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A symmetric and asymmetric nexus between environmental sustainability and tourism development in BRIC nations: What is the role of good governance and globalization?

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The motivation of the study was to gauge the impact of environmental quality (EQ), good governance (GG), and globalization (GLO) on tourism development in BRIC nations for the period 1990–2021. The study implements linear and nonlinear frameworks for evaluating the elasticity of explanatory variables on tourism and the directional association by using the non-granger causality test. Combined cointegration test statistics show a long-run association between EQ, GG, and GLO and tourism development in BRIC nations. Furthermore, the long-run association in the empirical estimation is established in both linear and nonlinear framework assessments. Referring to linear assessment, the study documents the positive, statistically significant linkage between good governance, globalization, and tourism development, implying that political stability, governmental effectiveness, and accountability foster tourism development. Furthermore, global economic and financial integration opens a window for tourism development by inducing the economy's international tourism. On the other hand, environmental degradation reveals adverse statistically significant influences on tourism development, suggesting that the environmental stability in the form of healthy and amicable ambiance positively triggers tourism development, especially in the long run. According to the test statistics of the standard Wald test, it is obvious that there is an asymmetric association between explanatory variables such as EQ, GG, and GLO and tourism development in the long-run and short-run assessment. The directional causality test documented bidirectional causality in explaining the causality between environmental quality and tourism development in Brazil, India, and China, good governance and tourism development in India, and globalization and tourism development in China. On a policy note, the study advocated that BRIC has to ensure environmental protection and governmental effectiveness to promote sustainable development in the tourism sector.

KEYWORDS

environmental quality, globalization, good governance, tourism, symmetric and asymmetric ARDL, TY-causality

1 Background of the study

Around the world, tourism has seen more rapid expansion worldwide than many other industries (Zappino, 2005). According to the so-called tourist-led growth theory, tourism is one of the primary drivers of global economic development because of its involvement in the creation of employment, the increase in revenues from exports, and the promotion of infrastructure improvements (Dwyer et al., 2004; Belloumi and Alshehry, 2016; Chiu and Yeh, 2017). Over the last decade, international tourism has solidified its position as one of the primary factors of sustainable socioeconomic growth. Compared to the previous year, 2020, 2021 saw a growth in tourism of 4 percent all over the globe (415 million against 400 million). According to UNWTO (2022), the number of foreign tourist arrivals (overnight tourists) in 2019 remained 72 percent lower than the year before the epidemic. This is a direct consequence of the year 2020, which was the worst year for tourism and saw a decrease of 73 percent in the number of foreign travelers. In addition, the predicted economic contribution of tourism in the year 2021 is $1.9 trillion. This figure represents an increase from $1.6 trillion in 2020 but a considerable fall from the value of $3.5 trillion before the pandemic. Foreign tourist export sales might reach over US$700 billion in 2021, a little increase over 2020 owing to a greater spending per trip, but less than half of the US$1.7 trillion achieved in 2019, in terms of the growth of tourism in the BRIC countries.

The impact of tourism development has extensively invested with the trade-off of diverse macro fundamentals such as economic growth (Lee and Chien, 2008; Chou, 2013; Teng et al., 2021), human capital development (Li and Qamruzzaman, 2022a), financial development, inflows of FDI (Yang et al., 2021), energy consumption (Meo et al., 2021), and environmental sustainability (Nguyen and Dinh Su, 2021; Liu et al., 2022; Villanthenkodath et al., 2022). Acknowledging the deniable and significant contribution of tourism development, many researchers have investigated the role of macro fundamentals , particularly the key determinants for tourism development (Chen, 2017; Sokhanvar, 2019; Akadiri et al., 2020; Jena et al., 2021; Meo et al., 2021). The study of Parida et al. (2017), for instance, has investigated the key determinants of tourism development in India with a panel of 25 states for the period 1995–2011. The study documented that economic growth, cultural practices, and natural resources are critical for tourism development. In the case of Laos tourism development, Phakdisoth and Kim (2007) revealed that infrastructural development, communication, economic stability, and trade openness are significant.

