Sustainable Tourism Development in Pakistan: Economic Opportunities and Environmental Challenges

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ABSTRACT

The tourism sector in Pakistan has gained immense importance due to country's rich cultural heritage, natural beauty, and famous religious sites. The tourism industry is required to be environmentally sustainable because it causes challenges of increased energy consumption, capital investment, waste generation, and CO_2 emissions. The instant study was meant to evaluate the relationship between development of tourism industry and the degradation of environmental quality in Pakistan with a particular focus on trade and infrastructure development. The time series data from 1991 to 2023 was derived from World Development Indicators and secondary data sources from Household Integrated Economic Survey. A mixed-methods approach was employed which blended numerical data analysis and thematic insights. The ARDL model was deployed to look for the long-and short-term relationship between environmental quality, trade, tourism, and Gross Fixed Capital Formation (GFCF). The effectiveness of environmental regulations and practices prevailing in Pakistan were evaluated for environmentally sustainable tourism. The results indicated that the dependent variables of trade, tourism, and GFCF had negative relationship with environmental quality in Pakistan. It was further evaluated that there was severe deficit of enforcement of effective regulations and practices for environmentally sustainable tourism development in the country. It was concluded that the sustainable development strategies e.g. environmentally friendly trade policies, climate resilient infrastructure, and sustainable tourism practices may be prioritized by the government and the policy framers for mitigating the adverse impacts of tourism development.

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1.   Introduction

The tourism sector has experienced rapid growth, making it one of the most dynamic sectors globally. It has exhibited remarkable progress irrespective of a country's income level. Undoubtedly, tourism has a profound impact on a nation's income, while also playing a vital role in promoting its cultural heritage and civilization. The tourism sector of Pakistan has experienced significant growth, driven by an increasing interest in diverse types of travel, including vacations, business trips, sports, health, religious pilgrimages, cultural exploration, and educational pursuits (Arshad, Iqbal, & Shahbaz, 2018; Pervaiz, Manzoor, & Awan, 2024). Fundamentally, the tourism industry seeks to strike a balance between facilitating the travellers exploring novel destinations along with preserving the local ecosystems and communities. Simultaneously, tourism contributes positively to the local economy and social structure. The sector encompasses a wide array of activities, including accommodations, dining, shopping, and other travel-related experiences. Whether undertaken for leisure, business, or socializing, the tourism caters to diverse purposes and experiences of the visitors. In Pakistan, the tourism

industry contributes significantly to economic growth of the country. For example, the country's GDP received a 5.9% rise from this sector in 2022 besides supporting 4.2 million jobs. Despite this, the sector's performance remains below its potential, given the country's rich cultural diversity and array of tourist destinations. Visitors' spending in Pakistan reached approximately USD 16 billion in 2022 and is projected to grow significantly, potentially reaching USD 30 billion by 2033. In 2022, the domestic tourism dominated the industry, accounting for 91% of visitor spending, with leisure activities being the primary focus. However, international arrivals had been more volatile: they peaked at 3.58 million in 2019, however, decreased to 163,000 in 2020 primarily because of unpresented COVID-19 pandemic. Fortunately, the sector experienced a gradual recovery, with international arrivals reaching 1.91 million in 2022 (WTTC, 2024).

