Relationship between CO2 emissions, tourism receipt, energy use and international trade in Pakistan

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Introduction

The tourism industry has developed over the years; the number of tourists crossing international borders in January and June 2016 increased by 4%, compared to the same period last year UNWTO, (2017). Similarly, its indicator shows about 21 million international tourists in the year 2016, much increased than that of in 2015 and bringing the total international tourists to 561 million in 2016 destinations worldwide. Additionally, Asia had the highest increase in international tourist arrivals in 2016 which was 9% followed by Africa 5%, 4% America, and 3% in Europe. Also, the report also shows that there is about a 9% decrease of international tourists to the Middle East between January and June 2016. (UNWTO World Tourism Barometer, 2016[1]). World development indicators on travel and trade in 2013, created a share of 6.1% of the total exports and international tourist's receipts amounted to over US$ 1.381 billion World Bank., (2015)[2]. As an export category, the UNWTO promoted that after fuels, chemicals and food tourism ranks fourth worldwide WTO, (2015)[3]. According to the United Nations World Tourism Organization report, (2018), a 7.0% increase in international tourists recorded in 2017, which was the highest since the global economic crisis in 2008, and the report predicts about 3.8% increase per year for the period 2010 to 2020. In 2016, a total of 1326 million international tourists were recorded worldwide which were increased in 2017 over 86 million .these results were encouraged by continuous travel for the destinations of all over the world, including the restoration of the people of security challenges in recent years.
According to World Travel and Tourism Council (WTTC, 2018)[4], The overall shares of tourism in GDP were US$ 832.1 million in Pakistan, which is 2.9% of total GDP in 2017 and it is likely to rise by 5.9% in 2018. Similarly, in 2017 tourism contributes to 1,493,000 jobs, which are 2.5% of total employment (UNWTO, 2017)[5].

The current study explores the potential impact of tourism, economic growth, energy consumption and trade openness on CO2 emisison in Pakistan over the period of 1980-2017. Many researchers have investigated the link between tourism development and economic growth along with other determinants but there is no clear picture as the results are inconsistent. This study is an attempt to complement the literature related to tourism and economic growth along with other variables. Thus, there is a dire need to investigate the role of the tourism sector in the economy that either it is sustainable or not.

Literature Review

Numerous studies have examined both theoretical and empirical sides about tourism and its determinants which determine different kinds of results. This section focuses on the main relationship between the key features that describe tourism attractiveness and the factors which

[1] United Nations World Tourism Organization [UNWTO]. (2016). Retrieved from http://www.unwto.org.

[2] World Bank. (2015). *World Bank Development Indicators: Travel and Tourism*. Author.

[3] World Tourism Organization. (2015). *UNWTO Annual Report 2014*. Madrid: Author.

[4] https://www.wttc.org/-/media/files/reports/economic-impact-research/regions-2017/world2017.pdf

[5] https://www.wttc.org/-/media/files/reports/economic-impact...2018/world2018.pdf

affect tourism growth in economic development. Some of the previous studies are presented as follows:

Tourism and CO_2 Emission

Tourism is considered helpful in boosting the world economies by creating new jobs and opening new areas for investment, but it also put environmental pressure by emitting huge amount of CO_2 emissions as it involves high energy consumption due to transport, air travel, food etc. Therefore, it is stated that being growth friendly, tourism at the same time could be harmful for environmental quality in the host countries (Paramati, Alam & Chin, 2017; Paramati, Alam & Lau, 2018; Raza, Sharif, Wong, & Karim, 2017; Shi et al., 2019). He et al. (2020) evaluates the energy efficiency of the tourism industry in 30 regions of China, covering the period 2005–2013. They found that tourism's energy efficiency was lower than the industry as a whole.