The present study has considered globalization, good governance, and environmental quality in tourism development. Because of globalization, people from all over the globe can more easily share their thoughts and ideas on various topics, including politics, the environment, technology, culture, and economics. (Zhao and Li, 2006), moreover, both globalization and tourism are tied to one another. This relationship has, thus, enabled the worldwide transmission of large quantities of knowledge through fostering mutual understanding. Political miscommunication across regions significantly hinders global tourism growth (Wood, 2008; Jena et al., 2021). Diverse countries' citizens are abandoning their ethnic, tribal, religious, and political cocoons to embrace humanity. Many people see the advantages of cooperating rather than antagonizing one another on false difficulties. Tourism and globalization have profited from this trend (Javid and Katircioglu, 2017; Chiu et al., 2021). So far, empirical data on the relationship between environmental quality measured by carbon dioxide emissions and tourism development have been ambiguous. According to Tian et al. (2021), increased tourist development tends to reduce carbon dioxide emissions, proving that tourism is not harmful to the environment and assists in pollution reduction in the G20 countries analyzed. Due to the G20 nations' move away from fossil fuels, the tourism industry, which depends on energy more than any other sector, has started incorporating renewable energy sources. However, Yue et al. (2021) found that tourism does not contribute much to greenhouse gas emissions. Countries are advised to forsake their nonrenewable energy in favor of renewable energy sources, which will help decrease the pace of environmental degradation.

COP26 is occurring at a vital moment, and the tourist sector is seeing an exceptional rebound, making it simpler to adopt operational changes. It is a perfect time for the public and commercial sectors to reset their operations to make them more ecologically sustainable and to improve their communication and relationships since they do not have to cope with high levels of tourist demand. Tourism is more likely to meet its sustainability objectives if these industries collaborate. According to a recent GlobalData poll*, 45 percent of respondents said the environment was the most significant ESG (environmental, social, and governance) aspect. The United Nations is responding to this rising public concern by requiring parties to agree to new environmental objectives at COP26, which include tourism as an established aspect of the plan. There is a chance that COP26 might be a turning moment in the role of sustainability in tourism. During the following decade, more concrete outcomes might be observed as a consequence of more transparent activities taken by numerous private sector businesses.

The motivation of the study was to investigate the impact of environmental sustainability, good governance, and globalization on tourism development in BRIC nations with the application of symmetric and asymmetric frameworks.

The study's contribution is as follows: first, existing literature has produced plenty of evidence focusing on the impact of tourism and globalization on various macro fundamentals such as economic growth, foreign direct investment, human capital development, and environment. However, the nexus

between globalization-led tourism developments has yet to investigate extensively; therefore, the present study has initiated mitigating the existing research gap with fresh knowledge. Second, the present study used linear and nonlinear frameworks to evaluate and document independent variables' elasticities in BRIC tourism development. The implementation of asymmetric assessment has offered alternative policy formulation ways to understand the positive and negative innovation effects on target variables.

The study's objective was to investigate the effects of globalization, good governance, and environmental quality in tourism development in BRIC nations for the period 1990–2021 by using linear and nonlinear frameworks. Combined cointegration test statistics show a long-run association between EQ, GG, and GLO and tourism development in BRIC nations. Furthermore, the long-run association in the empirical estimation is established in both linear and nonlinear framework assessments. Referring to linear assessment, the study documented the positive and statistically significant linkage between good governance and globalization, implying that political stability, governmental effectiveness, and accountability have been revealed as boosting factors for tourism development. Moreover, global economic and financial integration opens a window for tourism development by inducing the economy's international tourism. On the other hand, environmental degradation, which is the carbon emission in the economy, adversely affects tourism development, indicating that the healthy and amicable ambiance positively triggers tourism development in the long run. According to the test statistics of the standard Wald test, it is obvious that there is an asymmetric association between explanatory variables such as EQ, GG, and GLO and tourism development in the long-run and short-run assessment. The directional causality test documented bidirectional causality in explaining the causality between environmental quality and tourism development [EQ←→TOR] in Brazil, India and China, good governance and tourism development [GG←→TOR] in India, and globalization and tourism development [GLO←→TOR] in China.

The remaining structure of the study is as follows. The literature survey of the study is given in Section 2. The variables' definition and methodology of the study are explained in Section 3. Section 4 addresses empirical model estimation and its interpretations. Discussion of the results is given in Section 5. Finally, the conclusion and policy implication are available in Section 6.