Pakistan boasts immense potential as a tourist destination, with its diverse cultural heritage, historical landmarks, and natural beauty. The country is home to a wealth of historical, religious, and archaeological sites, attracting visitors from worldwide. Prior to the pandemic, Pakistan welcomed over two million international tourists every year, primarily drawn to its scenic northern regions. Pakistan's breathtaking peaks, serene lakes, picturesque valleys, sacred sites, historic landmarks, traditional cuisines, diverse dining options, and renowned hospitality have captivated global attention. The northern regions of Pakistan, particularly Gilgit-Baltistan and Khyber Pakhtunkhwa, are prime attractions for tourists, offering opportunities for trekking and cultural exploration (us Saqib et al., 2019). However, Pakistan's improving global tourism rankings and increasing visitor spending indicate a strong potential for future growth. For Pakistan to continue its upward trend, it is crucial to emphasize sustainability, invest in infrastructure development, and launch marketing drives to capture the attention of international and domestic tourists. Pakistan's architectural marvels, rich culinary traditions, diverse dining experiences, and warm hospitality further enhance its appeal. International tourists are also drawn to the thrilling activities available, including paragliding, desert safaris, hunting, rock climbing, and fishing at various scenic spots. As a middle-income developing country, Pakistan recognizes the significance of tourism in contributing to its economic development. The sector directly and indirectly contributes to economic development, generating revenue that improves the balance of payments, employment, and tax revenue (Archer, 1995; Balaguer & Cantavella-Jorda, 2002; Khan, Seng, & Cheong, 1990). Tourism revenue can be taken as an alternate to export which drives economic growth through spillovers and other externalities (Marin, 1992; Uddin et al., 2024). The Government of Pakistan has launched various initiatives aimed at attracting an increasing number of tourists. The citizens of 126 countries are eligible for visa-free entry for tourism in Pakistan. Furthermore, the government has streamlined the process for tourists from other countries to obtain visas with greater ease (GoP, 2024).

Pakistan's tourism industry has an immense significance in its economy; however, any increase in tourism activity may lead to environmental concerns such as decrease in forest cover, habitat destruction, contamination of the nature (air and water), and degradation of natural landscapes. These environmental issues both affect the natural landscape and scenic beauty which attract tourists in the country. The Pakistani government has undertaken various measures in response to these environmental challenges for the promotion of environment friendly tourism practices. In this context, various laws and regulations have been formulated e.g. The Pakistan Tourist Guides Act (1976); The Punjab Tourist Guides (Amendment) Act (2020); The Khyber Pakhtunkhwa Tourism Act (2019); and The Pakistan Hotels and Restaurants Act (1976). These laws and regulations aim to regulate tourist activities and minimize their negative impacts on the natural environmental. The concept of ecotourism has been widely promoted at the government level for the adoption of environment friendly behaviours amongst the tourists and the local residents. The implementation of environmentally responsible strategies entails utilization of potential for renewable energy, reduction of waste generation, and efficient water management. The negative environmental impacts associated with tourism development can be mitigated by promoting sustainable tourism practices, and meanwhile the sector's economic benefits will be maintained for country's development. The success of the tourism industry is closely linked with preserving the natural, historical, and cultural sites. The tourism sector in Pakistan has significant environmental implications especially in mountainous, wildlife, and coastal areas. The natural ecosystems have to bear immense pressure due to heavy influx of tourists which poses issues such as air pollution, overfishing, overhunting, and degradation due to sold wastes. Any

unchecked development leads to destruction of habitat and the loss of natural beauty which takes toll of the sustainability of tourism sector. Similarly, the expansion of the trave and tourism industry has negatively affected the environment and posed threat to wildlife and natural landscapes (Kasim, 2006; Pervaiz, Pervaiz, & Manzoor, 2022). Therefore, it is essential to investigate the complex relationships between tourism, environmental sustainability, and economic development in the context of Pakistan. The instant study is planned to explore the environmental implications of Pakistan's tourism development and its relationship with economic development. The research seeks to establish understanding of interplay between tourism development, environmental management, and economic growth in Pakistan. The study aims to contribute to the development of tourism policies in Pakistan by the promotion of environmentally responsible tourism. Overall, tourism represents a significant challenge in the country, affecting both natural resources and local communities. This study's outcomes will offer actionable recommendations for legislators, regulators, and relevant stakeholders for the promotion of sustainable tourism practices in Pakistan. Using a quantitative approach, this research seeks to address several key questions:

1. What is the impact of tourism on Pakistan's ecosystem?
2. What is the relationship between Pakistan's tourism industry and environmental sustainability?
3. Does fixed capital formation has any impact on Pakistan's tourism sector?

2. Literature Review
The examination of the intricate relationships among tourism sustainability, economic growth, and environmental degradation, considering ambitious legislative goals is important for improving environmental quality and reducing emissions through a sustainable tourism sector.

