An Econometric Analysis of the Role of Sustainable Development in Tourism Growth: Fresh Insights from the BRICS Economies

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An Econometric Analysis of the Role of Sustainable Development in Tourism Growth: Fresh Insights from the BRICS Economies

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ABSTRACT

Tourism is crucial for a country's economic development, especially in emerging economies like the BRICS countries. This study investigates the role of economic growth, environmental sustainability, and institutional quality in tourism development. Therefore, data was collected from the World Bank and ICRG from 1997 to 2023 for BRICS countries, and NARDL was used to test the hypothesis. Moreover, a cross-sectional dependency test is also employed to check the intercorrelation among the cross-sections. The results of this study indicated that sustainable growth and environmental sustainability have a long- and short-run impact on tourism. As far as institutional quality is concerned, it has an essential influence on tourism development. The results of this in-depth study are crucial for BRICS officials and stakeholders by concluding the short- and long-run relationship between tourism, economic growth, sustainability, and institutional performance. Understanding these relationships can help policymakers promote environmental protection and sustainable development in these critical and vibrant businesses while fostering sustainable tourism growth.

Keywords: Sustainable development, Institutional performance, Tourism, Environmental sustainability

JEL Classification Codes: 047, G18, L83, O44

1. BACKGROUND OF THE STUDY

Currently, most countries rely on tourism and promote it as a source of income for their economies. In this regard, Ullah *et al.* (2023a) pointed out that the forces

underlying the rising fascination with tourism are the potential economic benefits for tourists. In 2012, extensive growth was observed worldwide, with 1,035 million visitors (Castañeda, 2012). Ventura *et al.* (2023) highlighted the importance of tourism development, which directly and indirectly contributes to macro- and micro-level economic growth. Unfortunately, this concept requires further investigation in the context of the environment (Ayalew, 2024; Rached & Rodrigues de Sá, 2024). In this regard, this study had the opportunity to investigate the unexplored asymmetric relationship between economic growth, environmental sustainability, and institutional quality by utilizing the latest data. According to the UNWTO Secretary-General's report in 2022, international tourism grew faster than expected, which "confirms that travel is now part of consumer patterns for an increasing number of people in both emerging and advanced economies" (Ullah *et al.*, 2023a; Zhang *et al.*, 2023).

According to the UNWTO, emerging countries' market share grew from thirty percent in 1980 to forty-seven percent in 2012 and is predicted to reach fifty-seven percent by 2030 (Adams, 2024). In 2013, the potential contribution of tourism to the world economy was 9.5%, and in 2014, this potential contribution was projected to increase by 4.3% (WTTC, 2024). It is predicted that the direct GDP contribution will increase to 4.3% in 2020 from its 2023 level of 2.9%. Tourism frequently contributes significantly to employment, accounting for 6-7% of all jobs (direct and indirect) globally (Castañeda, 2012). Gan *et al.* (2024) state that tourism makes various economic contributions to the GDP of developed and diverse nations, ranging from a small industry accounting for barely 2% of GDP to a significant economic pillar contributing over 10% of GDP.

The BRICS countries, perhaps the best exemplars of the new world powers, also claim to speak for the developing world (Liu *et al.*, 2023). After South Africa attended the BRICS meeting in Sanya, China, in April 2011 (Akarli, 2024; Da-Costa Santos, 2022), it was evident that their inclusion was not due to geographic proximity or prior collaborative projects. The BRICS countries hardly meet the requirements for a unified coalition, notwithstanding their development. There are more contrasts between them than similarities. The economies vary in overall size, GDP per capita, and other characteristics. Even though their GDPs have proliferated regularly, China and India outperform the other BRICS countries. Additionally, their economies differ significantly on a fundamental level. With the largest populations, most rapidly expanding economies, and strongest domestic

markets, the BRICS nations have the potential to surpass the seven largest economies by the year 2040 (Robiou du Pont *et al.*, 2016).

The main concern of this study is to investigate the impact of economic growth, environmental sustainability, and institutional quality on tourism development. Keeping the objectives in mind, this study contributes to the body of knowledge by examining the intersection of the aforementioned relationships using the panel nonlinear ARDL approach. Moreover, the study's significance lies in providing insights into the role of environmental sustainability, which enhances long-term viability and helps attract tourism (Wang *et al.*, 2024). Institutional quality, measured through an index that includes regulatory standards, transparency, and governance, is considered within the framework of tourism development. Institutional quality is often overlooked when examining the relationship between economic growth and environmental sustainability. This study also assists in formulating policies for authorities and stakeholders. It was conducted to address gaps in the literature and data, incorporating up-to-date information to support the achievement of sustainable development goals.