On the other hand, in the case of Pakistan, Liu, Kumail, Ali and Sadiq (2019) concluded that there is no significant relationship between tourism and CO_2 emission during the period of 1980-2016. Moreover, Zhang, Khan, Kumar, Golpîra & Sharif, (2019) revealed that logistics and transport-related activities are positively associated with inbound tourism and fossil fuel and carbon emissions have a negative impact on tourism abroad in the context of Thailand. Shi et al. (2019) investigated the multi-relationship between economic growth, CO_2 emissions, tourism, and primary energy use and revealed that CO_2 emissions in low-income countries are more elastic to an increase in per capita tourist expenditures as compared to lower and high-income countries. On the same note, Eyuboglu and Uzar (2019) explored the relationship between CO_2 emissions, tourist arrivals, energy use and economic growth in Turkey and concluded that tourism, energy use, and growth impede environmental quality by increasing the concentrations of CO_2 emissions in the country.

Tourism & Energy Consumption

Both energy and tourism are connected through possible yet a variety of channels. The tourism industry may demand higher energy production and consumption, as both go hand in hand. However, due to the complexity in the tourism sector, energy demand may vary from place to place. According to Isik, Dogan, and Ongan (2017), the rapid increase in the tourism sector may affect tourists' choices or even change them towards higher-intensive transportation and non-renewable energy sector, which ultimately can result in global GHG emission of about 5%. Nižić, Grdić, and Hustić (2017) say that since tourism activities have a higher demand for energy, energy is indispensable for the tourism sector.

In a study of eight regions of the Asia Pacific, Meng and Niu (2011) found that there is a long-term association between CO_2 emissions, energy consumption, and economic growth. Similarly, from a study of 27 OECD countries, Saboori and Sulaiman (2013) revealed bilateral nexus in energy consumption, transportation CO_2 emissions and economic growth in the road transport sector. Moreover, Ali, Abdullah and Azam (2017a, 2017b) investigated the environmental Kuznets curve (EKC) in the case of Malaysia and concluded that energy consumption and economic growth are important indicators of CO_2 emissions. Research has revealed the existence of two-dimensional relationships between CO_2 emissions and energy consumption, while economic growth and other variables cause non-directional Granger CO_2 emissions.

Data Methodology and Model Specification

Sources of Data Collection

The present analyzes the time series data to investigate the long-run and causal relationship between the variables from 1980-2017 for Pakistan. The current study collected the annual time series data by the World Bank database and Economic Survey of Pakistan.

Model Specification

The current study indicates that tourism development is a major contributor to the levels of environmental impacts. Therefore, we specify an econometrically estimable equation, following (Liu et al., 2019; Ali et al., 2017 and Katircioglu, 2018), as follows:

$$\boldsymbol{CO2 = F(CGDP, TR, , EC, TO)} \qquad (\mathbf{1})$$

To get the direct elasticities of coefficients and to make easy the process of estimating the current study followed the work of Ali, Azam and Abdullah (2017b) and took the natural log of the variables of the study. Thus, our model can be rewritten as follows:

$$\boldsymbol{y_t = \alpha + \beta_1 LnCGDP_t + \beta_2 LnTR_t + \beta_3 LnE_t + \beta_4 LnTO_t + \mu_t} \qquad (\mathbf{1})$$

where y_t is the natural log of $CO2_t$, TRt is the natural log of tourism reciept, Et is the natural log of per capita energy consumption, TO_t is the natural log of trade openness (% of GDP), $CGDP_t$ is GDP per capita which is a proxy for economic growth and u is Gaussian error term.

Estimation techniques

After inspecting the data, this study uses Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration by Pesaran, Shin, and Smith (2001) to examine the long-run relationship between the variables of the study. The ARDL technique has various advantages over other cointegration tests. These cointegration tests can be used irrespective of the stationary variables whether they are I (0), I (1) or the correlation of both (Pesaran and Shin 1998). The ARDL method has worked out small sample properties (Haug 2002). The ARDL exceeded the Johansen and Juselius technique because of its small sample properties (Pesaran, Shin, and Smith 2001). There is no endogeneity problem in the ARDL approach and is free from residual correlation because of the selection of suitable lag selection. The ARDL method made easy to distinguish between dependent and independent variables. Therefore, for I(2) variables the Computed F-statistics of Pesaran and Shin, (2001) table will be invalid (Ouattara 2004).

