INTERNATIONAL JOURNAL OF SOCIAL SCIENCES RESEARCH
ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

ECONOMIC GROWTH, TOURISM, AND ENERGY USE AS DRIVERS OF CO_2 EMISSIONS: TESTING THE ENVIRONMENTAL KUZNETS CURVE IN PAKISTAN

Saima Ejaz

PhD Scholar, Studied from National University of Modern Languages

ejaz.saima1992@yahoo.com

Corresponding Author: *
Saima Ejaz

Received	Accepted	Published
10 October, 2025	15 December, 2025	31 December, 2025

ABSTRACT

Tourism has grown rapidly with advancements in communication and transportation, contributing to economic growth but also to CO_2 emissions. This study examines the relationship between tourism, economic growth, energy consumption, trade openness, and CO_2 emissions in Pakistan from 1995 to 2020 using the Fully Modified Ordinary Least Squares (FMOLS) method and data from the World Development Indicators (WDI). Results show that tourism can reduce CO_2 emissions when supported by strict environmental regulations. However, economic growth, energy use, trade liberalization, and urbanization significantly contribute to environmental degradation. The study recommends promoting sustainable tourism and enforcing strong environmental policies to curb emissions.

Key Words: *CO2 emissions, tourism, GDP, energy consumption, FMOLS, Pakistan.*

INTRODUCTION

Tourism is a major economic driver, contributing approximately 3% to global GDP and creating 10% more jobs than any other sector (WTTC, 2018). It fosters innovation and infrastructure development, attracting foreign investment and enhancing local economies (Fahimi et al., 2018). The sector accounted for 1.46 billion international tourists in 2019, with tourism receipts outpacing global GDP growth between 2009 and 2019 (Rasool et al., 2021).

Tourism also plays a critical role in export diversification, reducing trade imbalances for many developing economies. For instance, in 2019, Macao (China) derived 48% of its GDP from tourism, while Jordan, Spain, and Mauritius reported contributions of 10% (Ahmad et al., 2020). Pakistan's tourism industry contributes 5.9% to GDP and generated 4 million jobs in 2019. However, the COVID-19 pandemic severely impacted the sector's growth prospects, despite global recognition of Pakistan as a top travel destination (Rasool et al., 2021).

Tourism's growth, while economically beneficial, comes with environmental costs, primarily through increased energy consumption and CO2 emissions. Studies reveal conflicting evidence regarding tourism's impact on emissions, often underestimating the role of energy consumption in sustainable development (Katircioglu et al., 2014). This study addresses the gap by focusing on Pakistan and employing robust econometric methods to analyze long-run relationships between tourism, GDP, energy use, and CO2 emissions.

Research Objectives and Questions

This study investigates the following:

Objectives

1. To examine the impact of GDP, tourist arrivals, receipts, and energy consumption on CO2 emissions.
2. To explore trade openness and urbanization as factors influencing emissions.

3. To validate the Environmental Kuznets Curve (EKC) hypothesis via tourism and GDP.

Research Questions

1. How do GDP and tourism (arrivals and receipts) influence CO2 emissions?
2. What is the impact of conventional and renewable energy use on emissions?
3. Does trade openness and urbanization exacerbate CO2 emissions?
4. Is the EKC hypothesis supported in the context of Pakistan?

Study Gap

This research differs from prior studies in three ways:

1. It focuses exclusively on Pakistan, moving beyond pooled data analysis to address country-specific policies (Ahmad et al., 2020; Koçak et al., 2020).
2. It employs advanced techniques, including FMOLS, to ensure robust and reliable findings (Al-Mulali et al., 2015).
3. Two distinct metrics—tourist arrivals and receipts—are used to capture tourism's dual impact on economic and environmental outcomes (Naradda et al., 2017).

Significance of the Study

Understanding the link between tourism, energy consumption, and CO2 emissions is critical for sustainable development in Pakistan. Tourism's dependency on energy amplifies environmental degradation, particularly through activities such as construction, transportation, and hospitality (Katircioglu et al., 2014). Policymakers and practitioners must address this nexus to balance economic growth with environmental sustainability.

Literature Review

Relationship Between Tourism and Economic Growth

Tourism serves as a significant driver of economic growth by generating employment opportunities, enhancing income levels, and contributing to GDP. Paramati et al. (2017a) highlight that target-market mechanisms enable high-spending tourists to travel to specific destinations, driving economic benefits. However, the absence of capital and reliance on local resources may limit the economic advantages (Ghosh et al., 2017). Wu and Wu (2018) stress the importance of variables such as exchange rates in understanding tourism's economic impact, further supported by Adeola et al. (2020), who establish a strong link between tourism demand and currency rates.

Relationship Between Exchange Rate and Tourism

The exchange rate plays a critical role in attracting or repelling international tourists. A favorable exchange rate, where the destination country's currency is weaker than that of tourists, enhances affordability and demand for tourism (Samirkaş & Samirkaş, 2016). Empirical studies suggest that currency fluctuations significantly influence tourism receipts and demand, as demonstrated by Rasheed et al. (2019). This connection underscores the interplay between economic variables and tourism growth.

Tourism's Contribution to CO2 Emissions

Tourism is a significant contributor to CO2 emissions, primarily through energy-intensive activities like aviation, transportation, and resource utilization at tourist destinations. Gössling et al. (2015) note the reliance on fossil fuels for travel, accommodation, and activities, with the aviation industry alone being a major contributor to global CO2 emissions. Similarly, changes in land use due to tourism investments exacerbate environmental degradation, as highlighted by Fereidouni et al. (2015), Karim et al. (2017), and Nisha (2017).

Positive Environmental Impact of Sustainable Tourism

Sustainable tourism policies can mitigate environmental degradation by promoting greener technologies and transportation modes. Infrastructure improvements, such as better roads and railways, can reduce CO2 emissions (Lau et al., 2018). Moreover, Grossman and Krueger's (1991, 1995) perspective suggests that economic growth through tourism could lead to a shift toward less polluting service sectors, thereby enhancing environmental quality.

Regional Differences in Tourism's Environmental Impact

Tourism's impact on CO_2 emissions varies across regions. For instance, Nurunnabi et al. (2018) report that while tourism reduces CO_2 emissions in Egypt, it increases them in Tunisia and Malaysia. Similarly, Alam (2017) finds a reduction in emissions in Western Europe but an increase in Eastern Europe due to tourism-related activities. This indicates the heterogeneity in tourism's environmental impact, influenced by regional factors and policies.

Empirical Evidence of Tourism-Environment Dynamics

Several studies employ econometric techniques to explore the link between tourism and CO_2 emissions. Solarin (2014) and Kilinc et al. (2014) find that tourist arrivals significantly increase CO_2 emissions in Malaysia and Cyprus, respectively. In contrast, Brahmasrene (2013) and Dogan and Aslan (2017) observe a lowering effect of tourism revenue on emissions in Europe and OECD nations. These mixed findings suggest that tourism's environmental impact depends on factors like energy efficiency and policy frameworks.

Role of Tourism Investments in Emissions Reduction

Investments in sustainable tourism infrastructure can help reduce CO_2 emissions. Paramati et al. (2018) emphasize that tourism-related investments in the EU significantly lower emissions, aligning with the broader goal of sustainable development.

Nonlinear and Reciprocal Relationships

Tourism exhibits nonlinear relationships with CO_2 emissions. For instance, Sherafatian et al. (2017) reveal a nonlinear association, while Akadiri et al. (2018) find a reciprocal relationship between tourist arrivals and CO_2 emissions in small island nations. These findings highlight the complex interplay between tourism growth and environmental outcomes.

Influence of Population and Energy Use on Emissions

Tourism, coupled with population growth and energy consumption, contributes to rising CO_2 emissions, particularly in developed nations (Alemán et al., 2014; Chen et al., 2017). However, investments in energy-efficient technologies can mitigate this impact.