2. LITERATURE REVIEW

According to the EKC hypothesis, environmental quality and GDP per person have an inverted U-shaped connection. Due to rising industry, resource consumption, and pollution, environmental degradation worsens as a country's economy develops (Wang *et al.*, 2024). To attract travelers searching for eco-friendly vacation places, nations may implement stronger environmental regulations, invest in environmentally friendly infrastructure, and promote sustainable tourism tactics (Li & Cao, 2024). Economic growth and sustainable development may surpass a crucial threshold during the transitional period of the EKC curve (Ben Jebli & Ben Youssef, 2015; Guo & Shahbaz, 2024). Applying the EKC theory to visitor arrivals in the context of the BRICS countries is incredibly fascinating (Hasan *et al.*, 2023). These countries represent the economic growth spectrum, from underdeveloped Brazil and India to highly developed China and Russia. The BRICS group has many policies to improve institutional performance standards, economic growth goals, and environmental sustainability (Ullah *et al.*, 2023b). The topic of how these nations balance their efforts to boost tourism with their theoretically conflicting economic development and

environmental protection objectives is covered (Ali *et al.*, 2023; Qamruzzaman, 2023).

In recent empirical studies, the behavior of global spillovers in stochastic frontier models has been examined. The general conclusion, supported by the vast majority of publications, is that, subject to the country's unique absorptive potential, tourism dramatically impacts productivity. The investigation makes use of numerous model parameters and analytical subgroups.

2.1. Environmental Sustainability and Tourism Development

The causes of carbon dioxide (CO2) emissions have been the subject of numerous empirical studies. However, most of these studies only considered per capita income and environmental quality variables in their Environmental Kuznets Curves (EKC), disregarding the quality of institutions (law and order, corruption, etc.). According to the literature evaluation done for this study, many academics have used various econometric techniques to examine the effects of variables brought on by carbon emissions. Several researchers integrated two or more strategies to test their model's effectiveness. Studies involving a single nation were researched using alternative approaches, such as ARDL, whereas studies involving numerous countries were investigated using FMOL and P-OLS.

Bilgili *et al.* (2023) conducted an analysis and its findings support the EKC theory by showing that financial expansion decreases carbon emissions while renewable energy raises them. The EKC hypothesis stated that the negative consequences of renewable energy sources influenced the country's carbon emissions, according to Kartal *et al.* (2023) in their research on Turkish residents. According to Zhang *et al.* (2023), non-renewable energy is the primary source of environmental emissions, even though renewable energy has minimal effect on those emissions. Using panel data for Tunisia from 1980 to 2009, Ben Jebli & Ben Youssef, (2015) showed a correlation between the EKC hypothesis on GDP and carbon emissions. The investigations by Chen *et al.* (2019) and Zambrano-Monserrate *et al.* (2018), which examined China between 1980 and 2014 and Peru between 1980 and 2011, came to the same result.

De-Vita *et al.* (2015) examined the EKC and found that carbon emissions and energy consumption were cointegrated to account for Turkey's expanding tourist

industry. This gave rise to the idea that these characteristics demonstrate how environmental decline has a significant, long-lasting advantage.

2.2. Sustainable Development and Tourism Development

One of the most prosperous businesses in the world, tourism has recently seen growth rates that have exceeded all other economic sectors. One of the critical forces promoting sustainable development is the tourism sector, which in 2022 supported 292 million people worldwide and generated $7.6 trillion, or one in ten jobs globally (Li *et al.*, 2024). Although tourism expansion is thought to have only had short-term effects since emigration reversed when tourist activities began to thrive in demographically declining portions of Southern Europe, the tourism sector is an essential contributor to the region's long-term development. Furthermore, Robiou du Pont *et al.* (2016) established a long-run equilibrium link between tourism and financial development in low- and middle-income countries like Iran, establishing a long-run equilibrium relationship between tourism and economic growth in Taiwan. As a result, tourism was envisioned as a long-term "cure-all" solution to a wide range of challenges in developing nations (Guo & Shahbaz, 2024).

There aren't many studies that demonstrate how tourism is detrimental to long-term growth. According to Peterson (2023), tourism is to blame for rural economies' unequal job and income distributions. In a recent study on the effects of tourism, quantitative variables were classified according to the environmental, social, and economic components (Seyfi *et al.*, 2023). Furthermore, governments need to take proactive measures to guarantee ongoing visitor growth (Hasan *et al.*, 2023).