2.1. Tourism Development and CO_2 Emission
Previous studies have identified tourism's dual impacts on climate change and mixed findings. (Akadiri et al., 2019; Katircioglu, Feridun, & Kilinc, 2014) revealed a positive reciprocal relationship between tourism and environmental quality. In contrast, (Font & Buckley, 2001) found that tourism can have both beneficial and detrimental effects on wildlife conservation efforts. While certain tourism activities, such as the establishment of protected areas, can contribute to environmental preservation, others can lead to ecosystem degradation, species harm, and loss of biodiversity. Sharpley and Telfer (2015) suggested that while few of the sustainable tourism initiatives mitigated the negative impacts of tourism, others were ineffective or even exacerbated the issues. They emphasized that the tourism development should be climate responsive and it must integrate social, economic, and environmental considerations. The importance of reducing pollution by encouraging tourists to adopt eco-friendly practices, such as minimizing travel and making energy-efficient business decisions that lower CO_2 emissions were underlined. Globally, tourism accounts for around 5% of total CO_2 emissions, however, the air travel has been estimated to account for more than 40% of these emissions (Bows, Anderson, & Peeters, 2009; Lenzen et al., 2018). Gössling et al. (2007) suggested that the slower modes of transportation, such as buses and trains, as an alternative to flying may be preferred as a mitigation strategy. Studies by (Katircioglu & Katircioglu, 2018); Katircioglu (2014) studied the environmental impact of the tourism both in the long run and short run in the context of Turkey, and suggested a inverse relation between tourism and carbon emissions. Their findings had concluded that the growth in tourism sector significantly accelerated CO_2 emissions. Similarly, research by Saenz-de-Miera and Rosselló (2014) explored the impact of tourism on air pollution levels in Mallorca, Spain, and substantiated the earlier findings regarding negative impact of tourism on environment. Furthermore, Raza et al. (2017) employed wavelet-based analysis to demonstrate that tourism growth in the USA had a significant environmental impact.

Alves and Moutinho (2013) and León et al. (2014) observed that the harmful effect of tourism on environment and natural resources of both developed and developing countries. Zhang and Gao (2016) identified tourism as a significant source of carbon emissions. They analysed energy consumption, CO_2 pollution, and international tourism. Their findings indicated that tourism had no environmental impact in Central but had a minor effect in Eastern and Western territories of mainland China, particularly due to travel-related CO_2 emissions in Eastern side of the country. Since initiating its reform and opening-up policies in 1978, China

became the third most visited country globally. By 2010, it was projected to attract 55.98 million international tourists and 1.61 billion domestic tourists.In 2009, China earned $45 billion in foreign exchange from tourism, ranking fourth worldwide (Zhang & Gao, 2016). Becken and Hay (2007) researched New Zealand and mentioned that tourism caused air pollution, therefore businessmen and tourist community should conserve the environment. Chin et al. (2014) discovered that the tourism can damage cultural and historic sites in Spain besides its potential for economic benefits. They emphasized the importance of sustainable tourism that protected and preserved cultural assets. According to Chim-Miki and Batista-Canino (2017), economic growth in certain Asian countries has had a dual impact: decreasing pollution while increasing energy consumption, with a net result of elevated level of CO_2. Al-Mulali, Saboori and Ozturk (2015) observed that, despite strict environmental regulations in EU countries, tourism had the ability to contribute to reducing CO_2 emissions. Additionally, several experts noted that tourism had an indirect impact on CO_2 emission. Similarly, Katircioglu, Feridun and Kilinc (2014) examined energy consumption, tourist arrivals, and carbon dioxide emissions. The study underlined the significance of tourism sector for economic development of Türkiye. They addressed a gap in the literature by examining the interconnected relationship of the tourism growth with trade, and environmental quality within a comprehensive framework that also considered investment and globalization. The findings indicated that tourism was associated with lower energy use and reduced carbon dioxide emissions. Similarly, Sharif, Afshan and Nisha (2017) explored how tourism and trade influenced carbon dioxide emissions in Pakistan. They analysed the complexities of the relationships between tourism, trade, and environmental quality, and emphasized the need for sustainable tourism practices and environmentally friendly trade policies.