STIRPAT Model Application in Tourism

The STIRPAT model has been used to analyze the determinants of CO_2 emissions in the tourism sector, identifying population, economic growth, and energy efficiency as critical factors (Alemán et al., 2014). The findings underscore the need for targeted policies to manage tourism's environmental impact while fostering growth.

These relationships highlight the multifaceted connections between tourism, economic growth, and environmental sustainability, emphasizing the importance of context-specific strategies for balancing economic benefits with ecological preservation.

Theoretical Underpinning

In environmental economics, several theories explore the relationship between economic development and environmental degradation. The Environmental Kuznets Curve (EKC) examines the connection between GDP growth and environmental deterioration, suggesting that pollution increases with economic growth up to a certain threshold, after which it begins to decrease (Grossman & Krueger, 1991). Research on the EKC has produced mixed findings across different countries (Ahmed & Long, 2012; Saboori et al., 2012).

The Pollution Haven Hypothesis (PHH) posits that trade and foreign direct investment (FDI) inflows lead to increased pollution in developing countries, as multinational corporations relocate pollution-heavy industries to nations with laxer environmental standards (Temurshoev, 2006). Conversely, the **Porter Hypothesis** suggests that strict environmental regulations can drive innovation, leading to improved environmental quality (Porter & Van Der Linde, 1995).

To understand the impacts of population growth, economic development, technology, and tourism on environmental quality, the Stochastic Impacts by Regression on Population Affluence and Technology (STIRPAT) model is widely used. This framework links human activities to environmental outcomes, considering factors like population, affluence, and technological development.

Proposed Hypothesis

H_1: GDP has a significant impact on the CO_2 emissions.
H_2: Tourist arrivals has a significant impact on the CO_2 emissions.
H_3: Tourist receipts has a significant impact on the CO_2 emissions.
H_4: Renewable energy use has a significant impact on CO_2 emissions.
H_5: Conventional energy use has a significant impact on CO_2 emissions.
H_6: Trade openness has a significant impact on CO_2 emissions.
H_7: Urbanization has a significant impact on CO_2 emissions.
H_8: Environmental Kuznets Curve is validated via GDP and Tourism.

Methodology

This section outlines the research methodology employed in this study, detailing data collection, variable measurement, econometric models, and analytical techniques to assess the relationships between GDP, tourism, energy use, and CO2 emissions from 1995 to 2020. This study adopts a quantitative, deductive approach with a correlational design. Data spanning 26 years (1995-2020) will be collected from the World Bank's World Development Indicators (WDI).

The study includes several key variables measured as follows (Table 1):

Symbol	Variable Label	Description	Measurement	Source
GDP	Economic Growth	GDP per capita, divided by midyear population. Represents gross value added and taxes/subsidies.	Per capita GDP (constant local currency)	WDI
TA	Tourist Arrivals	Number of international inbound tourists (overnight visitors).	Number of passengers carried	WDI
TR	Tourism Receipts	Expenditures by inbound visitors, including payments for goods and services.	% of total exports	WDI
TAR	Tourist Arrivals & Receipts	Composite value of tourist arrivals and receipts.	Composite of TA and TR	WDI
CO2	Carbon Dioxide Emissions	CO2 emissions from solid fuel consumption (mainly coal).	Metric tons per capita	WDI
CEU	Conventional Energy Used	Fossil fuel consumption, including coal, oil, and natural gas.	% of total energy use	WDI
REU	Renewable Energy Used	Share of renewable energy in total final energy consumption.	% of total energy use	WDI
TOP	Trade Openness	Ratio of (Imports + Exports) to GDP.	(Imports + Exports) / GDP	WDI
URB	Urbanization	Proportion of the population living in urban areas, based on national statistics.	Share of urban population	WDI

Econometric Model

Two econometric models are used to analyze the data:

1. Model 1 (Multivariate Regression): This model incorporates variables related to economic growth, tourism, energy use, trade openness, and urbanization to examine their effects on CO2 emissions, following Manzoor et al. (2019) and Karedla et al. (2021).

$$CO_2 = \beta_0 + \beta_1 GDP + \beta_2 TA + \beta_3 TR + \beta_4 CEU + \beta_5 REU + \beta_6 TOP + \beta_7 URB + ei \quad (1)$$

2. Model 2 (Environmental Kuznets Curve - EKC): This model tests the EKC hypothesis using the Fully Modified Ordinary Least Squares (FMOLS) technique to assess the relationship between GDP, tourism, energy consumption, and CO2 emissions, following El Menyari (2021). Tourism is represented by

a composite variable, TAR, combining tourist arrivals (TA) and receipts (TR).

$$CO_2 = \beta_0 + \beta_1 GDP + \beta_2 GDP^2 + \beta_3 TAR + \beta_4 TAR^2 + \beta_5 CEU + \beta_6 REU + \beta_8 TOP + \beta_{10} URB + ei \quad (2)$$

Where:

- GDP = Gross Domestic Product
- TA = Tourist Arrivals
- TR = Tourism Receipts
- TAR = Composite of Tourist Arrivals & Receipts
- CO2 = Carbon Dioxide Emissions
- CEU = Conventional Energy Use
- REU = Renewable Energy Use
- TOP = Trade Openness
- URB = Urbanization
- $\beta 0$ = Constant
- $\beta 1$–$\beta 8$ = Coefficients of independent variables
- e_i = Error term

The research will utilize EViews statistical software to conduct a series of analyses aimed at ensuring the accuracy and reliability of the results. Descriptive statistics will first be employed to summarize the dataset, providing insights into the central tendencies (mean, median, mode) and dispersion (variance, skewness, kurtosis) of the variables. These descriptive measures will offer an initial understanding of the distribution and nature of the data. To ensure the robustness of the regression results, unit root tests will be conducted to assess the stationarity of the time series data. This step is essential, as non-stationary data can lead to unreliable estimations and spurious relationships. By identifying any trends or non-stationarity in the variables, this analysis will help to confirm that the data is suitable for further modelling. Next, the appropriate lag length for the model will be determined, a critical step in ensuring that temporal effects are properly accounted for. By selecting the correct lag length, the analysis will avoid the pitfalls of omitted variable bias and overfitting, which could distort the relationships between the variables. Correlation analysis will then be performed to examine the relationship between pairs of variables. This step will reveal any significant positive or negative correlations, providing insight into how the variables move in relation to one another. Understanding these relationships will be crucial for interpreting the findings and ensuring that the model captures the underlying dynamics.

The study will also employ Fully Modified Ordinary Least Squares (FMOLS) to estimate cointegration relationships. This method, developed by Phillips and Hansen (1990), will be used to address endogeneity and serial correlation in the time series data. FMOLS is particularly useful for estimating long-run relationships between variables while correcting for potential biases caused by non-stationarity. Finally, diagnostic tests will be conducted to validate the robustness and consistency of the FMOLS results. These tests will include heteroskedasticity checks, serial correlation tests, the Jarque-Bera test for normality, the Ramsey RESET test for model specification, as well as the CUSUM and CUSUM of squares tests for stability. By performing these diagnostics, the study will ensure that the results are reliable and provide a solid foundation for drawing conclusions.

Result and Discussion

Descriptive Analysis

Table 4.1, shows the mean value of carbon emissions (CO_2), composite value of tourism arrival and receipts (TAR), squared term of (TAR^2), gross domestic product (GDP), squared term of GDP (GDP^2), tourist arrivals (TA), tourist receipts (TR), conventional energy use (CEU), renewable energy use (REU), trade openness (TOP) and urbanization (URB). The mean values are 4.77, 4.93, 24.68, 5.65, 37.45, 5.90, 3.96, 57, 47.44, 29.38, and 34.49 respectively. While the standard deviation are 0.35, 0.62, 5.98, 2.38, 29.72, 0.26, 1.40, 10.46, 3.80, 4.36, and 1.58 respectively. Standard deviation of GDP2 and CEU are quite high which means the data point of these two variables are quite scattered. Moreover residuals of GDP2 and TA variables are not normally distributed as per the probability values of Jarque-Bera.

ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

Table 4.1: Descriptive Analysis

	CO2	TAR	TAR^2	GDP	GDP^2	TA	TR	CEU	REU	TOP	URB
Mean	4.77	4.93	24.68	5.65	37.45	5.90	3.96	57	47.44	29.38	34.49
Median	4.76	4.99	24.94	5.22	27.34	5.91	4.17	57.73	47.30	29.43	34.48
Maximum	5.27	5.88	34.62	11.35	128.90	6.81	6.19	76.72	53.12	36.58	37.16
Minimum	4.17	3.65	13.32	0.46	0.21	5.56	1.42	36.12	39	19.93	31.83
Std. Dev.	0.35	0.62	5.98	2.38	29.72	0.26	1.40	10.46	3.80	4.36	1.58
Skewness	-0.15	-0.43	-0.20	0.22	1.64	1.47	-0.17	-0.27	-0.51	-0.31	0.00
Kurtosis	1.68	2.40	2.24	3.90	5.49	6.60	2.01	2.58	2.53	2.34	1.85
Jarque-Bera	1.97	1.21	0.80	1.10	18.52	23.42	1.18	0.50	1.39	0.89	1.42
Probability	0.37	0.54	0.66	0.57	0.00	0.00	0.55	0.77	0.49	0.63	0.49
Sum	124	128	642	147	974	153	103	1482	1233	764	897
Sum Sq Dev.	3.13	9.67	895	142	22084	1.75	49.04	2737	361	477	62.51
Observations	26	26	26	26	26	26	26	26	26	26	26

Correlation Analysis

Table 4.2 displays the correlation between the variables under study. Understanding the interplay between the independent and dependent elements was the primary goal of this investigation. In order to draw objective conclusions, it is necessary that the segments be completely independent of one another. Based on the data shown in Table 4.2, it is apparent that there is very little association between the different factors. As per the correlation results the composite value of tourism has a strong positive correlation of 0.90 with CO2. Tourism arrivals TA has a very strong positive correlation of 0.85 with CO2, and tourism receipts TR has a very strong negative correlation of -0.95 with CO2. Both the GDP and GDP^2 have week positive correlation of 0.28 and negative 0.35 respectively with CO2. In case of energy use the CEU has very weak positive correlation of 0.23 with CO2 and REU has a very strong negative correlation of -0.88 with CO2. Trade openness TOP has a very weak positive relation of 0.36 with CO2. In last the Urbanization URB has a very strong positive relation of 0.99 with CO2.

Table 4.2: Correlation Analysis

Correlation										
Probability	CO2	TA	TR	TAR2	GDP	GDP2	CEU	REU	URB	TOP
CO2	1.									

TA	0.802	1.								
p.value	0.0000	-----								
TR	-0.954	-0.653	1.							
p.value	0.000	0.000	-----							
TAR2	-0.916	-0.553	0.990	1.						
p.value	0.000	0.003	0.000	-----						
GDP	0.286	-0.290	0.280	0.271	1.					
p.value	0.155	0.150	0.165	0.179	-----					
GDP2	-0.356	-0.319	0.358	0.348	0.948	1.				
p.value	0.074	0.111	0.072	0.080	0.000	-----				
CEU	0.232	0.118	-0.374	-0.361	0.058	-0.004	1.			
p.value	0.252	0.562	0.059	0.069	0.778	0.980	-----			
REU	-0.885	-0.743	0.867	0.819	0.230	0.257	-0.295	1.		

p.value	0.000	0.000	0.000	0.000	0.256	0.203	0.142	----		
URB	0.993	0.805	-0.959	-0.918	-0.263	-0.328	0.289	-0.928	1.	
p.value	0.000	0.000	0.000	0.000	0.194	0.101	0.152	0.000	----	
TOP	0.360	0.261	-0.294	-0.32	-0.249	-0.303	-0.456	-0.169	0.30	1.
p.value	0.070	0.197	0.143	0.110	0.219	0.132	0.018	0.407	0.135	----

Unit Root Analysis

Table 4.3.1 and 4.3.2 shows the unit root analysis under ADF and PP tests respectively. Before going on to model estimation, the study uses the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test statistics to determine if the data exhibit stationarity. As shown in table 4.3 of the ADF statistics, which shows that all the variables, CO2, TAR, TAR2, GDP, GDP2, TA, TR, CEU, REU, TOP and URB are stationary at the level of I(0). Table 4.3.2 from the PP statistics also shows that all the concerned variables are stationary at I(0). These results of unit root analysis indicates that all the model variables satisfy the condition of Fully modified ordinary least square (FMOLS) estimation technique. (*) is 10% significant; (**) is 5% significant; (***) is 1% significant; no means not significant.

Table 4.3.1: Augmented Dickey-Fuller (ADF) Test

		CO2	TAR	TAR^2	GDP	GDP^2	TA	TR	CEU	REU	TOP	URB
C	t-Statistic	-2.98	-3.48	-4.46	-4.90	-5.14	-3.52	-3.06	-4.44	3.35	-2.86	-2.99
	Prob.	0.07 *	0.06 *	0.00 ***	0.00 ***	0.00 ***	0.05 **	0.05 *	0.00 ***	0.05 **	0.09 *	0.07 *
C & T	t-Statistic	-3.26	-3.10	-4.12	-5.22	-5.87	-3.28	-3.97	-4.57	-4.21	-4.77	-3.29
	Prob.	0.06 *	0.07 *	0.00 ***	0.00 ***	0.00 ***	0.09 *	0.05 **	0.00 ***	0.00 ***	0.00 ***	0.06 *
Without C & T	t-Statistic	7.66	-0.71	-0.94	-1.30	-1.80	1.21	-1.58	0.01	-2.60	-0.24	3.84
	Prob.	1.00 n0	0.39 n0	0.29 n0	0.17 n0	0.06 *	0.93 n0	0.10 n0	0.67 n0	0.01 **	0.58 n0	0.99 n0
At First Difference												
		dCO2	dTAR	dTAR^2	dGDP	dGDP^2	dTA	dTR	Dceu	dREU	dTOP	dURB
C	t-Statistic	-5.00	-4.00	-4.37	-5.63	-6.57	-5.45	-4.75	-4.62	-4.20	-4.35	-1.40
	Prob.	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.56 n0
C & T	t-Statistic	-5.24	-3.70	-4.14	-5.79	-6.56	-2.55	-4.49	-4.53	-4.31	-4.08	-1.08
	Prob.	0.00 ***	0.04 **	0.01 **	0.00 ***	0.00 ***	0.30 n0	0.00 ***	0.00 ***	0.01 **	0.02 **	0.91 n0
Without C & T	t-Statistic	-2.04	-3.97	-4.32	-6.48	-6.38	-2.64	-4.31	-4.71	-3.51	-4.43	0.04
	Prob.	0.04 **	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.01 **	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.68 n0

Notes: b: Lag Length based on SIC

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

Table 4.3.2: Phillips- Perron (PP) Test

At Level												
		CO2	TAR	TAR2	GDP	GDP2	TA	TR	CEU	REU	TOP	URB
C	t-Statistic	-1.56	-1.48	-1.46	-4.90	-5.14	-0.32	-1.06	-1.50	0.28	-1.98	0.00
	Prob.	0.48	0.52	0.53	0.00	0.00	0.90	0.71	0.51	0.97	0.29	0.95
		n0	n0	n0	***	***	n0	n0	n0	n0	n0	n0
C & T	t-Statistic	-1.26	-3.05	-3.08	-5.24	-6.45	-3.09	-3.23	-1.62	-1.39	-1.92	-2.37
	Prob.	0.87	0.13	0.13	0.00	0.00	0.12	0.10	0.75	0.83	0.61	0.38
		n0	n0	n0	***	***	n0	n0	n0	n0	n0	n0
Without C & T	t-Statistic	7.69	-0.75	-0.98	-1.21	-2.31	1.32	-1.70	0.01	-2.47	-0.24	32.02
	Prob.	1.00	0.37	0.28	0.19	0.02	0.94	0.08	0.67	0.01	0.58	0.99
		n0	n0	n0	n0	**	n0	*	n0	**	n0	n0
At First Difference												
		dCO2	dTAR	dTAR²	dGDP	dGDP²	dTA	dTR	dCEU	dREU	dTOP	dURB
C	t-Statistic	-5.01	-3.97	-4.35	-22.72	-23.24	-2.29	-4.73	-4.62	-4.20	-4.35	-1.81
	Prob.	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.36
		***	***	***	***	***	n0	***	***	***	***	n0
C & T	t-Statistic	-5.44	-3.67	-4.11	-21.91	-23.77	-2.45	-4.47	-4.53	-4.31	-4.33	-1.10
	Prob.	0.00	0.04	0.01	0.00	0.00	0.34	0.00	0.00	0.01	0.01	0.90
		***	**	**	***	***	n0	***	***	**	**	n0
Without C & T	t-Statistic	-1.79	-3.97	-4.35	-23.71	-24.14	-2.58	-4.33	-4.71	-3.48	-4.43	-0.12
	Prob.	0.07	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.63
		*	***	***	***	***	**	***	***	***	***	n0