2.3. Institutional Quality and Tourism Development

Political risk and poor leadership hurt the tourism industry. Institutional quality is essential in determining visitor flows, according to Zhang *et al.*, who also examined how it relates to power, socioeconomic problems, and political risks in tourism (Zhang *et al.*, 2023). During political unrest, tour operators and service providers may halt operations. The absence of security and stability brought about by the military's political engagement hinders the growth of the tourism sector because these variables might affect visitor inflows (Agu *et al.*, 2024). Current literature explores the composite aspects of political impacts on the tourism sector,

which include nations' regional integrity, safety, security, social stability, institutions, and peace (Mzembe *et al.*, 2023).

Studies and evaluations have been conducted on the value of robust institutions in democracies (Markowski, 2024). Others refute this assertion and give several examples of democracies with strong institutions (like Singapore and Hong Kong) and non-democracies (like Hong Kong and Hong Kong) with such institutions. Just three of the 148 governments that strongly depend on tourism—Macau, the Seychelles, and the Bahamas—are committed to a tourist-led booming economy with a significant secondary purpose of controlling players (Scott *et al.*, 2024).

According to Chang & Zhang (2024), inadequate governance is a structural problem limiting expansion and growth. The extent to which public authority is used for private gain impacts how well corruption is combated, claim Agu *et al.* (2024). Corruption is a major issue impeding the effectiveness of government in terms of economic growth, despite efforts to reduce both its short- and long-term adverse effects (Wang *et al.*, 2024; Wang *et al.*, 2023). Significant reliance on tourism often results in lax anti-corruption measures; as a result, these countries' economies are more stable.

3. METHODS

The study examines the connection between institutional quality and the effects of tourism on the environment. Excellent institutional quality, according to research (Nguyen & Dinh Su, 2021), can function as a catalyst in reducing the rising impacts of economic factors on CO2 emissions or augmenting the decreasing effects. In other words, understanding the relationship between institutional quality and how tourism influences society provides a strong foundation for assessing policy consequences, particularly for those who advocate sustainable tourism growth. Institutions establish regulatory norms and policies in the public sphere by enforcing the required constraints (Torres-Delgado & López Palomeque, 2018; Usman *et al.*, 2020)

An econometric approach that integrates economic, statistical, and econometric methodologies is applied for data analysis and presentation. As a result, the tool for data analysis is an economic multiple regression technique. The three primary components of the econometric modeling approach used in this work are data collection, model creation, estimation, and model assessment (Li & Cao, 2024).

Tourism was chosen as the variable of interest because it effectively addresses the goal of the study by combining institutional performance, CO2 emissions, GDP effects, and their combined influence on visitor arrivals. For various reasons, some of which are outlined below, tourism was used as the dependent variable. Annual statistics for the BRICS nations for all five factors were gathered over 25 years, from 1998 to 2022. The data were compiled using the World Development Indicators (WDI) and ICRG databases. Table 1 displays each variable along with its measurement units and sources.

3.1. Preference of the study area

The BRICS countries have collaborated on geopolitical concerns and economic growth, standing out for their remarkable diversity, pursuit of economic expansion, and commitment to sustainable development. As the influence of tourism on these nations increases, the connection between institutional performance, environmental sustainability, and GDP growth has gained significance.

This research examines the intricate connections between the BRICS countries' GDP, tourism, environmental sustainability, and institutional performance. Institutional frameworks, encompassing laws, regulations, and governance systems, play a crucial role in shaping how tourism affects environmental and economic health. A thorough investigation of these relationships is essential to understanding the factors that either promote or obstruct sustainable tourism growth in each BRICS member state.

3.2. Data Collection Methods

This study aims to experimentally investigate the impact of institutional efficiency and economic growth on visitor arrivals. The sample comprises BRICS nations based on annual data from 1995 to 2022, with these countries also forming the study's population. The BRICS nations—Brazil, Russia, India, China, and South Africa—are shown in the table below.

The study incorporates five distinct variables, referencing the literature discussed in the Literature Review section. Independent variables are used to investigate their influence on visitor arrivals, while the dependent variable is the number of tourists arriving. Data for these variables is collected from various sources, covering 1996 to 2022. However, only 27 years of data are available through the

World Development Indicators (WDI) and International Country Risk Guide (ICGR) web pages.