2.2. Nexus of Tourism and Infrastructure

The tourism growth and infrastructure development is interconnected. The infrastructure development significantly enhances tourists' accessibility and, conversely, the tourism growth drives infrastructure investment. This positive relationship between tourism and infrastructural development has been substantiated by various studies e.g. the studies conducted by Seetanah et al. (2011), Fareed et al. (2016), Khan and Rasheed (2016), Nguyen (2021), Pervaiz, Pervaiz and Manzoor (2022) and Jama et al. (2024). There are incidences when infrastructure in Pakistan was improved which has substantially increased the appeal of northern areas like Hunza and Swat e.g. Karakoram Highway and Skardu International Airport. Moreover, initiatives under CPEC have improved the connectivity to remote tourist destinations. However, sufficient challenges still persist for encouragement of tourism in Pakistan e.g. poor road conditions, inadequate public transport, and unregulated development etc. The infrastructure improvements have also driven revenue growth which is evidenced by the enhanced visitors spending reaching USD 16 billion in 2022 in Pakistan. It is essential to prioritize eco-friendly infrastructure projects and foster public-private partnerships for ensuring sustainable growth in the tourism sector in Pakistan (WTTC, 2024).

2.3. Tourism and Trade Relationship

The relationship between degradation of the environmental with enhanced trade in Pakistan depends on the specific context. The environmental consequences of the trade are twofold - both favourable and unfavourable impacts. The positive impact of the trade can facilitate the promotion of climate responsive technologies, foster sustainable livelihoods, and facilitate the adoption of low-carbon energy solutions, thereby supporting long-term sustainable growth. Moreover, Pakistan has substantial prospects for manufacturing and exporting sustainable energy solutions, including solar panels (Khan, Safdar, & Nadeem, 2023). Conversely, trade can lead to environmental degradation. For instance, the economic development in Pakistan has resulted in enhanced pollution especially in the urban settlements. Meanwhile, similar development in the agricultural sector has led to deforestation and decreased levels of vegetative cover. Due to awareness about sustainable development could be evidences e.g. the trade agreements have started to include environmental related provisions for the promotion of climate responsive development. Additionally, the growing interest in "green trade" also underlines the promotion of climate resilient goods and services (Ali et al., 2021).

3. Research Methodology

This study investigated the effects of tourism on the environment in Pakistan and explored the relationship of country's tourism industry with environmental sustainability. The analysis of fixed capital formation has done in order to see its impact on Pakistan's tourism sector. Additionally, the instant research examined how environmental sustainability was linked with tourism industry, and also assessed the role of Pakistani laws and policies in promoting eco-tourism. A mixed-methods approach was employed which blended numerical data analysis and thematic insights to assess the impact of environment quality, gross fixed capital formation and trade on tourism sector of Pakistan. The model is as following:

$$TU = f(EC, TR, GFCF)$$

Here, EC represents Environmental Condition that is calculated by CO_2 Emission, TR is represented trade of Pakistan which is taken as Trade (%of GDP), and GFCF is Gross Fixed Capital Formation which is used for infrastructure. TU is used for the tourism sector of Pakistan that is taken as railway and international airline receipts.

3.1. Data Source and Econometric Model Specification

Data collection is an essential phase of research, influencing the credibility and generalizability of the results of the study. In this article secondary data is used which was derived from different datasets. Environmental quality and tourism's data was taken from WDI and gross fixed capital formation, and trade's data was derived from Household Integrated Economic Survey (HIES). The time series data was analyzed for a time period from 1991 to 2023.

Table1: Variables detail with its abbreviation and Data-Sources

Variables	Description	Symbol of Variables	Data-Source
A) Dependent Variable			
Tourism	Railways and Airlines revenue	TU	WDI
B) Independent Variable			
Trade	Percentage of Trade that contribute in GDP	TR	HIES
Gross Fixed Capital Formation	Investment on infrastructure	GFCF	HIES
Environmental Condition	Carbon di Oxide emission	EC	WDI

For the estimation of relationship among the variables ARDL model was used. This approach is most reliable for time series data because it deals with stationary and non-stationary variables as well (Pesaran, Shin, & Smith, 2001).