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***)Significant at the 1% and (n0) Not Significant
b: Lag Length based on SIC

Lag Length Criteria

Cointegration may be tested with the FMOLS approach, but only after the appropriate lag period, as established by the integration level, has been confirmed. In Table 4.4, according to AIC, SC, and HQ, a one-year lag is ideal.

Table 4.4

Endogenous variables: CO2 GDP TA TR CEU REU TOP URB

Exogenous variables: C

Sample: 1995 2020

Included observations: 25

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-224.1846	NA	0.016117	18.57477	18.96481	18.68295
1	-26.70204	252.7777*	4.86e-07*	7.896163*	11.40653*	8.869788*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Fully Modified Ordinary Least Squares Estimation (Model 1)

Fully modified OLS (FMOLS) is used once the optimal lag duration has been determined since it is more effective than OLS. To address serial correlation and endogeneity, the FMOLS technique takes a non-parametric tack and is recommended by Kao and Chiang (2001) and by Mark and Sul (1999). Table 4.5 displays the obtained data of Model 1. All computed coefficients are statistically significant, as demonstrated by the outcomes.

Table 4.5: FMOLS

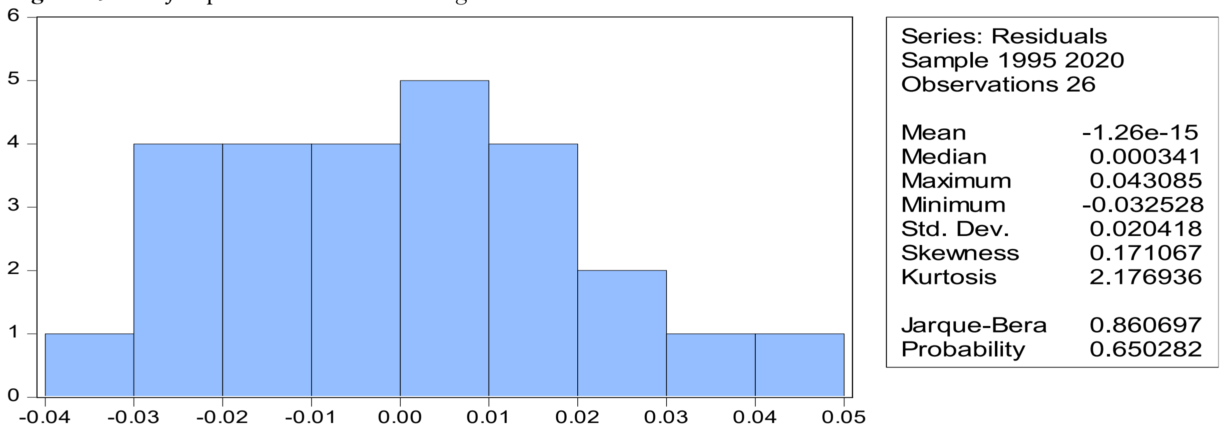
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.04	0.01	2.79	0.012**
TA	1.08	0.30	3.49	0.002***
TR	-0.24	0.17	13.86	0.000***
CEU	0.007	0.02	3.39	0.003***
REU	-0.081	0.03	2.78	0.012**
TOP	0.029	0.01	2.80	0.011**
URB	0.220	0.05	4.40	0.003***
C	-5.029	0.79	-7.2	0.000***
R-squared	0.9966			
Adjusted R-squared	0.9853			
S.E. of regression	0.0240			
Sum squared resid	0.0104			
Log likelihood	64.792			
F-statistic	771.84			
Prob(F-statistic)	0.0000			
Prob(Wald F-statistic)	0.0000			
Durbin-Watson stat	1.8611			

__Notes:__
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (ns) Not Significant

Residual and Stability Diagnostics

Figure 4.6. Shows the residual diagnostic by Jarque Bera stat. It has probability value of 65% which is insignificant or more than 5% of significance therefore it is concluded that the residuals of the model 1 are normally distributed.

Figure 4.6.1: Jarque-Bera Residual Diagnostic



ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

Table 4.6.2 and 4.6.3 shows the residual diagnostic under serial correlation and heteroskedasticity. As the probability values of both F and observed R^2 are insignificant therefore there is found no serial correlation and heteroskedasticity issue. Table 4.6.4 shows the stability diagnostic under Ramsey test. The t statistic and F statistic has insignificant p-values which proves that the linear model is not misspecified. Figures 4.6.5 and 4.6.6 are CUSUM and CUSUM of squares test. As the CUSUM of standardized deviations are under the 5% range, it means that the Beta coefficients are stable in the estimation.

Table 4.6.2: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.948	Prob. F(2,16)	0.408
Obs*R-squared	2.756	Prob. Chi-Square(2)	0.252

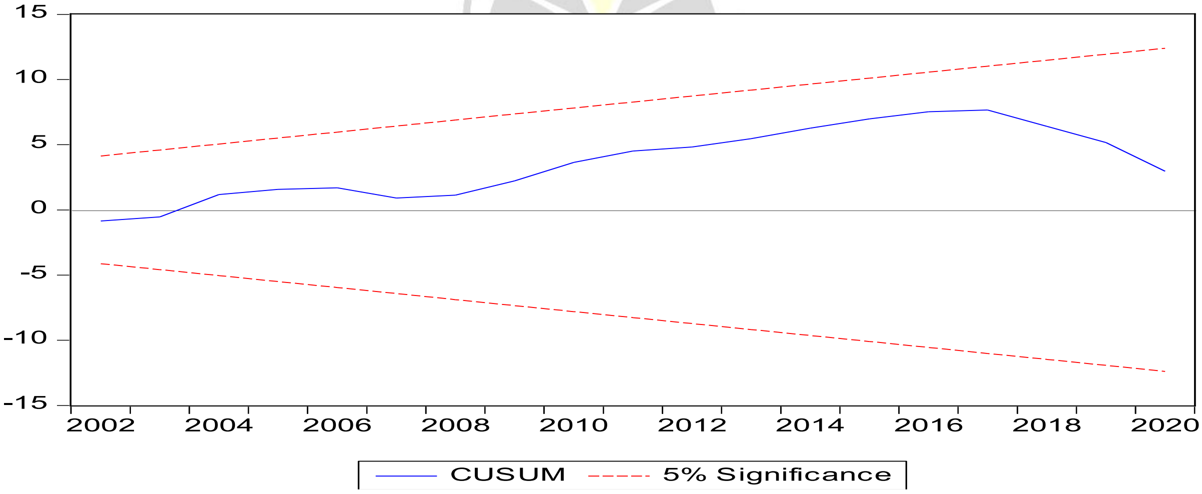
Table 4.6.3: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.196	Prob. F(7,18)	0.354
Obs*R-squared	8.254	Prob. Chi-Square(7)	0.310