Table 1: BRICS Economics

Country Symbol	Country Name
B	Brazil
R	Russia
I	India
C	China
S	South Africa

Table 2: Variable Description

Symbols	Variables Name	Unit of Measurement	Sources
TA	Tourist Arrival	No. of Tourist arrival	WDI
CO_2	Environmental Sustainability	CO2 emissions (metric tons per capita)	WDI
GDP	Sustainable Development	GDP growth (annual %)	WDI
IQ	Institutional Performance	PCA of 6 indicators (The rule of law ICRG (Internal Conflict, External Conflict, Corruption, Socioeconomic Conditions, Investment Profile)	ICRG

3.3. Econometric Model

To address the methodology bias and independent variables of the Environmental Kuznets Curve (EKC) theory (Anand & Kanbur, 1993) and other related studies that might have, over time, rendered this study's findings inconclusive for cross-national policy recommendations, this study builds on earlier research by Anand & Kanbur (1993). The EKC link claims that environmental contamination increases during a country's early phases of development and declines once wealth reaches a particular level.

Ben Jebli & Ben Youssef (2015) presented this argument in favor of the EKC theory, asserting that developing a prosperous nation is the best and perhaps the only way to create a decent environment in most nations. He further argued that

while an economy's growth often leads to an increase in pollution during the initial stages of development, this is not always the case.

$$Y_{it} = \beta_{it} + T_{it} + \propto_1 + x_{it} + \propto_2 + x_{it}{}^2 + \mu_{it} \quad (1)$$

This equation is also approximated without the cubic component. This is good for EKC. Contrarily, the cubic formulation below enables an inverted U-shaped EKC that underlines the asymmetry of carbon dioxide emissions and a monotonically increasing link between environmental N-income.

$$Y_{it} = \beta_i + T_i + \propto_1 x_{it} + \propto_2 + x_{it}{}^2 + \propto_3 + x_{it}{}^3 + \propto_i z^1 y_{it} + \mu_{it} \quad (2)$$

X denotes per capita income, i and t subscripts designate the nation and era, respectively, and y denotes environmental deterioration. Z is a vector of macroeconomic factors theoretically caused by emissions that might impact the environment. Data analysis and presentation employ an econometric technique that blends economic, statistical, and econometric methodologies. So, the tool for data analysis is an economic multiple regression technique. The three main steps of the econometric modeling procedure used in this study are data collection, model building, estimate, and model assessment (Zellner, 1979). This section presents the rationale for using the panel estimate approach. The equation used in this work is as follows and is based on earlier research:

$$logTA_{it} = \alpha_0 + \beta_1 logCO2_{it} + \beta_2 logGDP_{it} + \beta_3 logIQ_{it} + u_{it} \quad (3)$$

To account for the dynamic nature of the data series, all variables have been converted to natural logarithms (Shahbaz *et al.*, 2016b). The panel estimate test used in this investigation is described below. Over the past 20 years, several techniques have been developed to demonstrate that time-series data exhibit a longer-term counterbalance relationship. To determine if there is a long-term relationship between variables, several well-known techniques have been employed, including tests by Johansen & Juselius (1990), Phillips & Hansen (1990), Engle & Granger (1987). The integration of variables is necessary for the overall test.

3.4. Unit Root Test

All of the independent variables (IVs) and dependent variables (DVs) passed the panel unit root test. The study employed various techniques, such as the Augmented Dickey-Fuller (ADF) unit root test, the Levin, Lin & Chu t-test, and the Im, Pesaran, and Shin W-statistic, to verify that all the variables were stationary.

Panel unit root tests are conducted for each selected variable to ensure that the panel data does not lead to spurious regression. The main objective of the panel unit root test when using the Augmented Dickey-Fuller (ADF) method is to address the low power issue. The panel unit root test, which has higher power and a conventional asymptotic distribution, can resolve this problem, thereby providing more reliable results.

As highlighted by Breitung (2005), Levin *et al.* (2002) , and Im *et al.* (2003), estimating a panel nonlinear and linear ARDL model is feasible when no variable becomes stable after second differencing. For variables like regressors and regressand that exhibit seasonality patterns at the level but become stationary after the first differencing, they need to be integrated in the same sequence in order to estimate a panel Nonlinear Autoregressive Distributed Lag (NARDL) model. This approach, as explained by Pesaran *et al.* (2001) and Shin *et al.* (2014), allows for the estimation of a panel-based NARDL model, even when some variables show non-stationary trends at the level and others are stationary. According to Shin *et al.* (2014), while certain variables are fixed at the level, others are not (such as the assortment of I (0) and I (1)).

$$CIPS(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) \quad (4)$$

The (Pesaran, 2004)1 CD test estimates the cross-sectional dependency test.

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \rho_{i,j}\right) \quad (5)$$

As previously mentioned, when neither the regressor nor the regressor are I (2), the Panel NARDL model may be estimated. The data sets ' cross-sectional dependence and seasonality effects are confirmed using Pesran's CD test and the Cross-sectional enhanced IPS Panel unit root test.