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_t + \beta_3 X_{t-1} + \cdots + \beta_k X_{tk} + \varepsilon_t$$

Y_t is the endogenous variable whereas Y_{t-1}, X_t, X_{t-1} are endogenous variables. The intercept is β_0, coefficients are β_1, β_2, to β_k and error term is ε_t. Our standard econometric model is following

$$TU = \beta_1 + \beta_2 EC + \beta_3 TR + \beta_4 GFCF + \varepsilon t$$

In above equation TU is dependent variable, EC, TR ang GFCF are independent variables.

3.2. Econometric Estimation

All the econometrics analysis's explanations are as following.

3.3. Correlation Analysis

This analysis evaluates the magnitude of linear correlation between two variables along with the direction of this association. It is measured by correlation coefficient (r). The value of r reveals the nature of the relationship: positive r values denote direct relationships, while negative r values denote inverse relationships. The value r near to 1 shown strong relationship

and the value near to 0 suggest weak or no linear relationship. Correlation analysis helps identify associations between variables but does not imply causation.

3.3.1. Unit Root Test

Augmented Dickey-Fuller (ADF) Test: The ADF test is commonly used to assess the stationarity of time-series data. The ADF analyses the potential serial correlation and is based on the null hypothesis that the time series contains a unit root, indicating non-stationarity. Rejection of the null hypothesis suggests stationarity in the series (Dickey & Fuller, 1981). The ADF test looks for serial correlation by regressing the time series on their lagged values. The null hypothesis is rejected if the test statistic falls below the critical value. It indicates that the data series is stationary. Conversely, if the test statistic exceeds the critical value, non-stationarity is confirmed. Stationarity is a crucial requirement for many time-series models to ensure validity which makes the ADF test an essential tool in the evaluation and modeling of time-series data.

Philips-Perron (PP) Unit Root Test: The PP test is used for identification of unit roots in the data. It examines the null hypothesis that a time series has a unit root using a t-statistic. If the t-statistic is less than the critical value, the null hypothesis is rejected which indicated stationary in the data . Uddin et al. (2024) applied the PP test to analyze the stationarity of Pakistani stock market and indicated that the time series of stock market returns had non-stationary trend and a unit root. Similarly, Majumder (2016) used the PP test to assess the stationarity of inflation in Egypt. Their research concluded that inflation was non-stationary.

3.3.2. Autoregressive Distributed Lag (ARDL) Approach

The ARDL approach is commonly used for the examination of correlation between two or multiple variables in the long-term e.g. a typical application involves exploring how economic indicators of CPI, aggregate demand, and interest rates respond to shocks to the economy. The ARDL approach estimates by regressing endogenous variable on its own lagged values. Following is ARDL econometric model:

$$\Delta TU = \beta_0 + \sum_i^n \beta_1 i\Delta TU_{t-1} + \sum_i^n \beta_2 i\Delta EC_t + \sum_i^n \beta_3 i\Delta TR_t + \sum_i^n \beta_4 i\Delta GFCF_t + \alpha_1 EC_{t-1} + \alpha_2 TU_{t-1} + \alpha_3 TR_{t-1} + \alpha_4 GFCF_{t-1} + \in_t$$

In above equation β_0 in intercept β_1 to β_4 is represented short-run relationship. $\alpha_1 to \alpha_4$ represented long-run relationship. TU on the left side shows dependent variables and on right side all variables are independent. The F test is employed for accepting or rejecting the null hypothesis (Dritsakis, 2012).

4.   Empirical Results and General Discussion
4.1.   Correlation Analysis

The correlation matrix given in the table 2 shows the relationships between tourism (TU) and the independent variables. GFCF (0.789) and TR (0.799) presented strong positive correlations with TU, suggesting that capital investment and trade significantly boost tourism. However, EC (-0.727) indicated a moderate negative relationship, implying that unfavorable environmental conditions may reduce tourism. These results highlight the economic and environmental factors influencing tourism sector of Pakistan.