Table 4.6.4: Ramsey RESET Test

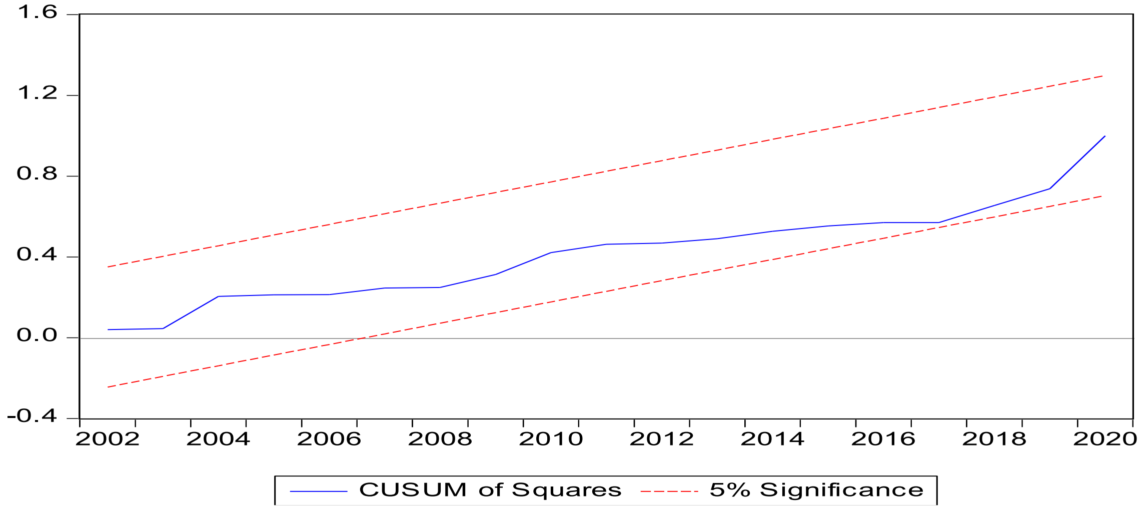
	Value	df	Probability
t-statistic	0.824228	17	0.4212
F-statistic	0.679351	(1, 17)	0.4212
Likelihood ratio	1.018784	1	0.3128

Figure 4.6.5: CUSUM



ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

Figure 4.6.6: CUSUM of Squares



Fully Modified Ordinary Least Squares Estimation (Model 2)

Table 4.7 of FMOLS estimation shows the model 2 of this study. In this model the main aim of the study was to check the environmental Kuznets curve EKC for Pakistan through GDP and tourism. In this regards the tourism composite variable was developed by combining the TA and TR dimensions. According to Table 4.7, when using the FMOLS approach, the square of GDP is negatively signed, indicating a connection between GDP and environmental deterioration. To achieve U shaped curved as per EKC analysis the study had to use quadratic equation. For a quadratic equation the study took the square term of GDP and Tourism variables. These squared terms must have a negative relationship with CO_2 to validate the EKC analysis.

Therefore, evidence supporting EKC theory in the context of Pakistan is discovered. Similarly, a negative significant finding for the tourism squared value TAR^2 in Pakistan supports the EKC theory. Consistent results have been discovered by Chen et al. (2016), Nasreen et al. (2017), and Destek et al (2018).

ISSN: 3106-7786 | 3106-7778
Volume 2, Issue 4, 2025

Table 4.7

Dependent Variable: CO2
Method: Least Squares
Sample: 1995 2020
Included observations: 26
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP^2	-0.03	0.0009	-28.31	0.00***
TAR^2	-0.05	0.004	-12.16	0.00***
C	6.10	0.10	59.88	0.00***
R-squared	0.84			
Adjusted R-squared	0.83			
S.E. of regression	0.14			
Sum squared resid	0.49			
Log likelihood	14.57			
F-statistic	61.27			
Prob(F-statistic)	0.00			
Prob(Wald F-statistic)	0.00			
Durbin-Watson stat	1.49			

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***)Significant at the 1% and (ns) Not Significant

Discussion and Conclusion

Discussion

There were two models employed in the research. Model 1 uses a multivariate regression technique based on the production function (Cobb, 1928). Consumption of electricity, trade liberalisation, labour, and urbanisation have all been included to the production function in the footsteps of Manzoor et al (2019).

The EKC's plan to aid Pakistan's long-term objectives is supported by the second model. We used FMOLS econometric methodologies to examine Pakistan's economy from 1995 to 2020 in light of the EKC hypothesis. This research is consistent with that of El Menyari (2021), who, between 1980 and 2014, looked at how the tourist industry, electricity consumption, and growth impacted CO2 emissions in North Africa. In the case of Pakistan, GDP and TAR were used to calculate EKC. The TAR variable is the sum of the two individual tourism indicators, "total arrivals" (TA) and "total revenues" (TR).

Table 4.5 displays the obtained data of Model 1. All computed coefficients are statistically significant, as demonstrated by the outcomes. Estimates from FMOLS suggest that a 1% increase in GDP would lead to a 0.4% increase in emissions. The findings suggest that higher rates of economic growth lead to greater use of carbon fuels and hence higher rates of greenhouse gases. Most investigations, including Lee and Brahmasrene (2013), Katirciolu (2014), and De Vita et al. (2015), have found the same thing.

When compared to the findings of Ben Jebli and Ben Youssef (2015), who found that a rising GDP leads to a decrease in carbon pollution, this conclusion seems counterintuitive. The findings emphasise the need of remediation technology, alternative energies, and efficient energy usage. An increase of 1% in tourist arrivals results in an increase of 0.139% in carbon outputs. If tourist receipts have a negative relation with CO2 emissions, a 1% rise in TR decreases the emissions by 0.24%. The estimation findings show that income from tourism reduces carbon dioxide (CO2) emissions.

These findings demonstrate the positive role that tourist earnings play in mitigating greenhouse gas emissions, a measure of economic prosperity. Results are in line with Naradda Gamage et al. (2017), Paramati, Sudharshan, et al (2017). Tourism revenues, in contrast to the general economy, have a constructive contribution to the environment by lowering emissions of CO2. Reasons for this may include the fact that the tourist industry, though still an important part of the service sector, uses less energy and produces less pollution than the sectors of agriculture and manufacturing.

In addition, a 1% increase in CEU results in a 0.007% increase in pollution. Increasing the use of alternate energy sources REU cuts carbon dioxide (CO2) emissions by 0.081 percent for every 1 percent increase in consumption. This is to be expected due to the fact that renewable energy sources might decrease the need for fossil fuels, and vice versa, as their use rises. This finding agrees with that of Ben Jebli et al (2016). However, it is opposite to the outcomes by Apergis et al. (2010) on 19 nations both developed and developing and by Ben Jebli et al. (2015a) research on Tunisia.

Additionally, every increase of 1% in trade openness leads to a 0.029% increase in pollution. Since more goods from imports and exports require more fossil energy to create, utilize, and carry, this might lead to increases in CO2 emission if trade liberalisation is expanded. The result is different from what was shown in OECD nations by Dogan and Aslan (2017). Finally there is found a positive significant relationship between urbansation URB and CO2. An increase of 1% URB rises the CO2 to 0.22%.

In case of model 2 Table 4.7, this study found a negative relation between the GDP^2 and CO2, meaning a 1% rise in GDP^2 decreases the CO2 levels by 0.03%. In the same way TAR^2 has a negative impact on CO2, meaning a 1% rise in TAR^2 will decrease the CO2 by 0.05%. Thus the environmental Kuznets curve is validated in the case of Pakistan and these results are in line with Chen et al. (2016), Nasreen et al. (2017), and Destek et al (2018).

Conclusion

This research study examined the impact of tourism and economic growth on the carbon emissions in Pakistan. For this purpose the study has utilized the data from 1995 to 2020. To get the empirical results clean from the issues of endogeneity the study used fully modified OLS (FMOLS) technique.

