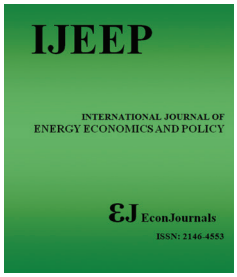

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Exploring Asymmetric Nexus between Tourism, Economic Growth and CO_2 Emissions in the Context of Pakistan

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ABSTRACT

This study aims to examine the nexus between tourism, economic growth, and CO_2 emissions in Pakistan. We examined the asymmetric relationship between tourism, economic growth, and CO_2 emissions for the period 1991 to 2019. We applied NARDL technique, and Granger Causality to predict results. Moreover, we also employed ADF, PP unit root test, Zivot and Andrews test for structural breaks. The nonlinear autoregressive distributed lag is the most appropriate econometric estimator in the case if asymmetric association exists among the variables. The NARDL technique is capable to discover the dynamic association between economic growth, tourism, and CO_2 emissions. Our results confirmed the asymmetric nexus between tourism, GDP and CO_2 emissions in the context of Pakistan. The results reported that in the short run as well as long run positive and negative shocks of tourism and GDP affect CO_2 emissions. The outcomes also revealed unidirectional causality between tourism and CO_2 emission, while bi-directional causality between economic growth and CO_2 emissions. Likewise, a bi-directional causality has also been reported between tourism and economic growth. The results are very useful for the macro level policy makers in Pakistan, and hopefully will provide significant insight to the relevant stakeholders.

Keywords: Tourism, CO_2 Emissions, Economic growth, NARDL, Pakistan
JEL Classifications: L83, Q13, B41

1. INTRODUCTION

Tourism is not only one of the world rapid developing industry, but also a key driving force behind economies of many developed and developing countries. It generates wealth, provide employment opportunities and contributes greatly to the well diversified economies around the globe (Yeh, 2020). However, for South Asian countries tantalizing economies, tourism act as a professed tool to get rid and cope with the development resources scarcity, such as expertise and finance. With the development of industrialization, advances in communication and transportation grids, globalization, and tourism sector has become world's one of the biggest industry and make enable globally economic growth by contributing almost 11% of global GDP (Qiu et al., 2020). Tourism industry's worth is in trillion-dollar and proven 1 in 10 approximately of all employment (Choi and Sirakaya, 2006; Dwyer and Forsyth, 2008). In order to address the different level of hurdles and challenges set out in development of sustainable goals United Nation nominated year 2017, and named the same as a year of sustainable tourism (World Trade Tourism Council, 2016). In recent decades, tourism industry in both developing and developed countries has evolved rapidly and recognized itself among the largest industries (Paramati et al., 2017). This rapid expansion is considered to be as key leading factor behind economic growth (Tan et al., 2015). However, despite tourism, s positive role, it has also impacted the environment quality.

The increase in international tourists' number not only results in economic growth stimulation but it also led to the greater amount of energy consumption. This consequently result in greater energy consumption in the shape of fossil fuel burning directly or through indirectly by the usage of electricity which mainly comes from oil production, coal and gas during tourism activities (Robaina-Alves et al., 2016). International tourism is foreign exchange primary earning source and generates revenue from export (Eugenio-Martin et al., 2004). Employment, revenue, earnings from foreign exchange and income are the principally derived benefits from the tourism activities (Archer and Archer, 1995; West, 1993). Tourism development not only stimulates but also a source of triggers of the country's economic growth (Chang et al., 2008; Holzner, 2011; Sequeira and Maçãs Nunes, 2008).