Table 2: Correlation matrix for the study variables

Variables	TU	GFCF	EC	TR
TU	1.000			
GFCF	0.789	1.000		
EC	-0.727	0.972	1.000	
TR	0.799	0.857	0.783	1.000

4.2.   Unit Root Test

Table 3 presents the results of the unit root tests. It is evident that based on the findings of both ADF test and PP Unit Root test, the variable of EC was stationery at 1st difference, however, all the other variables were already stationary.

Table 3: Unit Root Tests

Variables	Level		1st Difference		Results
	t-test	Prob	t-test	Prob	
A) *Augmented Dickey-Fuller (ADF) Test*					
EC	-2.9817	0.1531	-6.5680	0.0000	1(1)
TR	-4.4356	0.0070	-7.9570	0.0000	1(0)
TU	-4.1613	0.0133	-6.8206	0.0000	1(0)
GFCF	-3.6434	0.0422	-4.2203	0.0130	1(0)
B) Phillip-Perron Unit Root Test					
EC	2.9817	0.1531	6.5415	0.0000	1(1)
TR	4.4170	0.0000	9.3578	0.0000	1(0)
TU	4.1907	0.0125	-8.2443	0.0000	1(0)
GFCF	3.536485	0.0528	10.63306	0.0000	1(0)

4.3. Leg Length Selection

The lag length criteria table compares different lags (0, 1, 2) AIC, SC, and HQ Criteria. The model having the least values against these criteria was regarded as most suitable. Here, lag 1 had the lowest AIC (-11.15521), SC (-10.21225), and HQ (-10.85989), indicating that a lag length of 1 was the best choice for this analysis.

Table 4: AIC, SC and HQ for Lag Length Selection

Lag Length	AIC	SC	HQ Criteria
0	-6.207631	-6.019038	-6.148566
1	**-11.15521**	**-10.21225**	**-10.85989**
2	-10.89450	-9.197163	-10.36291

4.4. ARDL Bound Test estimation

The ARDL Bound Test was utilized to assess the presence of a long-run relationship among tourism, variables of Environmental Condition (EC), Gross Fixed Capital Formation (GFCF), and Trade (TR). According to Table 4, the F-statistic value was **5.8632**, which exceeded the upper critical bounds at all significance levels. For instance, at the 5% significance level, the upper bound was 4.01, which was lower than the F-statistic. This confirmed the rejection of the null hypothesis of no cointegration, indicating a long-term relationship among the variables in the model.

Table 5: ARDL Bound Test

Statistics	Value	Significance	Upper Bound	Lower Bound
F-Statistic	5.8632	10%	2.45	3.52
		5%	2.86	4.01
		1%	3.74	5.06

4.5. ARDL Short Run Estimation

The ARDL was employed to estimate the short-run relationship of tourism with its determinants. The findings revealed that GFCF had a positive and statistically significant short-term impact on tourism. However, the lagged value of GFCF showed a statistically significant negative effect, indicating diminishing returns in the short term. Environmental Conditions (EC) had a negative impact on tourism in the short run, however, the value was not statistically significant. The error correction term was estimated at -1.0623 which was statistically significant, indicating that the dependent variable adjusted toward its long-run equilibrium at a speed of 106.23% annually. The overall model was statistically significant, providing robust insights into the short-run dynamics of tourism determinants.

Table 6: ARDL Short Run Results

Variables	Coefficient	Std. Error	t-Statistic	Prob
D(GFCF)	2.0015	0.5448	3.6739	0.0013
D(GFCF(-1))	-2.3571	0.7290	-3.2331	0.0038
D(EC)	-0.2019	0.9733	-0.2075	0.8376
CointEq(-1)	-1.0623	0.1203	-8.8288	0.0000

4.6. ARDL Long-Run Estimation

The long-run results as given in Tabe 6 indicated that Gross Fixed Capital Formation (GFCF) positively and significantly impacted on tourism, with a coefficient of 2.536. It suggested that the increased investment boosted the tourism. Environmental Condition (EC) had a negative and significant effect (-2.165), implying that deteriorating environmental conditions hindered the growth in tourism. Trade (TR) also negatively impacted tourism (-0.365), showing that increased trade activities might divert resources or attention from tourism. The constant term (C) was significant, highlighting its inherent factors influencing tourism.