The present study applied the ARDL method to identify the existence of a long-run relationship.

$$\begin{aligned}\boldsymbol{\Delta lnCO_2 = \beta_\circ + \sum_{i=1}^{p} \beta_1 \Delta lnCO_{2t-i} + \sum_{i=1}^{p} \beta_2 \Delta lnCGDP_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta TR_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta lnEC_{t-i}} \\ \boldsymbol{+ \sum_{i=1}^{p} \beta_5 \Delta lnTrade_{t-i} + \lambda_1 lnCO_{2t-i} + \lambda_2 lnCGDP_{t-i} + \lambda_3 TR_{t-i} + \lambda_4 lnEC_{t-i}} \\ \boldsymbol{+ \lambda_5 lnTrade_{t-i} + \lambda_6 lnGDP_{t-i} + \varepsilon_t} \qquad (\mathbf{2})\end{aligned}$$

where $\boldsymbol{\beta_0}$ is a constant term and $\boldsymbol{\varepsilon_t}$ is the error term. The error correction dynamics is signified by the term with summation sign while the next part of the calculation links the long-run relationship and is represented by $\boldsymbol{\lambda}$. Therefore, after the selection of model estimation and lag length, if the long-run exists then the error correction model is represented as follows:

$$\Delta lnCO_2 = \beta_\circ + \sum_{i=1}^{p} \beta_1 \Delta lnCO_{2t-i} + \sum_{i=1}^{p} \beta_2 \Delta lnCGDP_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta TR_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta lnEC_{t-i} + \sum_{i=1}^{p} \beta_5 \Delta lnTrade_{t-i} + \theta ECT_{t-i} + \varepsilon_t \quad (3)$$

where the $\mathbf{ECT_{t-1}}$ is the shock in the short-term and it represent the speed of long-term adjustment towards equilibrium. Similarly, serial correlations, functional form, diagnostic tests, normality tests including heteroscedasticity tests for testing the reliability of the model are performed. The study applied the cumulative sum and the cumulative sum of squares tests to check the stability of the model introduced by (Brown et al., 1975). It is argued that if CUSUM and CUSUMSQ figures cannot reject the null hypothesis and the critical bound is within a 5% level, then the regression will be considered as stable.

Results and Discussion

The first step in determining that, whether the model is ready for regression or not is to find out the stationarity properties of the series under investigation. The current study used the ADF, PP and DF-GLS Unit root tests to investigate the level of stationarity of all the variables of the study to further move towards regression analysis. The study applied these unit root tests in their intercept form and intercept and trend form to find out which type of unit root is there in the data. The study applied this method to the series in the model and concluded that all the variables having unit roots in their level forms as there is no such clear trend in the series.

Table: 1

ADF, PP, and DF-GLS Unit Root Test

Variables	ADF Level		PP Level		DF-GLS Level	
	Intercept	Trends & Intercept	Intercept	Trends & Intercept	Intercept	Trends & Intercept
lnCO2	-4.10754***	-0.147957	-4.55189***	0.208851	-0.28166	-0.315666
lnCGDP	-3.84954***	-3.859262***	-3.81388***	-3.816206***	-2.27189	-3.464763
lnTR	-1.33723	-3.353247**	-1.0257	-2.371159	-0.83145	-3.453753
lnE	-3.25873***	-0.224708	-3.13586***	-0.2369	-0.29223	-0.435472
TO	-1.57122	-2.250424	-1.64321	-2.374587	-1.52669	-2.499848
Ist Difference	Intercept	Trends & Intercept	Intercept	Trends & Intercept	Intercept	Trends & Intercept
lnCO2	-2.14476	-8.077967***	-5.52149***	-7.820629***	-2.0332	-8.263465
lnCGDP	-7.55833***	-7.57035***	-10.8139***	-16.27762***	-6.48988	-7.454162
lnTR	-4.98225***	-4.754741***	-3.66902***	-3.14103	-4.25265	-4.076432
lnE	-4.50372***	-5.530712***	-4.55443***	-5.524774***	-3.99737	-5.636602
TO	-7.34488***	-7.428989***	-7.34946***	-7.477542***	-6.97641	-7.510417