The significance of this research lies in the fact that the Asian countries are now ranked as the world's second most popular tourist destination, and because it is an outward-looking region marked by rapid urbanisation and rising levels of wealth. The empirical findings show that GDP, tourism, energy consumption, trade and urbanisation, and environmental degradation are all linked in a long-term LR dynamic relationship. The empirical findings point to the growing role of tourism in contributing to carbon emissions that degrade the environment in Pakistan. A comparison of these findings with those of Sharif et al. (2017), Dogan and Aslan (2017), Chen et al. (2018), and Eyuboglu and Uzar (2020) reveals striking similarities.

In other words, tourism is a major contributor to the environmental deterioration of Pakistan. Nevertheless, the study's findings are intriguing because they provide support for the environmental Kuznets curve concept, which has been a controversial topic. The study also found that the gross domestic product, conventional energy use, trade openness, and urbanisation are all key variables that tend to have a large influence on environmental deterioration in the Asian area, especially Pakistan.

Policy Implications

The research provides vital policy foundations for the Asian area. First, while tourism has proven to be an essential factor to market prosperity in Pakistan by creating jobs, earnings, and economic expansion, it also is likely to contribute towards environmental devastation as the tourism & hospitality industry is evolved and more pavements are concreted and tourist industry platform is built to expedite the influx of both international and domestic visitors. Similarly, as a more urbanised and globally engaged area, Pakistan should see an increase in emissions as a result of the increased size of its manufacturing sector and other commercial growth.

There is support in the data for the EKC hypothesis, which suggests that beyond a certain point, environmental damage may begin to improve as a result of the adoption of greener practises and technologies. The environmental impacts of urbanisation and tourism can be mitigated by employing eco-friendly technology. The research concludes that to boost supply and efficiency, eco-friendly tourism, and economic growth, Pakistan should prioritise modern and environmentally friendly strategies. As a means of mitigating the damaging effects of increased urbanisation and commercial globalisation on the environment and laying the groundwork for a long-term, environmentally friendly tourist industry, regional economies should shift their focus toward renewable energy sources.

Taking into account the significance of the tourist industry to employment, economic activity, and regional growth, drastic changes are required to lower area carbon emissions. This is a challenging procedure because of the political repercussions and the lethargy of the stakeholders involved. The first is that the region's elites and political dynasties have a firm grip on the tourist sector, making wholesale changes and a significant reduction in carbon emissions in the region a tall order. A major political issue is posed by the potential loss of jobs and decline in profits that would result from a shift from conventional to environmentally friendly technology in the tourist sector. Investment in green technology is costly up front and returns take a long time to materialise.

Foreign and domestic investors alike have been wary of these kinds of projects since the spread of the COVID-19 virus. Local and national governments of the region countries should incentivize the technological reform process in the tourism industry with subsidies, tax rebates, and zero import duties for investors and stakeholders who opt for environmentally friendly technologies in order to avoid political backlash from the local elite and other stakeholders and restore investor confidence.

Manufacturing firms will compete to use renewable energy sources. The region's influential civil society organisations (CSOs) might play a role in educating the public and tourists about the benefits of green tourism and pushing for stricter laws to ensure the industry's adoption of green energy and practices.

Limitation of Study

However, the study has certain restrictions because it is limited to a particular nation. On top of that, it only includes the years 1995-2020 because earlier years' data was not collected. This investigation has several potential avenues for further exploration. To what extent CO2 emissions from popular tourist spots have an effect on the health of the locals there will be an intriguing study to follow. Even yet, it would be fascinating to employ forecasting techniques like the neural network to foresee the long-term effects of tourism on a country's environmental quality.

Future Studies

In line of our research study, in future researchers can work in the relevant field by focusing on certain type tourism in Pakistan. More over in future a comparative study should be done between Pakistan and its neighbouring countries by considering the moderating role education expenditure or infrastructure development.

REFERENCES

Adeola, O., & Evans, O. (2020). ICT, infrastructure, and tourism development in Africa. Tourism Economics, 26(1), 97–114.

Ahmad, F., Draz, M. U., Lijuan, Su., & Rauf, A. (2019). Taking the bad with the good: The nexus between tourism and environmental degradation in the lower middle-income Southeast Asian economies. Journal of Cleaner Production, 233, 1240–1249. https://doi.org/10.1016/j.jclepro.2019.06.138

Akadiri, S. S., Lasisi, T. T., Uzuner, G., & Akadiri, A. C. (2018). Examining the causal impacts of tourism, globalization, economic growth and carbon emissions in tourism island territories: Bootstrap panel granger causality analysis. Current

Issues in Tourism, 1–15. https://doi.org/10.1080/13683500.2018.1539067.

Akay, G. H., Cifter, A., & Teke, O. (2017). Turkish tourism, exchange rates and income. Tourism Economics, 23(1), 66–77.

Al-Mulali, U., Fereidouni, H. G., & Mohammed, A. H. (2015). The effect of tourism arrival on CO 2 emissions from transportation sector. Anatolia, 26(2), 230–243. https://doi.org/10.1080/13032917.2014.934701.

Ang JB (2007) CO2 emissions, energy consumption, and output in France. Energy Policy 35(10):4772–4778. https://doi.org/10.1016/j.enpol.2007.03.032

Anser MK, Alharthi M, Aziz B, Wasim S (2020) Impact of urbanization, economic growth, and population size on residential carbon emissions in the SAARC countries. Clean Techn Environ Policy 22(4): 923–936. https://doi.org/10.1007/s10098-020-01833-Y

Arbulú, I., Lozano, J., & Rey-Maquieira, J. (2015). Tourism and solid waste generation in Europe: A panel data assessment of the Environmental Kuznets Curve. Waste Management, 46, 628–636.

Assaf, A. G., & Tsionas, M. (2018). The estimation and decomposition of tourism productivity. Tourism Management, 65, 131-142.

Azam M, Khan AQ, Ozturk I (2019) The effects of energy on investment, human health, environment and economic growth: empirical evidence from China. Environ Sci Pollut Res 26(11):10816–10825. https://doi.org/10.1007/s11356-019-04497-4

Azam, M., Mahmudul Alam, M., & Haroon Hafeez, M. (2018). Effect of tourism on environmental pollution: Further evidence from Malaysia, Singapore and Thailand. Journal of Cleaner Production, 190, 330–338. https://doi.org/10.1016/j.jclepro.2018.04.168.

Balcilar M, Van Eyden R, Inglesi-lotz R, Gupta R (2014) Time-varying linkages between tourism receipts and economic growth in South Africa Time varying linkages between tourism receipts and economic growth in South Africa. Appl Econ 46(36):37–41. https://doi.org/10.1080/0003684

Ben Jebli, M., & Hadhri, W. (2018). The dynamic causal links between CO2 emissions from transport, real GDP, energy use and international tourism. International Journal of Sustainable Development & World Ecology, 25(6), 568–577

Bhagwati, J. N., & Srinivasan, T. N. (1979). On inferring resource-allocational implications from DRC calculations in trade-distorted small open economies. Indian Economic Review, 14(1), 1-16.

Bhagwati, J., and Srinivasan, T. (1979), 'Trade policy and development', in Dornbunsch, R., and Frenkel, J., eds, International Economic Policy: Theory and Evidence, Johns Hopkins University Press, Baltimore, MD, pp 1–35.

Bilgili, F., Koçak, E., Bulut, Ü., & Kuloğlu, A. (2017). The impact of urbanization on energy intensity: Panel data evidence considering cross-sectional dependence and heterogeneity. Energy, 133, 242–256. https://doi.org/10.1016/J.ENERGY.2017.05. 121.

Castro-Nuño, M., Molina-Toucedo, J. A., & Pablo-Romero, M. P. (2013). Tourism and GDP: A meta-analysis of panel data studies. Journal of Travel research, 52(6), 745-758.

Cernat, L., & Gourdon, J. (2012). Paths to success: Benchmarking cross-country sustainable tourism. Tourism management, 33(5), 1044-1056.

Chou, M. C. (2013). Does tourism development promote economic growth in transition countries? A panel data analysis. Economic modelling, 33, 226-232.

de Vita, G., Katircioglu, S., Altinay, L., Fethi, S., & Mercan, M. (2015). Revisiting the environmental Kuznets curve hypothesis in a tourism development context. Environmental Science and Pollution Research, 22(21), 16652–16663. https://doi.org/10.1007/s11356-015-4861-4.