Table 7: ARDL Long-Run Results

Variables	Coefficient	Standard Error	T. Test	Probability
GFCF	2.536124	0.621141	4.083011	0.0005
EC	-2.164931	0.804134	-5.818371	0.0000
TR	-0.364636	0.062670	-5.818371	0.0000
C	6.560622	2.007070	3.268756	0.0035

4.7. Model Stability Test

As depicted in Figure 1, the CUSUM test results revealed that the cumulative sum of residuals was within the critical limits which indicated the stability of the model's coefficients over time. This implied that there were no significant structural breaks, confirming the stability of the estimated long-run relationships. The CUSUM of Squares plot showed that the blue line remained within the 5% significance boundaries, indicating the stability of the ARDL model over the sample period. This confirmed that the model parameters were structurally consistent and did not exhibit significant instability.

Figure 1: Diagnostic Test for Model Specification

A) CUSUM of Squares   B) CUSUM
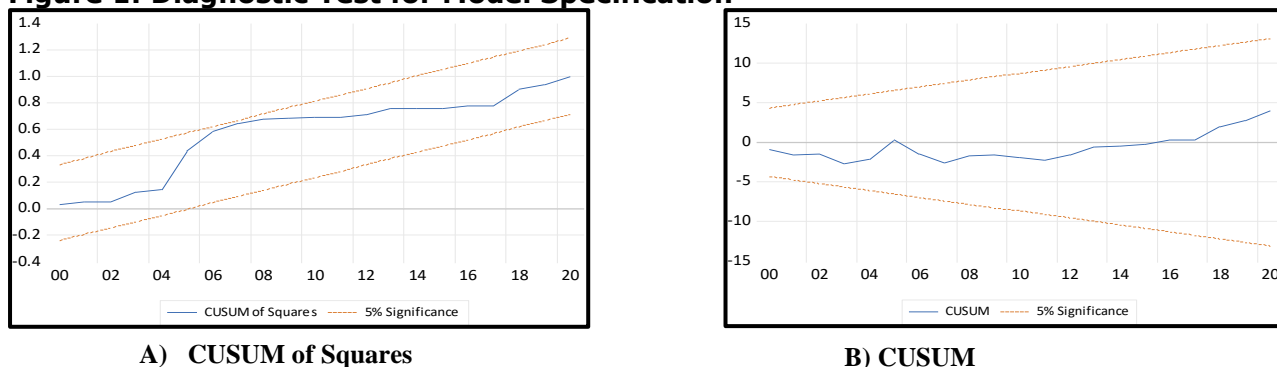
As per Table 7, the model diagnostic tests provided strong evidence of model robustness and its reliability. The estimated value of Autocorrelation LM test i.e. 0.8326 indicated that there was not significant autocorrelation present in the residuals. The null hypothesis of no autocorrelation was accepted. Additionally, the results of Breusch-Pagan-Godfrey test for heteroskedasticity yielded a value of 0.5953 which suggested the absence of heteroskedasticity in the model, thus supporting the null hypothesis of homoskedasticity. Finally, the estimation of Ramsey RESET test with a value of 0.0062 confirmed that there were no specification errors in the model which guided to accept the null hypothesis of correct model specification. These results collectively indicated that the model was well-specified, stable, and free from issues such as autocorrelation, heteroskedasticity, or mis-specification.
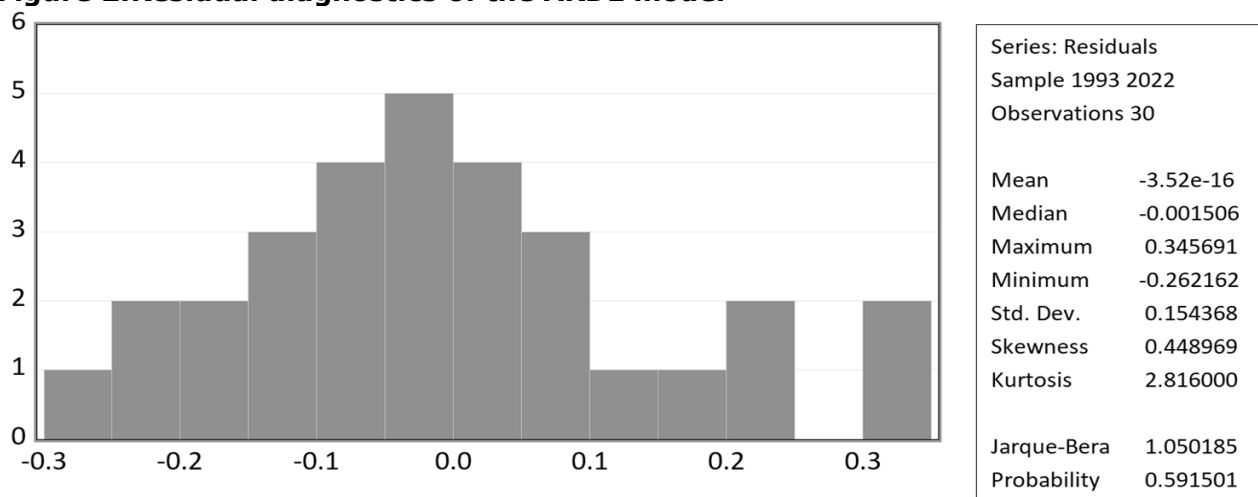
Table 8: Model Diagnostic Test