Note: *, **, and * represent the significance level at 10%, 5%, and 1% respectively.**

After knowing the stationarity level and making the data stationary is to look for the presence of any correlation between the variables in the long-term. The study, thus, applied the ARDL bounds test to investigate the presence of a long-run relationship between the variables of the study.

Table: 2
ARDL Bounds Test

Test Statistic	Value	
F-statistic	9.692206***	
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.45	3.52
5%	2.86	4.01
1%	3.74	5.06
Remarks: **Cointegration**		
Note: *, **, *** indicates cointegration at 10%, 5% and 1%.		

The ARDL Long-run and Short-run results

The long-term results of ARDL show that tourism demand is negatively significant, which indicates that the growth of tourism demand in Pakistan is negatively related to the long-term CO_2 emission. This main finding shows that the tourism development in Pakistan under inspection does not lead to a deterioration in the quality of the environment, thus, Pakistan's tourism demand is said to be harmless to the environment. The results of this study are consistent with Katircioglu (2018a). This outcome means that the current tourism industry in Pakistan is developing well within the boundaries of environmental sustainability and is productive both on economic and environmental fronts. This means that tourism is one of the most important industry which can promote the growth of the country without harming the environmental quality.

Table: 3
ARDL Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCGDP	0.03485	0.01323	2.634164	0.0151**
LNTR	-0.245323	0.12956	1.893499	0.0715*
LNE	0.257014	0.018303	14.042374	0.0000***
LNTO	0.023442	0.012441	1.884269	0.0728*
C	0.799534	0.11086	7.212138	0.0000
*Note: p-values and any subsequent tests do not account for model selection				

The result of the short-run is also similar to the long run. However, there is only one major difference between both which is the magnitude. The former has a relatively lower magnitude than that of the latter. This study shows that the variables selected by us have a higher impact on the foreign tourist's receipt in the longer-run.

In the short term, tourism development once again has a negative and significant impact on Pakistan's CO_2 emission, this indicates that the tourism activities in Pakistan are negatively correlated with the CO_2 emission, which means that they show an increase in pollution resistance. In the short-run even, the tourism-related activities are not harmful to the environment and could lead to sustainable economic growth in the country. The results of this study support the literature of pioneers who believe that tourism has a sustainable relationship with the environment (Hunter and Greene, (1995); Lukashina et al. (1996); Butler, (2000) among them.

Table: 4
ARDL ECM Cointegrating Form Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCGDP)	0.0409	0.019	2.152631	0.0427**
D(LNTR)	-0.0458	0.0135	3.392592	0.0027***
D(LNE)	0.0178	0.0171	1.040935	0.3088
D(LNTO)	0.00438	0.001947	2.249591	0.0348**
CointEq(-1)	-0.1868	0.0578	-3.231833	0.0038

Note: *, **, and *** represent the significance level at 10%, 5%, and 1% respectively

The study also applied diagnostic tests to confirm that there is no problem with the estimation of results, and the model is overall stable. The study further checks the viability of the functional form of the model and concluded that the functional form of the model is the correct one as the probability value of the test is higher than the rejection level at 5%.