Tourists' international arrivals in Pakistan started to increase in year 2016, after a significant dropped down due to 9/11 and afghan war in Afghanistan till year 2015, and reported to 1,750,000 in the year 2017. In year 2017, tourism and travel total contribution to GDP was recorded as $22,286.3 million, which represents 7.4% of total GDP, while in 2018, the same reached $39,851.6 million, stand and account for 5.8% of GDP with 5.4% annual increase (WTTC, 2018). However, in the same period of time CO_2 emissions also raised in the country in the year 1962, and the CO_2 emission recorded was as 14,155 kilo tons. It increased to 32,068 and has shown an increasing trend until the year 2017. Transportation, lodging, and other tourist management attraction bring greater consumption of energy because of the many different functions that impact environment change through various different channels. World Tourism Organization (UNWTO), report revealed 5% of CO_2 emits globally by tourism sector and put share of 4.6%, in the global warming (Dogan and Aslan, 2017). However, according to the WTO (World Tourism Organization) report in year 2018, total $1.3 billion/day were spent by international tourists in year 2001, which contribute total $462 billion. However, many countries considered tourism revenue as export earnings substitute, and its contribution to their balance of payment. While it also enhances household income and government can generate extra revenue through the development of tourism sector both domestically as well internationally by austere visa related policies. In the era of globalization, tourism is a source for third world countries to enhances their economy by promoting greater peace, reduce poverty level and human resource development. Tourism enhances earnings and provide greater opportunities for employment thus a major economic significance of the local community population. This help local communities to improve their standard of living and socio-economic conditions, which may result in reduction of poverty, especially in less developed areas.

Pakistan is well known for tourism activities in the region of South Asia. The country tourism industry is at growing stage, and has already achieved record growth. According to the Pakistan Tourism Development Corporation (PTDC), report for the year 2017, 1.9 million tourists from all over the world traveled Pakistan. However, almost 90% of the tourist travel by road, only few travels by air or train. In the same year 2017, WTTC (World Travel and Tourism Council), state that 19.4 million US dollars revenue generated by the tourism sector which made-up almost 7% of the GDP, while contributed 6.3% to the total employment. World Travel and Tourism Council also expect the amount to be rise by 2030 to 361 million dollars. Hence tourism has shown an encouraging economic growth influence on Pakistan unstable economic situation and still continue to grow. Previous research is limited to countries years and their relationship among economic growth, tourism, and emissions of CO_2 (For instance, Raza et al., 2016), for the USA conducted wavelet-based analysis by using a ARDL, with VECM for Malaysia (Solarin, 2014). However, very few research studies have investigated tourism indirectly affects environment and an as indicator of the consumption of the energy which leading to global change in climate (Paramati et al., 2017).

The purpose of the study is to examine the nexus between tourism, CO_2 emissions, and economic growth in the context of Pakistan. The remaining structure of the study has been organized to as follow; Section 2 summarizes the detail in depth review of previously available previous literature, Section 3 represents the model specification and data sources, part 4 shows results followed by discussion, and lastly, Section 5 represents conclusion on the basis of the findings, followed by the limitations and future directions for research in the area.

2. LITERATURE REVIEW

Although previous literature is dominant by the overall tourism positive contribution to the prosperity of economic growth, however the environmental adverse consequences as a result of greater tourism activities cannot be simply ignored. In this regard the association between tourism activities, economic growth and CO_2 emissions have been precisely investigated. This part of the present study divides the available literature into further three sub-sections as follow;

2.1. Tourism and Economic Growth

All over the world travel and tourism sector are key important leading activities. Tourism industry for many countries remains the important and key source for the generation of employment and extra income generation in informal and formal sectors. Such as in a research study Hwang and Lee claimed that the increasing rapid development in Korea economic growth is because of the increase in tourism activities. Similarly, huge amount of foreign exchange can be engendering by developing countries from tourism activities, and boost sustainable development and growth. Which act as a main foundation in developing economies and the prosperity of economic growth can be maximize by encourage tourism activities both domestically and internationally. Despite a variety of views of the researchers about how tourism led to the economic growth and high level of employment in many different developing and developed countries. However, many researchers have consciences on the opinion that the tourism play significant role and how it contributes to the economy growth of the country. World Tourism Organization (Smith), describe tourism as an activity and traveling by the people for the purpose of recreational and leisure, however, outside the day to day environment circumstances. Tourism has been acknowledged as one of the driving forces behind economic growth, employment level, and generating of local revenues. The debate of tourism

activities and relation to economic growth has been around in scholar's circle of research for many years, and which built and relay on economic theory of tourism which stated that the tourism-driven positive economy growth hypothesis, which means that growth of the economy can be enhances by tourism activities. Panel, cross-sectional, and time series data analysis have been greatly considered in the foremost relationship of economic growth and tourism. Many studies focus mainly on tourism role in the economic growth. The tourism-led hypothesis of economic growth studies suggests that economic growth is mainly due to the result of greater tourism related activities. For instance (Katircioglu, 2009b; Panahi et al., 2015) support empirically the hypothesis. Recently, Paramati et al. (2017) for EU countries also confirms that that tourism enriches economic growth.

