in CO_2 emissions over the long run. Environmental deterioration and energy usage have long been associated. The findings of long run approach indicate that a one percent more power is consumed causes the release of carbon dioxide increased by 0.46%. According to the data, carbon emissions increase by 0.51% for every 1% increase in GDP, showing that economic activity has a considerable impact on Pakistan's CO_2 emissions.

Table 8
Short Run ARDL Results

Variables	Coefficient	T-statistics	Prob.
ΔlogTA	0.58	-3.44	0.00*
Δlog GDP	0.27	2.04	0.00*
ΔlogEC	0.30	1.91	0.05**
ECT (-1)	-0.58	-7.93	0.00*

Since the variables have a cointegrating nexus, an error correction model that can determine adjustment speed is needed to determine the series dynamic in the short-term and the coefficient of it. The projected ECM adjustments term, ECM (1), becomes crucial at one percent is statistically significant and negative (0.58). Table 10 displays the short-term outcomes as well as the link between the dependent variable and independent variable (CO_2 emissions) and the accordingly. According to the findings (coefficients = 0.58 & value of P= 0.00), foreign tourists significantly improve Pakistan's environment.

The findings also show that economic development and energy usage have short-term effects on the environment. A one percentage point spike in gross domestic product is connected to a 0.30% increase in CO_2 emissions at the 10% significance level, in addition to 1% increase in energy consumption is associated with a 0.27% increase at the 5% crucial level.

4.5. Diagnostic Test Results

Table 9
Diagnostics Test

Test	Values
Serial correlation	0.42
Breusch-Godfrey LM test for autocorrelation	0.68
Heteroscedasticity	0.59
Normality Jarque-Bera	0.88
F-stat (prob.)	293.1
Adjusted R^2	0.98

As tests for diagnosis, series correlation, heteroscedasticity, and normality were evaluated using the Breusch-Godfrey, LM analysis for autocorrelation as well as the Jarque-Berra

examination. The Jarque-Bera, Breusch Godfrey LM, as well as the test findings show no indication of serial correlation, data heteroscedasticity, or residual heteroscedasticity.

4.6. Stability of the Model

The (CUSUMQ) and the (CUSUM) are used to evaluate The model's parametric sustainability (Turner, 2010). Given that the CUSUM and CUSUMQ values are are within the critical regions of the 5% variable stabilisation confidence interval, the information in Figs. 3 and 4 suggests that there is no confirmation of coefficient instability.
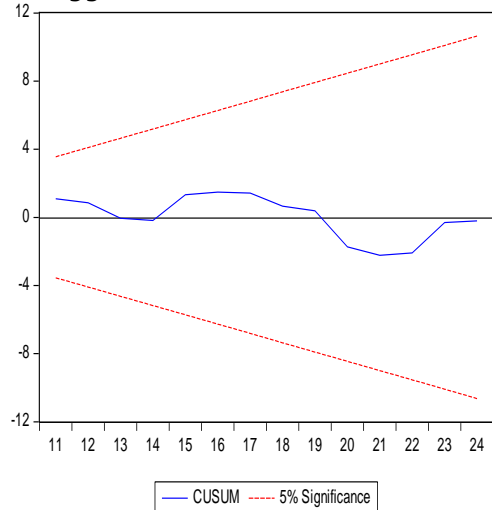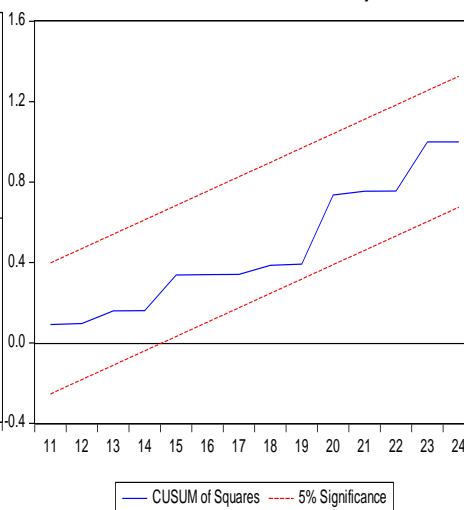