As previously mentioned, when neither the regressor nor the regressand exhibit second-order integration I(2), the Panel NARDL model can be estimated. The data sets' cross-sectional dependence and seasonality effects are tested using Pesaran's Cross-sectional Dependence (CD) test and the Cross-sectional enhanced IPS Panel unit root test.

These tests are crucial for confirming the presence of cross-sectional dependence (which indicates that the errors in different cross-sections are correlated) and to ensure that the panel data is stationary at appropriate levels, which are essential for reliable econometric modeling.

3.5. Nonlinear Auto Regressive Distributed Lag Model

The linear ARDL model developed by Pesaran *et al.* (2001) has an asymmetrical extension known as NARDL. The most significant benefit of adopting the NARDL framework is that it permits concealed co-integration testing, which prevents ignorance of any connections that are not obvious in a typical linear context. As a result, the NARDL model enables the separation of linear co-integration from nonlinear/asymmetric co-integration. For both short- and long-term investigation of potential asymmetric effects, the NARDL model is employed. It relaxes the essential presumption that all variables must be integrated in the same order, either I[0] or I[1] or mutually exclusive, with the caveat that there must be no I(2) variables. This is the main benefit of employing ARDL or NARDL in co-integration analysis. The following linear equation has been used to examine the long-term relationships between the independent variables and visitor arrival. The asymmetrical impacts of various components on carbon emissions are investigated using the nonlinear ARDL technique. Adopting this assessment technique accomplishes the following objectives: It allows including nonlinear asymmetry and co-integration in a single equation.

$$TA = f(CO2, GDP, IQ) \tag{6}$$

where letters such as CO2, GDP, IQ, and TA stand in for environmental sustainability, institutional quality, Sustainable development, and tourist arrival, respectively. The research takes advantage of unit root testing. The NARDL test comes after the F-bound exam.:

$$\ln \mathrm{TA}_t = \alpha_t + \delta_t + \beta^+ \ln CO2_t^+ + \beta^- \ln CO2_t^- + \beta^+ \ln GDP_t^+ + \beta^- \ln GDP_t^- + \beta^+ \ln IQ_t^+ + \beta^- \ln IQ_t^- + \mu_t \tag{7}$$

In this section, the estimated coefficient and the recurring outcomes are, where s is the accurate constant coefficient, is the intercept, and is, and u is the time step t. An expression for the NARDL framework of equation (8) is as follows:

$$\Delta \ln \mathrm{TA}_{it} = \mu + \ln TA_{it-1} + \theta^{+} \ln CO2^{+}_{it-1} + \theta^{-} \ln CO2^{-}_{it-1} + \vartheta^{+} \ln GDP^{+}_{it-1} + \vartheta^{-} \ln GDP^{-}_{it-1} + \omega^{+} \ln IQ^{+}_{it-1} + \omega^{-} \ln IQ^{-}_{it-1} + \sum_{j=0}^{n1} \Delta \ln TA_{it-j} + \sum_{j=0}^{n2} (\theta_j^{+} \Delta \ln CO2^{+}_{it-j} + \theta_j^{-} \Delta \ln CO2^{-}_{it-j}) + \sum_{j=0}^{n3} (\vartheta_j^{+} \Delta \ln GDP^{+}_{it-j} + \vartheta^{-} \Delta \ln GDP^{-}_{it-j}) + \sum_{j=0}^{n4} (\omega_j^{+} \Delta \ln IQ^{+}_{it-j} + \omega^{-} \Delta \ln IQ^{-}_{it-j}) + \in_{it} \quad (8)$$

Equation related to measure the short run the following equation is used.

$$\Delta ln\, TA_{it} = \mu + \sum_{j=0}^{n1} \Delta\, ln\, TA_{it-j} + \sum_{j=0}^{n2} (\theta_j^{+} \Delta\, ln\, TE^{+}_{it-j} + \theta_j^{-} \Delta\, ln\, TE^{-}_{it-j}) + \sum_{j=0}^{n3} (\vartheta_j^{+} \Delta\, ln\, EC^{+}_{it-j} + \vartheta^{-} \Delta\, ln\, EC^{-}_{it-j}) + \sum_{j=0}^{n4} (\omega_j^{+} \Delta\, ln\, IQ^{+}_{it-j} + \omega^{-} \Delta ln\, IQ^{-}_{it-j}) + \emptyset ECM_{it-1} + \in_{it} \quad (9)$$