Many studies propose hypothesis that tourism led to overall economic prosperity for the countries. For instance, for the European Union (EU) countries (Albalate and Bel, 2010; Holzner, 2011), in Austria Falk (2010), in Eastern Europe Hall (1998), for Spain Balaguer and Cantavella-Jorda (2002) for Greece Dritsakis (2004), for UK Blackstock, White, McCrum, Scott, and Hunter (2008) and for Italy Bernini (2009). However, Mihalič (2002) come up with many benefits of tourism such as growth strategy by comparing it with exports of services and goods. However, (Nowak et al., 2007) argued that many countries governments primary purpose of engagement in tourism activities and development is for the overall economic prosperity. Moreover, Malta, Singapore, and Turkey the tourism-driven economic growth hypothesis is confirmed in many studies (Katircioglu, 2009a). However, Bi-directional causality is there in the association of the economic growth and tourism, which has been proved in past literature (Apergis and Payne, 2012) in nine countries of Caribbean. However, very few or less studies have investigated tourism and economic growth non-causality. Likewise, Ekanayake and Long (2012) for 140 developing countries found no causality (Choudhury et al., 2013). However, when tourism activities are conducted in a kind of natural and full capacities and only focus future productivity can contribute to the sustainable development and regeneration of natural resources Bramwell and Lane (1993). (Gao et al., 2019) examined the correlation among tourism revenues and GDP in Guizhou, China. Their findings revealed a positive significant correlation among GDP and tourism. While (Akan et al., 2007), by using Phillips–Perron test, Granger Causality test, the co-integration, demonstrated causal relationships for the economic variables and the sort of tourism. For Turkey, for the time period 1985–2007 with a Vector Auto regression (VAR) model also indicate a long-term correlation among tourism and economic growth do exists. This increased tourism economic importance raises new questions regarding the best practices for management and policy makers to promote economic growth and contribute to the reduction in emissions of CO_2.

H_1: More tourism contributes to Economic Growth.

2.2. Tourism and CO_2 Emissions

Tourism activities has social, economic, and environment cost associated with it. The tourism industry is an intensive usage energy industry and a emitter of greenhouse gases, such as CO_2 emissions (Hart, 2005). the increase in tourism demand not only bring linkage of opportunities with other sectors but also result in consequences of cultural, social, and environmental factors (Deike, 2003). Higher economic growth also require in higher consumption of energy which result in higher level of emissions of CO_2 (Arouri et al., 2012).

The literature is mainly divided into two schools of thoughts among the researchers with regard of economic growth and tourism role in emissions of CO_2. One prefers argued the direct impact of tourism on CO_2 emission level. Likewise, Katircioğlu (2014) also confirmed for the short-term and long-term relationship of CO_2 emissions and tourism activities for the case of Turkey. Their empirical findings suggest that CO_2 emission is accelerates with the tourism activities. Similarly, Ragab and Meis (2016) concludes tourism emits directly 464.3 tons of emissions of CO_2. Moreover (Solarin, 2014) regions (León et al., 2014; Robaina-Alves et al., 2016). The other researcher group found that CO_2 emissions indirectly effects by tourism for instance, Lee and Brahmasrene (2013) added further that not only tourism stimulate economic growth but also help in reduction of CO_2 emissions. Similarly, findings were noted for case of Cyprus by Katircioğlu (2014) in their study, they investigated the relationship between tourism movement as indicators demand of consumptions of energy, and emissions of carbon. Their results also found that tourism make the pace for moving the energy demand and CO_2 emissions.