| **Figure 3: CUSUM Graph** | **Figure 4 CUSUMSQ Graph** |

5. Discussion And Findings

Programs to save energy and reduce emissions are putting pressure on Pakistan's economic expansion. It is essential to have a workable plan for decarbonizing Pakistan's economy. The The objective of this research is to ascertain whether or not tourism worsens environmental surroundings. We use several methods, such as ADF, PP unit root tests, long- and short term ARDL methodologies. The ADF, PP, and results, it was demonstrated that the carbon dioxide (CO_2) carbon dioxide emissions, arrivals of travellers, usage of energy, gross domestic product per person, and all population indicators under examination were steady at the first difference. Next, long-term a cointegration between variables was examined using the ARDL limits test approach.

The long term ARDL Model results show that increasing visitor counts have a significant long-term influence on CO_2 emissions in Pakistani economies. This further suggests that tourists from other countries are seriously harming Pakistan's ecology. Due to the frequent usage of transit and subsequent growth in CO_2 emissions caused by energy consumption, The tourism sector significantly affects environmental change. The link among to rise CO_2, increasing the use of energy, and increasing Perhaps the most significant issues in the climate change discussion is the growth of the economy.

Environmental deterioration is mostly brought about by economic expansion and energy usage, which act as vital transmission lines. Our long-term findings show that both EC and GDP have an impact on Pakistan's CO_2 emissions. These findings may be explained by Pakistan's recent rapid economic expansion, but the country's high energy consumption has also been a factor.

Our predicted findings show that short-term tourist arrivals, together with One of the additional explanatory variables, the EC and gross domestic product, have a favourable and substantial effect on carbon dioxide emissions in Pakistan economies.

Given that energy consumption, tourist arrival and GDP growth have both short and long-term effects With relation to emissions of carbon dioxide along with environmental degradation , this makes logical. This study concludes short term as well as long term CO_2 emissions in Pakistani economies are positively and statistically significantly influenced by GDP, energy, and tourism. This is consistent with recent study, which found long term as well as short term impact (Pata & Balsalobre-Lorente, 2022). Pakistan's economy needs to make significant changes to its industrial and commercial sector, and invest in low-carbon technologies in order to meet current emissions targets and move towards decarbonization or a zero environmental degradation economy.

At the end of the discussion is that Pakistan is an Islamic nation and According to Awan, Rahman, Ali, and Zafar (2023) Islamic economic system is the best economic system among all the other economic system so the Pakistani government should embrace it for the economic growth of the country .since there are several ways to combat pollution there. Another study by Younas, Shoukat, Awan, and Arslan (2023) found that green economies may be implemented for sustainable growth so Govt should promote eco-friendly environments.

6. Conclusion

Global population loss is a severe issue caused by environmental degradation. The majority of research on the connection between environmental deterioration and tourism has focused on how a changing climate affects visitor demand. It is believed that tourism is a good activity for both leisure and financial benefit. Tourism-related activities that are poorly planned and managed affect the environment. Studies of the emissions that the tourist industry generates and programs to promote more foreign travel have not received much attention. This study analyzed the connection among tourism and growth in the economy, Total population, the use of energy, and releases of carbon dioxide while adjusting for other factors using time series data spanning 44 years (1998-2022). In this study, the correlation was evaluated using the ARDL approach. All series are connected at the first difference, per the findings of the unit root tests. The findings of the test demonstrated that the components had a stable connection. According to the ARDL model's long-run coefficients, the tourism industry, energy use, and Environmental quality is positively and significantly impacted by Economic. The expansion of the economy, the use of energy, and foreign travel all greatly increase Pakistan's carbon dioxide emissions.