$$\ln CO2_{it} = \ln CO2_0 + \ln CO2^{+}_{it} + \ln CO2^{-}_{it} \quad (10)$$

$$\ln \mathrm{GDP}_{it} = \ln \mathrm{GDP}_0 + \ln \mathrm{GDP}^{+}_{it} + \ln GDP^{-}_{it} \quad (11)$$

$$\ln IQ_{it} = \ln IQ_0 + \ln IQ^{+}_{it} + \ln IQ^{-}_{it} \quad (12)$$

Where ln TA depicts the arbitrarily selected integer, then, $\ln \mathrm{CO2}^{+}_{it} + \ln \mathrm{CO2}^{-}_{it}$, $\ln GDP^{+}_{it} + \ln GDP^{-}_{it}$, and $\ln IQ^{+}_{it} + \ln IQ^{-}_{it}$, and are used to describe summation processes that accrue both positive and negative modifications and are recognized as

$$\ln CO2^{+}_{it} = \sum_{j=0}^{t} \Delta \ln CO2^{+}_{it} = \sum_{j=0}^{t} \max(\Delta \ln CO2_{j,0}) + \in_{it} \quad (13)$$

$$\ln CO2^{-}_{it} = \sum_{j=0}^{t} \Delta \ln CO2^{-}_{it} = \sum_{j=0}^{t} \max(\Delta \ln CO2_{j,0}) + \in_{it} \quad (14)$$

$$\ln GDP^{+}_{it} = \sum_{j=0}^{t} \Delta \ln GDP^{+}_{it} = \sum_{j=0}^{t} \max(\Delta \ln GDP_{j,0}) + \in_{it} \quad (15)$$

$$\mathrm{Ln}\, GDP^{-}_{it} = \sum_{j=0}^{t} \Delta \ln GDP^{-}_{it} = \sum_{j=0}^{t} \min(\Delta \ln GDP_{j,0}) + \in_{it} \quad (16)$$

$$\ln IQ^{+}_{it} = \sum_{j=0}^{t} \Delta \ln IQ^{+}_{it} = \sum_{j=0}^{t} \max(\Delta \ln IQ_{j,0}) + \in_{it} \quad (17)$$

$$\ln IQ^{-}_{it} = \sum_{j=0}^{t} \Delta \ln IQ^{-}_{it} = \sum_{j=0}^{t} \min(\Delta \ln IQ_{j,0}) + \in_{it} \quad (18)$$

4. ESTIMATION OF RESULTS

4.1. Descriptive Analyses

The descriptive evaluation of the panel information involves summing up and visualizing the critical components of your dataset using the tools EViews 10. A collection of views performed on several entities over time is called panel data, longitudinal data, or repeated measurement data. Descriptive analysis can help you interpret the information before going on to more complicated econometric or quantitative investigations. The Jarque-Bera test's p-value of 9.7 and the data's mean value of 7.15 show that the distribution of the information is not at regular levels.

Table 3: Descriptive Analysis

	TA	CO2	IQ	GDP
Mean	7.1557	0.7838	2.5207	7.5549
Median	7.1175	0.7449	1.4280	7.0020
Maximum	8.2422	2.2484	9.6545	25.840
Minimum	6.2991	0.0063	0.2138	0.0189
Std. Dev.	0.5385	0.4778	2.6037	4.3185
Skewness	0.5543	0.6504	1.5741	1.5982
Kurtosis	2.2863	3.1476	4.0597	7.0469
Jarque-Bera	9.7791	9.6406	62.071	149.5999
Probability	0.0075	0.0081	0.0000	0.0000
Sum	966.0129	105.8142	340.2935	1019.917
Sum Sq. Dev.	38.8520	30.5879	908.4408	2499.057
Observations	135	135	135	135

4.2. Unit Root Test Results

A statistical significance test to determine if the panel data in the dataset has a unit root is known as the unit root test, especially for data from a panel. If a panel data variable has a unit root, it is unpredictable, meaning its statistical characteristics, such as means and deviation, change with time. As stationary behavior is a foundational assumption of many models and statistical approaches, it is essential to distinguish between stationary and non-stationary variables in econometrics and time series analysis. I'll provide a summary of two of the several unit root tests

that are frequently used with panel data. The LLC and IPS tests suggested by (Choi, 2001) were the unit roots used in the investigation.

This test extends the conventional Dickey-Fuller unit-root analysis to data from panels. Each unique time series has a unit root, which suggests non-stationarity, the null hypothesis. The null assumption is accepted or rejected by comparing the test statistics to critical values. Based on whether or not hypotheses regarding person- and time-specific effects are made, there are three variants of the Levin, Lin, and Chu test. Based on the outcomes of the panel's unit root tests, components are added in an alternate series, either during level I (0) or/and after the first differential I (1).