H_2: More tourism contributes to more CO_2 emissions.

2.3. GDP and CO_2 Emissions

Carbon emissions overall cost associated with climate change estimated is about 5% GDP reduction each year. However, even 20% initiative actions not ever taken so far (Stern and Stern, 2007). However, to weaken carbon emissions, demand have to be reduced for energy needs Martinho (2016) at the costs of macroeconomic variables at national level (Hourcade et al., 1996). To mitigate carbon emissions in attempt to reduce energy consumptions will result in negative pressure on economic growth, due to the ground fact that energy is key input in function of production (Al-Mulali and Sab, 2012; Sadorsky, 2011). However, Environmental Kuznets curve (Aydin and Karaman-Kepenekci), shows that economic growth initial increase will initially result in more CO_2 emissions, and when economic growth is increased then eventually CO_2 falls. Ample studies with focus on variables describing economic growth and pollution are existed, but nexus with inconsistent findings (Alam and Paramati, 2016; Dogan and Inglesi-Lotz, 2017; Jardón et al., 2017). Some studies focusing the nexus of country's economic growth and energy consumption. While some related studies are focused on more advanced time series mechanism and other multivariate models, but the outcomes obtained from these studies are divergent (Apergis et al., 2010; Mutascu, 2016; Zeeshan et al., 2021; Zhang-Wei and Xun-Gang, 2012). Likewise, Ang (2007) argues that energy consumption, the variables of economic growth, and CO_2 are interrelated. To avoid misspecification and the association of these need to examined through more integrated and organized framework. However, despite the ample available existing literature on environment and economic growth, very few or less known empirical studies

try to explore the two streams of separate literature together to investigate the relationships causality. Likewise the positive nexus between GDP and CO_2 emissions has been evident from the researches (Mikayilov et al., 2018).

H_3. GDP enhances the amount of CO_2 emissions

3. METHODOLOGY AND MODELS

3.1. Data Source and Sampling Method

We collect the data of CO_2 emissions and economic growth from world development indicator (WDI), which is an authentic and one of the most precise global wise databases prepared by the World Bank. Tourism is denoted by Tou, GDP represent economic growth and CO_2 emissions is shown through CO_2. Tourism is measured as the entire amount of incoming tourists in the country over one year period. It is measured in line with previous researchers (Fareed et al., 2018; Seetaram and Dwyer, 2009). The economic growth is measured as % age of GDP, in support to many previous studies (Chow and Li, 2002; Ward et al., 2016). CO_2 emission has been taken in metric tons per capita, in the spirit of previous literature (Akbar et al., 2020; Hanle et al., 2004; Ullah et al., 2019; Zeeshan et al., 2021).

3.2. Research Method and Econometric Technique

This research explores the asymmetric nexus between tourism, economic growth and CO_2 emissions in the context of Pakistan using the nonlinear autoregression distributed lag (NARDL) model. We take annual data for the period 1991-2019 to analyze the relationship and establish results.

For empirical calculation, we suggested the following:

$$\ln CO_{2t} = f(\ln Tou_t, \ln GDP_t) \quad (1)$$

Below Equation is of linear form (1)

$$\ln CO_{2t} = \beta_0\beta_1 \ln Tou + \beta_2 \ln GDP + \mu t \quad (2)$$

In long-run the association between two or more variables is determined by applying the ARDL methodology, ECM, or Granger causality according to econometric techniques. These models reflect the asymmetrical sort of data order. Otherwise, linear relationship among variables are planned over linear models of regression, which fail to compensate for the variables' nonlinear performance. In view of the current non-linear difficulty of the variables, Shin et al. (2014) explained the ARDL structure of Pesaran et al. (2001) and Pesaran et al. (1999) cointegration method to asymmetric Auto Regressive Distributed Lag. This technique can catch short-run uncertainties and structural breaks. We observed the asymmetric tourism effect and economic growth on CO_2 emissions.