Dogan E, Aslan A (2017) Exploring the relationship among CO2 emissions, real GDP, energy consumption and tourism in the EU and candidate countries: evidence from panel models robust to heterogeneity and cross-sectional dependence. Renew Sust Energ Rev 77(March):239–245. https://doi.org/10.1016/j.rser.2017.03.111

Dogan, E., Seker, F., & Bulbul, S. (2017). Investigating the impacts of energy consumption, real GDP, tourism and trade on CO 2 emissions by accounting for cross-sectional dependence: A panel study of OECD countries. Current Issues in Tourism, 20(16), 1701–1719. https://doi.org/10.1080/13683500.2015.1119103.

Dritsakis, N. (2004). Tourism as a long-run economic growth factor: an empirical investigation for Greece using causality analysis. Tourism economics, 10(3), 305-316.

Dwyer, L., Forsyth, P., Spurr, R., & Hoque, S. (2010). Estimating the carbon footprint of Australian tourism. Journal of Sustainable Tourism, 18(3), 355–376. https://doi.org/10.1080/09669580903513061.

Faber, B., & Gaubert, C. (2019). Tourism and economic development: Evidence from Mexico's coastline. American Economic Review, 109(6), 2245–2293.

Fetscherin, M., & Stephano, R. M. (2016). The medical tourism index: Scale development and validation. Tourism Management, 52, 539-556.

Ghosh, R. N., & Siddique, M. A. B. (Eds.). (2017). Tourism and economic development: Case studies from the Indian ocean region. Routledge.

Goffi, G., Cucculelli, M., & Masiero, L. (2019). Fostering tourism destination competitiveness in developing countries: The role of sustainability. Journal of cleaner production, 209, 101-115.

Gössling, S., Scott, D., & Hall, C. M. (2015). Inter-market variability in CO2 emission intensities in tourism: Implications for destination marketing and carbon management. Tourism Management, 46, 203–212. https://doi.org/10.1016/j.tourman.2014. 06.021.

Gregory, A. W., & Hansen, B. E. (1996). Residual-based tests for cointegration in models with regime shifts. Journal of econometrics, 70(1), 99–126. https://doi.org/10.1016/ 0304-4076(69)41685-7.

Halicioglu F (2009) An econometric study of CO2 emissions, energy consumption, income and foreign trade in Turkey. Energy Policy 37(3):1156–1164. https://doi.org/10.1016/j.enpol.2008.11.012

Helpman, E., and Krugman, P. (1985).Market structure and foreign trade (MIT Press Cambridge).

Hernández-Maestro, R. M., & González-Benito, Ó. (2014). Rural lodging establishments as drivers of rural development. Journal of Travel Research, 53(1), 83-95.

Hossain S (2012) An econometric analysis for emissions, energy consumption, economic growth, foreign trade and urbanization of Japan. Low Carbon Econ 03(03):92–105. https://doi.org/10.4236/lce.2012.323013

Huete-Alcocer, N., López-Ruiz, V. R., & Grigorescu, A. (2019). Measurement of satisfaction in sustainable tourism: A cultural heritage site in Spain. Sustainability, 11(23), 6774.

Işik, C., Kasımatı, E., & Ongan, S. (2017). Analyzing the causalities between economic growth, financial development, international trade, tourism expenditure and/on the CO2 emissions in Greece. Energy Sources, Part B: Economics, Planning and Policy, 12(7), 665–673. https://doi.org/10.1080/15567249.2016.1263251.

Jiang, J.-J., Ye, B., Zhou, N., & Zhang, X.-L. (2019). Decoupling analysis and environmental Kuznets curve modelling of provincial-level CO2 emissions and economic growth in China: A case study. Journal of Cleaner Production, 212, 1242–1255.

Jin, J. C. (2011). The effects of tourism on economic growth in Hong Kong. Cornell Hospitality Quarterly, 52(3), 333-340.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—With applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169–210. https://doi.org/10.1111/j.1468-0084.1990. mp52002003.x.

Kasman A, Duman YS (2015) CO2 emissions, economic growth, energy consumption, trade and urbanization in new EU member and candidate countries: a panel data analysis. Econ Model 44:97–103. https://doi.org/10.1016/j.econmod.2014.10.022

Katircioğlu ST (2014) Testing the tourism-induced EKC hypothesis: the case of Singapore. Econ Model 41:383–391. https://doi.org/10. 1016/j.econmod.2014.05.028

Katircioglu, S. T. (2014). International tourism, energy consumption, and environmental pollution: The case of Turkey. Renewable and Sustainable Energy Reviews, 36, 180–187. https://doi.org/10.1016/J.RSER.2014.04.058.

Khan, A., Bibi, S., Ardito, L., Lyu, J., Hayat, H., & Arif, A. M. (2020). Revisiting the dynamics of tourism, economic growth, and Environmental Pollutants in the Emerging economies—sustainable tourism Policy implications. Sustainability, 12(6), 2533.

Khan, M. K., Teng, J. Z., Khan, M. I., & Khan, M. O. (2019). Impact of globalization, economic factors and energy consumption on CO2 emissions in Pakistan. Science of the total environment, 688, 424-436.

Kim, H. J., & Chen, M. H. (2006). Tourism expansion and economic development: The case of Taiwan. Tourism management, 27(5), 925-933.

Krueger, A. (1980), 'Trade policy as an input to development', American Economic Review, Vol 70, pp 188–292.

Kumar, A., & Singh, G. (2019). Seasonal effect on tourism in India. Journal of Finance and Economics, 7(2), 48-51.

Lean HH, Smyth R (2010) CO2 emissions, electricity consumption and output in ASEAN. Appl Energy 87(6):1858–1864

Lee, J. W., & Brahmasrene, T. (2013). Investigating the influence of tourism on economic growth and carbon emissions: Evidence from panel analysis of the European Union. Tourism Management, 38, 69–76.

León CJ, Arana JE, Alemán AH, León CJ, Arana JE, Alemán AH (2014) CO2 emissions and tourism in developed and less developed countries. Appl Econ Lett 21(16):1169–1173. https://doi.org/10.1080/ 13504851.2014.916376

Manzoor, F., Wei, L., & Asif, M. (2019). The contribution of sustainable tourism to economic growth and employment in Pakistan. International Journal of Environmental Research and Public Health, 16(19), 3785.

Mazanec, J. A., & Ring, A. (2011). Tourism destination competitiveness: second thoughts on the World Economic Forum reports. Tourism Economics, 17(4), 725-751.

Michailidou, A. V., Vlachokostas, C., & Moussiopoulos, N. (2016). Interactions between climate change and the tourism sector: Multiple-criteria decision analysis to assess mitigation and adaptation options in tourism areas. Tourism Management, 55, 1–12.

Munir S, Khan A (2014) Impact of fossil fuel energy consumption on CO 2 emissions: evidence from Pakistan (1980-2010). Pak Dev Rev: 327–346

Nag, A. (2018). A study of Tourism industry of Himachal Pradesh with Special Reference to Ecotourism. Sumedha Journal of Management, 7(1), 85-106.

Naradda Gamage, S. K., Hewa Kuruppuge, R., & Haq, I.u. (2017). Energy consumption, tourism development, and environmental degradation in Sri Lanka. Energy Sources, Part B: Economics, Planning and Policy, 12(10), 910–916. https://doi.org/10.1080/15567249.2017.1324533.

Nepal, R., Indra al Irsyad, M., & Nepal, S. K. (2019). Tourist arrivals, energy consumption and pollutant emissions in a developing economy–implications for sustainable tourism. Tourism Management, 72(December 2018), 145–154. https://doi.org/10.1016/j.tourman.2018.08.025.

Ng, T. H., Lye, C. T., & Lim, Y. S. (2016). A decomposition analysis of CO2 emissions: Evidence from Malaysia's tourism industry. International Journal of Sustainable Development & World Ecology, 23(3), 266–277.