4.2.1. Levin Lin Chu test (LLC):

Table 4: LLC Unit Root Test

Name Of Variables	At Level	At First Difference
TA	-1.7890*	2.2624
CO2	1.9056	-1.6852*
IQ	-1.6452*	-5.2204*
GDP	-1.2459*	-4.0101*

4.2.2. Im-Pesaran-Shin (IPS) Test:

The IPS analysis considers a cross-sectional dependency among each panel's time sequences. The augmented Dickey-Fuller (ADF) test is expanded to consider cross-sectional dependency. This test is applied if longitudinal dependency raises the likelihood of erroneous regression. The presumption at zero is that every time series has a unit root. The critical coefficients are used to decide whether to reject the null hypothesis, much like the Levin, Lin, and Chu test.

Table 5: IPS Unit Root Test

VARIABLES	AT LEVEL	AT FIRST DIFFERENCE
TA	-0.8188	-2.6456*
IQ	-3.2691*	-6.2416*
CO2	0.34398	3.3919*
GDP	-2.1905*	6.3972*

4.3. Asymmetric Autoregressive Distribution Lag Model

The research uses a nonlinear model developed by (Herron) to evaluate the possibility of asymmetrical relationships between the quality of institutions, tourist expenditure, visitor arrival, and energy usage. Table 6 displays the outcomes of the NARDL algorithm's long-term and short-term estimations. Finding the nonlinear asymmetric link between tourist spending, energy usage, and the quality of institutions is the primary goal of this investigation. The estimated coefficients for the positive and negative sums of the changes in the decomposed variables are shown in the long-term system's output. It has been established that there is a long-term imbalance between the decomposed factors and visitor arrival. The nonlinear limitations test F value results of 15.64, which are significant at the 1% level, show a nonlinear long-term relationship between both variables. The decomposing CO2 on tourism with both beneficial and detrimental shocks has coefficients of 0.01 and 0.000, respectively, consistent with the long-run NARDL data. The coefficients for the effect of rising (decreasing) CO2 emissions on tourism are highly significant at the one percent level, implying that an upsurge in travelers' expenses is anticipated to cause a 0.00% decline in tourism activity. In contrast, a decrease in carbon emissions is expected to cause just a 0.01% improvement in tourist arrival. The federal government started initiatives to promote output by reducing travel costs, which increases tourism, but the decline in tourist spending spurs policymakers to strengthen the industry's economy.

4.4. Asymmetric Long-Run and Short-Run Effects Estimation

Table 6: Asymmetric Long Run Estimations

Long Run Estimations				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
IQ_POS	0.0359	0.0476	0.7541	0.4529
IQ_NEG	-0.3422	0.0479	-7.1316	0.0000
GDP_POS	-0.0194	0.0062	-3.1363	0.0024
GDP_NEG	0.0286	0.0082	3.4689	0.0008
CO2_POS	0.0153	0.0074	2.0678	0.0417
CO2_NEG	0.0032	0.0110	0.2889	0.7734

Table 7: Asymmetric Short Run Estimations

Short Run Estimations				
Coefficient	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
CointEq(-1)*	-0.7866	0.1954	-4.0249	0.0010
D(IQ_POS)	0.0128	0.0284	0.4505	0.0005
D(IQ_NEG)	0.0382	0.0488	0.7837	0.0004
D(GDP_POS)	0.0043	0.0152	-0.2859	0.7757
D(GDP_NEG)	0.0089	0.0126	0.7059	0.0022
D(CO2_POS)	-0.0168	0.0152	-1.1093	0.0005
D(CO2_NEG)	0.0376	0.0256	1.4670	0.0001
C	0.7442	1.0373	0.7175	0.0001

4.5. Stability Tests

Additionally, stability approaches were used in this study to assess the models' foundational stability. The overall stability of a time series of information or an equation with regression over time is evaluated using statistical methods such as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ). These tests frequently identify changes or alterations in the basic information generation process in disciplines like econometrics and data quality control. Both methods are effective instruments for tracking and spotting structural alterations in data over time. Changes in the data's mean, variance, or other statistical characteristics may be responsible for these modifications.