The real long-term asymmetric eq of CO_2 emissions is as follows:

$$CO_{2t} = \alpha_0 + \alpha_1 Tou_t^+ + \alpha_2 Tou_t^- + \alpha_3 GDP_t^+ + \alpha_4 GDP_t^- + \varepsilon t \quad (3)$$

Where CO_2 emissions show Carbon Dioxide emission, Tou specify tourism, and GPD represents economic growth, and a = (α_0, α_1, α_2, α_3, α_4) are cointegrating matrixes to be measured. In Equation (3), Tou_t^+, Tou_t^-, GDP_t^+ and GDP_t^- are slight sums of negative (−) and positive (+) of tourism, economic growth, accordingly in CO_2 emissions:

$$Tou_t^+ = \sum_{i=1}^{t} \Delta Tou_t^+ = \sum_{i=1}^{t} max\left(Tou_{1i,}0\right).....o) \quad (4)$$

$$Tou_t^- = \sum_{i=1}^{t} \Delta Tou_{2i}^- = \sum_{i=1}^{t} min\left(\Delta Tou_{2i,}0\right) \quad (5)$$

$$GDP_t^+ = \sum_{i=1}^{t} \Delta GDP_t^+ = \sum_{i=1}^{t} max\left(\Delta \mathrm{GDP}_i, 0\right) \quad (6)$$

$$GDP_t^- = \sum_{i=1}^{t} \Delta GDP_t^- = \sum_{i=1}^{t} min\left(\Delta \mathrm{GDP}_i, 0\right) \quad (7)$$

Following equation (2), which is recognized by Shin et al. (2014), in the asymmetric Auto Regressive Distributed Lag System.

$$\Delta CO_2 = \beta_0 + \beta_1 CO_{2t-1} + \beta_2 Tou_{t-1}^+ + \beta_3 Tou_{t-1}^- + \beta_4 GDP_{t-1}^+ + \beta_5 GDP_{t-1}^- + \sum_{i=1}^{m} \delta_{1i} \Delta CO_{2t-1} + \sum_{i=0}^{n} \delta_{2i} \Delta Tou_{t-1}^+ + \sum_{i=0}^{\rho} \delta_{3i} \Delta Tou_{t-1}^- + \sum_{i=0}^{q} \delta_{4i} \Delta GDP_{t-1}^+ + \sum_{i=0}^{r} \delta_{5i} \Delta GDP_{t-1}^- + u_i \quad (8)$$

In equation (8) we signified m, n, p, q, and r as orders of the lags. But, $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5, denote the long-run negative and positive shocks carried by tourism and economic growth on CO_2 emissions. $\sum_{i=0}^{n} \delta_{2i}, \sum_{i=0}^{\rho} \delta_{3i}, \sum_{i=0}^{q} \delta_{4i}$ and $\sum_{i=0}^{r} \delta_{5i}$ reveals the short-run results of both negative and positive effect of tourism and economic growth on CO_2 emissions, respectively. In this study the nonlinear long-run associations are taken by employing Nonlinear Auto Regressive Distributed Lag methodology. The asymmetric ARDL model taking following stages. Initially, through ADF (augmented Dickey–Fuller) and PP (Phillips–Perron) unit root tests for the stationarity of all variables.

For ARDL technique, stationary review is not required, when all the variables are strictly stationary at 1(1), or 1(0), or a mixture of 1(1) or (0), we applied the Auto Regressive Distributed Lag model. Whereas there is some limitation in the model as the ARDL model cannot continue in the presence of series 1(2) (Aminu, 2015). Consequently, for evading uncertainty in outcomes we check the stationarity of variables. In the 2nd phase, Equation (8) has been properly assessed by OLS. Furthermore, we followed the SIC information criterion and the general-to-specific technique as trailed by (Katrakilidis and Trachanas, 2012). Cointegration was verified in the third step by applying bound test for knowing about the prevailing cointegration. We employ the asymmetric autoregressive distributed lag (ARDL) model after checking that cointegration happens. The asymmetric increasing lively multiplier impacts of 1% change are removed in this stage