Pablo-Romero, M. and Molina, J. A. (2013). Tourism and economic growth: A review of empirical literature. Tourism Management Perspectives, 8, 28-41.

Paramati, S. R., Alam, M. S., & Chen, C. F. (2017b). The efects of tourism on economic growth and CO2 emissions: A comparison between developed and developing economies. Journal of Travel Research, 56(6), 712–724

Paramati, S. R., Alam, M. S., & Lau, C. K. M. (2018). The effect of tourism investment on tourism development and CO2 emissions: Empirical evidence from the EU nations. Journal of Sustainable Tourism, 26(9), 1587–1607. https://doi.org/10.1080/09669582.2018.1489398

Paramati, S. R., Shahbaz, M., & Alam, M. S. (2017a). Does tourism degrade environmental quality? A comparative study of Eastern and Western European Union. Transportation Research Part d: Transport and Environment, 50, 1–13.

Payne, J. E. andMervar, A. (2010). The tourism–growth nexus in Croatia. Tourism Economics, 16, 1089–1094.

Pulido-Fernandez, J. I., Cárdenas-García, P. J. (2020). Analyzing the bidirectional relationship between tourism growth and economic development. Journal of Travel Research, 0047287520922316.

Pulido-Fernández, J. I., Cárdenas-García, P. J., & Espinosa-Pulido, J. A. (2019). Does environmental sustainability contribute to tourism growth? An analysis at the country level. Journal of Cleaner Production, 213, 309–319.

Rasheed, R., Meo, M. S., Awan, R. U., & Ahmed, F. (2019). The impact of tourism on defcit in balance of payments of Pakistan: An application of bounds testing approach to cointegration. Asia Pacifc Journal of Tourism Research, 24(4), 325–332.

Rauf, A., Liu, X., Amin, W., Ozturk, I., Rehman, O., & Sarwar, S. (2018). Energy and ecological sustainability: Challenges and panoramas in belt and road initiative countries. Sustainability, 10(8), 2743.

Raza, S. A., Sharif, A., Wong, W. K., & Karim, M. Z. A. (2017). Tourism development and environmental degradation in the United States: Evidence from wavelet-based analysis. Current Issues in Tourism, 20(16), 1768–1790. https://doi.org/10.1080/ 13683500.2016.1192587.

Rosentraub, M. S., & Joo, M. (2009). Tourism and economic development: Which investments produce gains for regions?. Tourism management, 30(5), 759-770.

Saidi, K., & Hammami, S. (2015). The impact of CO2 emissions and economic growth on energy consumption in 58 countries. Energy Reports, 1, 62-70.

Samirkaş, M., & Samirkaş, M. C. (2016). The impact of exchange rate on tourism industry: The case of Turkey. In International business: Concepts, methodologies, tools, and applications (pp. 1165-1176). IGI Global.

Schubert, S. F., Brida, J. G., & Risso, W. A. (2011). The impacts of international tourism demand on economic growth of small economies dependent on tourism. Tourism Management, 32(2), 377-385.

Sghaier, A., Guizani, A., Ben Jabeur, S., & Nurunnabi, M. (2018). Tourism development, energy consumption and environmental quality in Tunisia, Egypt and Morocco: a trivariate analysis. Geo Journal, Wttc 2017, 1–17. https://doi.org/10.1007/s10708- 018-9878-z.

Sghaier, A., Guizani, A., Jabeur, S. B., & Nurunnabi, M. (2019). Tourism development, energy consumption and environmental quality in Tunisia, Egypt and Morocco: A trivariate analysis. Geo Journal, 84(3), 593–609.

Shahzad, S. J. H., Shahbaz, M., Ferrer, R., & Kumar, R. R. (2017). Tourism-led growth hypothesis in the top ten tourist destinations: New evidence using the quantile-on-quantile approach. Tourism Management, 60, 223-232.

Shakouri, B., Khoshnevis Yazdi, S., & Ghorchebigi, E. (2017). Does tourism development promote CO2 emissions? Anatolia, 28(3), 444–452. https://doi.org/10.1080/ 13032917.2017.1335648.

Sharif, A., Afshan, S., & Nisha, N. (2017). Impact of tourism on CO2 emission: Evidence from Pakistan. Asia Pacific Journal of Tourism Research, 22(4), 408–421. https://doi. org/10.1080/10941665.2016.1273960

Sharif, A., Afshan, S., & Nisha, N. (2017). Impact of tourism on CO2 emission: Evidence from Pakistan. Asia Pacific Journal of Tourism Research, 22(4), 408–421. https://doi. org/10.1080/10941665.2016.1273960 .

Sherafatian-Jahromi, R., Othman, M. S., Law, S. H., & Ismail, N. W. (2017). Tourism and CO2 emissions nexus in Southeast Asia: New evidence from panel estimation. Environment, Development and Sustainability, 19(4), 1407–1423. https://doi.org/10. 1007/s10668-016-9811-x.

Sokhanvar, A., Çiftçioğlu, S., & Javid, E. (2018). Another look at tourism-economic development nexus. Tourism Management Perspectives, 26, 97–106.

Solarin, S. A. (2014). Tourist arrivals and macroeconomic determinants of CO2 emissions in Malaysia. Anatolia, 25(2), 228–241. https://doi.org/10.1080/13032917.20 13. 868364.

Statista, (2021). Pakistan: Fossil fuel CO2 emissions 1970–2019 | Statista. Available at: https://www.statista. com/statistics/486054/CO2-emissions-pakistan-fossil-fuel-and-industrial-purposes/#:˜:text=Carbon% 20dioxide%20emissions%20in%20Pakistan,over%20the%20past%2050%20years

Surugiu, C., & Surugiu, M. R. (2013). Is the tourism sector supportive of economic growth? Empirical evidence on Romanian tourism. Tourism Economics, 19(1), 115-132.

Timothy, D. J. (2011). Cultural heritage and tourism: An introduction (Vol. 4). Channel View Publications.

Tugcu, C. T., & Topcu, M. (2018). The impact of carbon dioxide (CO2) emissions on tourism: Does the source of emission matter? Theoretical and Applied Economics, 25(614), 125–136.

Usman, O., Bekun, F. V., & Ike, G. N. (2020). Democracy and tourism demand in European countries: does environmental performance matter? Environmental Science and Pollution Research, 27(30), 38353-38359.

Volpi, D., & Yuli, and Sonia Regina Paulino. (2018). The sustainability of services: Considerations on the materiality of accommodation services from the concept of life cycle thinking. Journal of Cleaner Production, 192, 327–334.

Wu, T. H., Chen, Y. S., Shang, W., & Wu, J. T. (2018). Measuring energy use and CO2 emission performances for APEC economies. Journal of Cleaner Production, 183, 590–601.

Wu, T. P., & Wu, H. C. (2018). The causal nexus between international tourism and economic development. Tourism Analysis, 23(1), 17–29.

Yap, G., & Saha, S. (2013). Do political instability, terrorism, and corruption have deterring effects on tourism development even in the presence of UNESCO heritage? A cross-country panel estimate. Tourism Analysis, 18(5), 587-599.

Zaman, K., Moemen, M. A.e., & Islam, T. (2017). Dynamic linkages between tourism transportation expenditures, carbon dioxide emission, energy consumption and growth factors: Evidence from the transition economies. Current Issues in Tourism, 20(16), 1720–1735. https://doi.org/10.1080/13683500.2015.1135107.

Zhang, L., & Gao, J. (2016). Exploring the effects of international tourism on China's economic growth, energy consumption and environmental pollution: Evidence from a regional panel analysis. Renewable and Sustainable Energy Reviews, 53, 225–234. https://doi.org/10.1016/j.rser.2015.08.040.

Zou Q, Chen X, Lv JN (2014) The environmental Kuznets curve and effect factors of CO2 emissions in China: dynamic econometric test based on ARDL model. Adv Mater Res 962–965:1670–1675. https://doi.org/10.4028/www.scientific.net/AMR.962-965.1670.