Fig.A

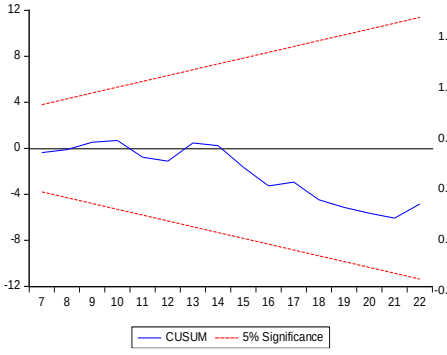
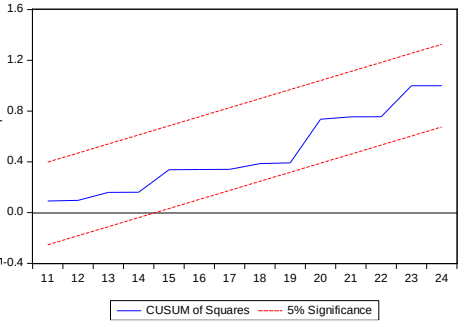


Fig B



To determine if model parameters need to be changed, whether an intervention is having an effect, or whether another fundamental change has occurred in the system under study, investigators and analysts employ CUSUM and CUSUMSQ. The cumulative sum or cumulative sum of squares plots are frequently used to interpret the findings of these experiments. In these graphs, a considerable divergence from a flat or steady line indicates that a structural change may have occurred at that period. More research may be required to comprehend the nature and significance of the identified alteration fully. In conclusion, the reliability tests CUSUM and CUSUMSQ are statistical methods for identifying structural alterations in time series data or regression models. They help monitor procedures and make wise decisions based on changes. The information for each exam is provided individually beneath. As per the findings of Brown *et al.* (1975), each model's values pass the combined total (CUSUM) and the ongoing sum of squares (CUSUMSQ) stability tests, and the predictions have substantial statistical statistics at the five percent (%) level. This is seen in the Figure above.

5. DISCUSSION, CONCLUSION, AND LIMITATION

The concern of this study is to investigate the impact of environmental sustainability, economic growth, and institutional quality on tourism development. The GDP, typically seen as a trustworthy indicator of economic success, impacts travel. When the GDP increases, more money is generally available for vacations and other leisure pursuits. We'll discuss tourism, its possible environmental repercussions, and how tourist numbers and GDP growth are positively correlated. For institutions to promote long-term prosperity and draw tourists, they must be productive. A nation with a strong infrastructure, a reliable government, and open policies may draw more visitors. The link between institutional quality, tourism, and sustainability may be the topic of this debate. Sustainable growth requires a balance between economic, social, and environmental issues. Sustainable development policies may promote tourism by safeguarding natural resources, assuring the welfare of locals, and maintaining cultural heritage. The discussion would center on how encouraging sustainable development may result in a more alluring and robust tourist industry. Tourism employs many people and significantly contributes to the nation's economy. We must make more infrastructure investments in tourism if we hope to draw both local and international visitors.

Readers will have a better understanding of the size of the BRICS economies as a result of this dissertation. The research's conclusions help us better understand how other factors, such as institutional performance, impact visitor attendance despite the limits of the market we analyzed. The objective of the current study is to ascertain the impact of external and internal performance measures on tourism in the BRICS countries. The nonlinear auto-regressive distributive lags (NARDL) are part of the method used to examine macroeconomic data's asymmetric or nonlinear influence on equity returns. The asymmetric viewpoint is investigated to seek any nonlinear relationship between macroeconomic issues and stock returns to prevent losing any connection that is not visible in the typical linear settings. The macroeconomic variables included in the asymmetric testing were selected depending on how frequently they are updated. The CPI inflation rate, industrial output growth rate, exchange rate, total quantity of money in circulation, and oil prices are a few of the statistics covered.

The NARDL bound testing method confirms a nonlinear long-run relationship between the series—the results of the study point to the possibility of asymmetric co-integration. Researchers were able to pinpoint the multiple factors that influence tourists' arrival in the BRICS nations by employing a rigorous and methodical approach. First, the findings confirmed a prior study's conclusion that attendance and visitor spending have no discernible relationship. However, the arrival of visitors can also promote long-term growth. Evidence shows that when electricity usage rises, it gets harder for people to arrive. Furthermore, no relationship existed between a desire to travel and a college degree.

Capable leaders, a lack of corruption, and institutional honesty are traits of high institutional quality. These traits also affect the political and economic stability of a country. Visitors will choose a stable government. The severe problems in BRICS economies, along with efficient governance and information accessibility, must be considered while improving institutional quality. The results imply that the BRICS countries' standing in the eyes of the international community may be enhanced by expanding the use of high-quality institutional performance. The tourism and travel sectors would ultimately gain. Along with a rise in tourism, higher institutional quality will assist in several ways to longer-term political and economic stability. In the context of future research, institutional quality must be studied as moderating variables, and economic uncertainty must also be included

for the generalizability of results. Sectorial comparative analysis also has different advantages when using cross-sectional data.

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