$Tou_{t-1}^+, Tou_{t-1}^-, GDP_{t-1}^+, GDP_{t-1,}^-$ accordingly, as

$$S_h^+ + (Tou) = \sum_{j=0}^{h} \frac{\partial CO_{2t+1}}{\partial Tou_{t-1}^+} \quad (9)$$

$$S_h^- + (Co_2) = \sum_{j=0}^{h} \frac{\partial CO_{2t+1}}{\partial Tou_{t-1}^-} \quad (10)$$

$$S_h^+ (GDP) = \sum_{j=0}^{h} \frac{\partial CO_{2t+1}}{\partial GDP_{t-1}^+} \quad (11)$$

$$S_h^- (GDP) = \sum_{j=0}^{h} \frac{\partial CO_{2t+1}}{\partial GDP_{t-1}^-} \quad (12)$$

4. EMPIRICAL ANALYSIS AND RESULTS

A critical form for applying the Auto Regressive Distributed Lag bound testing methods is that at 1(2) (Table 1) number one in the arrangement should be stationary. Similarly, (Ouattara, 2004), argue that the results of auto regressive distributed lag will be improper in the case if any of the I (2) variable is comprised in the research model. Here after, it is vital to describe the stationarity of the data. That is why, we apply Augmented Dickey Fuller and PP unit root tests and findings of the tests are revealed in Table 2. The findings of the unit root tests show that CO_2 emissions, tourism, and economic growth are stationary at first difference and not stationary at level. Moreover, we employ Zivot and Andrews (1992) unit root testing which estimates structural breaks as stated by that the basic ADF unit root test gives incorrect outcomes in structural breaks to contest the unit root's null hypothesis (Perron, 1989; Phillips and Perron, 1988). To counter the issue of structural splits, we apply the unit root test by Zivot and Andrews (1992), we also examined and reported by the results that none of the variables is stationary at 1(2) (Table 3). Hence, it is proved that we apply auto regressive distributed lag (ARDL) bounds testing techniques as no one of the series is stationary at 1(2) or over. Likewise, Bahmani-Oskooee and Bohl (2000) contended that long-run relationships differ on optimal lags, Stock and (Watson, 2012) and Watson (2012), also view that neither many lags nor employing minimum lags can evade important information of the model or report sort of insignificant calculation. Here after, expecting the implication of optimum lags, we go for using only two lags as optimum findings SIC information criteria. Table 4 designates bounds test results in the non-linear reports. The calculated F-statistic value is greater than the values of upper bounds.

Significant value at 5% level, this determine and validate asymmetrical cointegration. Due to this fact we use asymmetric autoregressive distributed lag model. We focus the Equation. (8), focusing and properly applying the general-to specific methodology by using p=q=2, being the optimum lags span. Similarly, Shin et al. (2014) also validate the same methodology. Based on general to specific technique, we removed repressor with irrelevant status form the model. later Katrakilidis and Trachanas (2012) argue that elimination of irrelevant lagged repressors can handle the issue of noise in dynamic multipliers. The study also tested the various regression issues i.e. normality of residuals and serial correlation by using the Breusch–Godfrey LM serial correlation test, Jarque–Bera technique, heteroskedasticity used the Breusch–Pagan–Godfrey test, and model stability with CUSUM and CUSUMSQ. The results demonstrate that none of such kind of problems exists in the data analysis as seen in Tables 5-7, based on these facts we apply NARDL methods. It is vital to mention that structural breaks were considered in the year 2008, as it had adverse effects on the economy. The nonlinear auto regressive distributed lag (NARDL) reported results are attributed to Table 5. This study observes the long-run asymmetric associations among tourism, economic growth and CO_2 emission in Pakistan. Table 6 covers the outcomes of long run asymmetric association.