Problem	Estimation	F. Test	Prob.	Inference
Autocorrelation	LM Test	0.832605	0.6125	Accepted Null Hypothesis/ No Autocorrelation
Heteroskedasticity	Breusch-Pagan-Godfrey	0.595271	0.8021	Accepted Null Hypothesis/ No Heteroscedasticity
Specification of Model	Ramsey RETEST Test	0.006156	0.9446	Accepted Null Hypothesis/ No Specification error

4.8. Heteroskedasticity test

The residual diagnostics of the ARDL model as shown in Figure 2, revealed that the mode was well-specified, with residuals being normally distributed (Jarque-Bera p-value: 0.591) and a mean close to zero. The skewness and kurtosis values were within acceptable

ranges, confirming no significant asymmetry or heavy tails. These results validated the model's reliability.

Figure 2:Residual diagnostics of the ARDL model

Series: Residuals	
Sample 1993 2022	
Observations 30	
Mean	-3.52e-16
Median	-0.001506
Maximum	0.345691
Minimum	-0.262162
Std. Dev.	0.154368
Skewness	0.448969
Kurtosis	2.816000
Jarque-Bera	1.050185
Probability	0.591501

5. Conclusion and Implication

This study investigates how the environmental quality in Pakistan is linked with tourism, infrastructure, and trade. The findings of the study indicated that environmental quality and infrastructure had a positive and significant impact on the tourism. This research contributed to the literature by identifying key factors influencing Pakistan's tourism sector. The unit root test, using ADF and PP tests, confirmed stationarity in all variables. The results showed that environmental condition (EC) was stationary at first difference, while trade, Gross Fixed Capital Formation (GFCF) and tourism were already stationary. Given the mixed stationarity results, the ARDL approach was deemed suitable. The dynamic relationships between variables were estimated using annual time-series data from 1991 to 2023, employing the ARDL model and ECM. The correlation and unit root tests were conducted before performing ARDL estimation. The findings of correlation analysis revealed that there existed strong relationships between participating variables. The ARDL and ECM results confirmed a long-run relationship between tourism, GFCF, environmental condition, and trade. The ECM result indicated that short-run errors converged to long-run equilibrium at a rate of 106%. Further, the effectiveness of prevailing environmental regulations and practices in promoting environmentally sustainable tourism was comprehensively evaluated. The trade, tourism, and GFCF exhibiting a negative correlation with environmental quality indicated a pressing need for sustainable development strategies. Furthermore, the analysis highlighted a significant deficit in the enforcement of effective regulations and practices for environmentally sustainable tourism development in Pakistan. Consequently, it was recommended that prioritizing sustainable development strategies, such as environmentally friendly trade policies, climate-resilient infrastructure, and sustainable tourism practices, could be crucial for mitigating the adverse impacts of economic development. Effective implementation of these strategies by the government and policy framers is essential for ensuring a balanced approach to economic growth and environmental conservation.

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