Table: 5
Diagnostic Tests

R-squared	0.890007	Durbin-Watson stat	1.90913
Adjusted R-squared	0.835011	Serial Correlation (Chi SQ)	1.526039(0.2167)
S.E. of regression	0.001364	Functional Form (Chi SQ)	1.037583(0.3200)
RSS	0.000041	Jarque-Bera (Chi SQ)	0.690041
F-statistic (Prob.)	16.183(0.000)	Heteroscedasticity (Chi SQ)	11.65511(0.3901)

Granger Causality

The current study finds long-run connectivity between CO_2 emission, international tourism, economic growth, energy consumption, and trade openness in Pakistan. Furthermore, after applying the ARDL cointegration test the direction of causality is not clear. Hence, to find the direction of causality we conduct a Granger causality test. The result shows that there is a unidirectional causal relationship from tourism receipt, energy consumption, economic growth and trade openness to CO_2 emission.

Table: 6
Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
LNCGDP does not Granger Cause $LNCO_2$	3.56195	0.0409
LNTR does not Granger Cause $LNCO_2$	4.22773	0.0245
LNE does not Granger Cause $LNCO_2$	8.31586	0.0013
LNTO does not Granger Cause $LNCO_2$	1.23175	0.3061

Note: *, **, and *** represent the significance level at 10%, 5%, and 1% respectively

Furthermore, this study used DOLS by applying leads and lags to confirm the long-run results of the ARDL model. Thus, the outcomes of the ARDL model are robust as supported by the DOLS results.

Table: 7
Dynamic Least Squares (DOLS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCGDP	0.005231	0.000851	6.147288	0.0000***
LNTR	-0.4744	0.087728	-5.407601	0.0001***
LNE	0.322353	0.00781	41.27293	0.0000***
LNTO	0.006008	0.014756	0.407154	0.6893
C	0.442761	0.083897	5.277457	0.0001***
R-squared	0.997006	Mean dependent var		2.440371
Adjusted R-squared	0.994012	S.D. dependent var		0.03962
S.E. of regression	0.003066	Sum squared resid		0.00015
Long-run variance	9.45E-06			

Conclusion

This detailed study related to tourism studies and examined the potential impact of CO_2 emisison, tourist's receipt, economic growth including international trade, and energy consumption in Pakistan from the year 1980 to 2017. In this, many methods and theories were applied to find out the potential of the tourism field in Pakistan.

The study adopted the Autoregressive Distributed Lagged (ARDL) model to investigate the short and long-run estimates simultaneously. The study further applied Granger causality to find out the direction of causalities. To arrive at long-run robust estimates, the study employed Dynamic Ordinary Least Squares (DOLS) model. Last but not least, the current study also used an innovative accounting approach i.e. Variance decomposition and Impulse production function. The results found that economic growth has a significant impact on CO_2 emission while, tourism receipt, CGDP, energy consumption and international trade are also the main determinants of tourism in Pakistan. The study found unidirectional causality from tourism receipt, GDP, energy consumption and trade openness towards CO_2 emission. The outcomes of ARDL model are also supported by the DOLS results. The innovative accounting approach further strengthens the results of the study. In a nutshell, overall results indicate that CO_2 emission, CGDP, tourist receipts, energy consumption, and trade openness are interlinked. Thoroughly observing and examining sundry of methods and techniques lead us to the conclusion that there are a highly positive coexistence and the relationship between CGDP, the openness of trade, consumption of energy, but there is highly negative significant impact of tourism reciept on CO_2 emission in longrun as well as in shortrun.

Granger causality's findings support the long-run impact of CO_2 emission and its determinants for Pakistan. Also, Granger causality results conclude that economic growth and trade openness are had wider implications on the tourism industry. In other words, when a country promotes its tourism sector and provides incentives to the very field, it will attract more and more foreign tourists and ultimately help boost forex reserves and economic growth. More international tourist means more investments and more inflow of wealth. In this way, it will also benefit the lower class, unkilled job workers and villagers of the related tourists' areas and locations. In this era of economic boom and globalization, it highly recommended for every nation especially for those engulfed with poverty and unemployment should work out on the tourism sector as it can benefit not only the economy but also promotes soft image of the country.

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