Table 6 explains the long-term asymmetric relationship of the variables. The reported results demonstrate that there is asymmetric long-term nexus between tourism and CO_2. The results predict that due to negative shock in tourism, reduces CO_2

Table 1: Descriptive Statistics

	$lnCO_2$	lnTou	lnGDP
Mean	2.172	17.306	4.948
Median	2.302	17.265	5.921
Maximum	2.895	18.100	6.966
Minimum	0.975	16.555	2.187
SD	−0.646	1.286	2.517
Skewness	−2.026	0.999	−0.1177
Kurtosis	4.511	2.617	2.305
Jarque-bera	6.226	2.099	3.135
Probability	0.867	1.323	1.112

Table 2: Augmented dickey fuller and PP unit root tests

Test	$lnCO_2$	lnTou	lnGDP
ADF (Augmented Dickey–Fuller test			
I (0)	−3.039	−3.424	−1.720
I (I)	−3.583**	−5.547**	−3.248**
PP (Phillips–Perron test)			
I (0)	−1.336	0.972	−3.248
I (I)	−5.112**	−5.395**	−5.491**

**Indicate level of implication at 5%

Table 3: Zivot and Andrews (1992) unit root test

Unit root at level 0 (1)		Unit root at 1st difference 1 (1)
Variables	t-statistics	t-statistics
$lnCO_2$	−0.174	−4.252*
lnTou	−0.189	−5.604*
lnGDP	−1.187***	−5.704*

Table 4: Bounds test consequences in nonlinear Specification

Model	F-Statistic	Upper bound	Lower bound
$lnCO_2$/(lnTou-POS, lnTou-NEG, lnGDP-POS, lnGDP-NEG)	13.518		
Critical values			
10%		5.264	2.536
5%		6.234	3.031
2.50%		7.201	3.541

The combined null hypothesis of no cointegration is r=u + = u − =0. The critical values are based on Narayan (2005) small sample size

Table 5: Dynamic estimate of NARDL results

Study variable	Coefficient	SE	t-Statistic	Probability
C	2.971	1.503	3.889	0.007
ln CO_2 (−1)	−0.049	0.935	−5.495	0.001
lnTou_NEG	1.245	0.866	7.633	0.001
lnTou_POS	1.101	0.865	5.468	0.001
lnGDp_NEG (−1)	0.92	0.871	2.49	0.099
lnGDP_POS (−1)	−0.596	0.876	−1.883	0.012
Dummy	−0.594	0.901	−1.245	0.063
DlnTou_NEG (−1)	−0.248	1.316	−1.234	0.055
DlnTou_POS (−2)	1.363	0.881	7.817	0.001
DlnGDP_NEG (−1)	0.845	0.823	2.82	0.051
DlnEP_POS (−2)	1.363	0.881	7.817	0.001

_NEG and _POS denotes to fractional amounts of negative and positive variations

Table 6: Long-run asymmetric association

Variables	Co-efficient	SE	t-Stat.
Tou_NEG	−0.325	0.142	−2.281
Tou_POS	0.455	0.114	3.995
GDP_POS	0.565	0.125	4.512
GDP_NEG	−0.399	0.169	−2.36

by 32%- or 0.32-units decrease is reported in CO_2 due to one-unit change in tourism. While due to positive shock in tourism, CO_2 is increased by 45% or 0.45 units increase in CO_2 emissions is reported due to negative shock in tourism. Moreover, it has been observed that GDP has an asymmetric effect in CO_2 emissions. Both positive and negative shocks effect the volume of CO_2 emissions. These kind of shocks effect CO_2 emission. The positive shock in GDP increase CO_2 emissions by 56% or each unit increase in GDP increases CO_2 by 0.56 units. The negative shock also effects the volume of CO_2 emissions in Pakistan. In this regard the reported results show that each unit decrease in GDP causes 0.39 units decrease in CO_2 emissions. The results show asymmetric association of tourism and GDP with CO_2 emissions, confirming the findings of previous studies. The results confirm that increase tourism and GDP have larger effect on CO_2 emissions.

Several diagnostic tests were approved out previous to the last application of this asymmetric ARDL model. Then the outcome of those examinations is verified in Table 7. The X^2 (P-value) of LM and Breusch– Pagan–Godfrey tests are 1.173 and 1.472, that highlight the appropriateness of the model based on heteroscedasticity and serial correlation. Moreover, the Jarque–Bera test also further verified residuals normality. The value 1.447 of Ramsey RESET is also statistically insignificant, which clearly and defines that our model has been defined properly. The VIF value is 4.224, confirming the feasibility of the model in regard to multicollinearity problems and hence the results do not foster any such hetero issue. In figure no 4, the model showing a stable form. Thus, the portfolio of modelling parameters and coefficients are stable (Table 7).