6.1. Recommendations

- Pakistani authorities ought to promote financing for the creation of green innovations. particularly for individuals working in the travel and tourism sector.
- Unplanned development has an effect on the ecosystem by causing the environment to deteriorate and the loss of natural resources such soil, water, and air (Alshuwaikhat, 2005). The government may include all significant players in the design and execution of ecotourism in order to produce a master plan that covers all of the challenges, including economic, environmental, and sociocultural components. The government must customise its current transportation regulations to the regional environment in order to reduce the environmental harm that visitors do.
- As a study conducted by Awan, Rahman, et al. (2023) best institutional performance boost tourism. So, Government leadership and intervention must focus on the improvement of institutional performance.it is the most effective ways of mitigating climate change and boosting the eco-friendly tourism when govt improve institutions quality.

- To decrease the damage that tourism does to the environment, the government must modify present transportation regulations to take into account the local ecosystem. Since government leadership and intervention are the most successful in slowing climate change, the government must play a large and leading role in the execution and management of the aforementioned efforts.
- To stop the environmental harm that tourism produces, the government must change the present transportation legislation to take the local ecology into consideration. Another issue that has to be addressed is the cheap cost of flying, which promotes hyper-mobile travel behaviours and the notion that travelling can be done for next to nothing. Since government leadership and action are most successful in tackling climate change, government must play a large and leading role in putting the aforementioned policies into place and ensuring their continuous effectiveness.

6.2. Policy Implications

The First, Pakistani officials have to prioritise developing an environmentally ecological tourist industry, for instance by encouraging clean energy infrastructure related to tourism rather than fossil fuel-based infrastructure and by creating a transport system based on sustainable energy via incentives as well as other sorts of assistance. Promoting environmentally friendly technologies and short-distance modes of transportation, including push bikes, is essential. Regulations should be put in place to assist a carbon-neutral tourism industry because Pakistan is home to several top-tier natural tourist attractions.

The findings of this research highlight about the need for more efficient methods to promote green tourism, one of which is the use of more eco-friendly travel by road choices, Similar hybridization combustion engines, or even carbon-neutral transportation choices, are being developed. The environment, biodiversity, and ecosystems must be protected and improved if they are to continue drawing tourists from across the world. To save energy and preserve the environment, adventure activities like Hiking and diving ought to be promoted. Developments Given the nation's decrease in emissions goals, advancements in solar, wind, hydrogen, and other technologies may aid Pakistani economies in becoming carbon-free.

The overall effect on policies ought to act as a warning to government officials and lawmakers who are more concerned with changing the appearance of policies than how they really function in order to achieve zero-carbon. If the Sustainable Development Goals and the emission target of no environmental effect are to be realised, resource distribution needs to be addressed. Strategies for developing the travel and tourism sector and associated businesses should be reassessed in light of Pakistan's capacity to lower emissions. A transport carbon tax might encourage the expansion of low-carbon travel. The federal and provincial governments of Pakistan should concentrate on transforming the carbon-intensive travel sector into a more environmentally friendly, "green" economy in order to lessen the impact of tourism on carbon dioxide emissions.

6.3. Future Research & Limitations

Future research may focus on how tourism affects the BRIC countries' economy and ecology. The Brics are where the growing global economy is actually situated. The employment of cutting-edge independent variable and Dependent variable. The researcher may take into account the link between environmental conditions and psychological health in addition to other indicators. It would be wise to look at the connections between tourism, environmental quality, and other growing economies like the BRICS. Using a bibliometric, environmental degradations may be evaluated.

To determine the types of tourism that have the most impacts on CO2 emissions and the tourist sites in Pakistan that have the biggest economic impacts, more study is needed. In addition, further study on COVID-19's effects on tourism and the environment may be quite interesting. This study's flaw is that it only considered one environmental component, The emission of carbon dioxide output, while ignoring others that could be equally significant.

Authors' contribution
Muqtadir Altaf: Write Introduction & Literature Review
Ayesha Awan: Write Methodology and Run Analyses
Saif ur Rehman: Analyses Interpretation and conclusion

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