We conduct granger causality estimator as a robustness test (Table 8). There is unidirectional causality between tourism and CO_2, as the F value is significant running from tourism to CO_2. While, from CO_2 to tourism it is insignificant. Likewise, there is bidirectional causality between GDP and CO_2. Similarly, the result demonstrates bidirectional causality between GDP and tourism.

Table 7: Diagnostic tests

Diagnostic tests	Problem	χ^2 (P-value)	Decision
LM	Serial correlation	1.173	No serial correlation exist
Jarque–Bera	Normality	1.144	Residuals are normal spread
Breusch Pagan Godfrey	Heteroscedasticity	1.472	No heteroscedasticity exist
Ramsey RESET test	Model specification	1.447	Model is properly specified
Variance Inflation Factor	Multicollinearity	4.224	There is no multicollinearity
CUSUM	Stability	-	Stable model
CUSUMSQ	Stability	-	Stable model

Table 8: Granger causality test

Null Hypothesis	F-Statistic	Prob.
Tou does not Granger Cause CO_2	8.4128	0.0000
CO_2 does not Granger Cause Tou	1.2350	0.0977
GDP does not Granger Cause CO_2	6.2781	0.0215
CO_2 does not Granger Cause GDP	4.9123	0.0401
GDP does not Granger Cause Tou	4.8301	0.0423
Tou does not Granger Cause GDP	7.3618	0.0010

5. CONCLUSION

This research contributes to the present work with the demonstration of asymmetric association among tourism activities, GDP and CO_2 emissions in Pakistan. This study is capturing the novel gap in the rapid growing area of tourism industry, CO_2 emissions and economic growth in Pakistani context. The presence of CO_2 emission has been found trace missing in terms of the association with tourism and economic growth. We favor Non liner techniques by employing NARDL to find out the asymmetric association among tourism, economic growth and CO_2 emissions. The findings of the outcomes support several earlier studies, verifying that tourism positively contributes to the volume of CO_2 emissions, validating the asymmetric association between tourism and CO_2 emissions. Many previous studies also validated similar resluts (León et al., 2014; Robaina-Alves et al., 2016). The outcomes also approve the positive and statistically significant and asymmetrically association between economic growth and CO_2 emissions. In the previous literature the similar results were obtained (Mikayilov et al., 2018). The outcomes of Auto Regressive Distributed Lag technology revealed that tourism promote an economic growth. Furthermore, the findings validate that tourism and economic growth both positively contribute to CO_2 emissions. The research contributed to the current data, importance and further highlighting the worldwide recognized significances of tourism.

Grounded on the outcomes, we suggest policy implications that are near to social growth and development of a region. First, we proclaim that the attentiveness of people growth in emerging regions, has the association with CO_2 emissions. The government and other interested shareholders should give special consideration to center around their health development policy to the desires of

elder persons with incapacities, children and women. This research shows the valued path of monetary funds which purposes to offer goods and service to public. At last, for supportable health growth, reflect all the probable behaviors to foster sustainable financial development. Government should also make proper arrangement to handle the waste generated by the tourists, and properly recycle it well in time to slow down the emission of dangerous gases in the country's environment. Moreover, government should provide proper fliers to each tourist coming in Pakistan, which would contain information and special directives for the incoming and domestic tourists how to contribute in clean and green Pakistan. Future researches should comprise more tourism linked variables with growth associated and emphasis to capture closely the development policies applied by the administration to observe its outcome on the CO_2 emissions. Similarly, future researches can also be showed by employing relative cases for two or many regions with same way. Furthermore, state statutory and legislation agenda as a mediator in the association of these variables and also to give a new vision to the scholars. Furthermore, the provincial assessment would also be a novel effort in the current literature.

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