2 Literature survey

Global integration in the form of economic and financial perspectives has affected the overall economic activities, including the internationalization of domestic trade, the involvement of foreign participants in economic development, the movement of cross-bordercapital, and political–economic development. As a result of globalization's ability to draw in players from other countries, the financial and economic spheres become more accessible to new ideas and innovations. This is especially true in the tourist industry, which has received much attention for its potential for future growth. Tourism as an increasingly significant activity reflects all of these shifts, particularly mass tourism, which can be seen in many aspects of global change. The development of tourism is illustrative of the tremendous implications of globalization, in particular, when one considers the progress that has been made in information technology, communication, and transportation, amongst other things. As an example of fast expansion and its rising importance on the global market, tourism has a significant effect on other directly or indirectly associated businesses (Hołowiecka et al., 2011; Li and Qamruzzaman, 2022b).

Regarding the tourism-globalization nexus, the present study has revealed two-directional study findings; first, many researchers have investigated the role of tourism effects on globalization (Sugiyarto et al., 2003). Tourism has played an important part in the progress of globalization by allowing travel mobility, such as airports, hotels, and resorts, while governments reduced formal processes to assist the processing of a growing number of visitors (Hannam et al., 2006). Moreover, the proponents of globalization assert that it fosters global economic development, generates employment, makes businesses more competitive, extends consumer options, and reduces production costs. The study by Meethan (2004) asserted that globalization intensifies macroeconomic activities by transferring technical knowledge, expanding the market, promoting innovation, and fostering international understanding.

Second, a group of researchers has investigated the role of globalization on tourism development (Zhao and Li, 2006; Wood, 2008; Knežević, 2015; Javid and Katircioglu, 2017; Chiu et al., 2021; Jena et al., 2021). The study of Chiu et al. (2021), for instance, has investigated the impact of globalization on tourism development with the application of panel dynamic threshold analysis. The study documented that economic global integration boost tourism development; in particular, the level of global integration has revealed the different levels of elasticity on tourism development. As a result of globalization, the tourism and economic sectors have also had a significant impact on marketing efforts, the dissemination of technical know-how, expanded access to transportation and infrastructure, boosted investment motivations, broadening and diversifying the range of tourism products, increasing employment in the industry, and many other aspects of the industry (Mustafa, 2010; Dwyer, 2015). There are many variables to consider regarding the connection between globalization and tourism.

Concerning issues about environmental quality and tourism, researchers have uncovered two distinct lines of inquiry: the

impacts of tourism on environmental quality, as indexed by carbon emissions; and the influence of environmental quality on the expansion of tourists. Referring to first the empirical nexus that is tourism-led environmental quality, a growing number of researchers have established positive and statistically significant associations (Paramati et al., 2017a; Mishra et al., 2020; Sharif et al., 2020). Numerous academics have examined the impact of tourism on carbon emissions on the environment. Tourism is a huge social and economic enterprise (Gössling et al., 2002; Paramati et al., 2017b). According to Katircioğlu 2014), the arrival of foreign tourists in Cyprus significantly impacts energy consumption and carbon emissions. According to Balli et al. (2019), this effect positively impacts CO2 emissions in Mediterranean countries due to tourism. From 1960 to 2014, Uzar and Eyuboglu (2019) showed that tourism increase had a positive long-term and short-term effect on carbon emissions in Turkey. Furthermore, from 1975 to 2012, Sajjad et al. (2014) investigated the relationship between air pollution and tourist growth in South Asia, North Africa, the Middle East, Sub-Saharan Africa, the Pacific regions, and East Asia. According to these studies, tourism expansion could lead to environmental degradation and biodiversity loss (e.g., Mikayilov et al. (2019) for Azerbaijan, Malik et al. (2016) for Austria, Katircioglu et al. (2018) for the major tourist destination countries, Zhang et al. (2019) for China, and Villanthenkodath et al. (2022) for India.

Considering the environmental quality–led tourism development, several researchers have investigated the effects of environmental quality on tourism development and documented a positive association between them. These findings suggest that the quality of the environment prompts tourism development by inducing foreign tourist visitors to the host economy. (Suharyono and Digdowiseiso, 2021). Tourism may theoretically be affected by the sustainability of a country's natural resources, such as its water and forest supplies (Gössling and Hall, 2006; Xia et al., 2022). As a result, governments need to increase their consumption of environmental goods to foster economic growth. When many tourist metrics are used in calculations, the link between environmental quality and tourism becomes more intriguing and complicated. In this context, several studies focus on individual visitors, including travel behavior, travel intention, destination choice (Becken et al., 2017), well-being and quality of life (Agarwal et al., 2021), visitors' satisfaction (Wu et al., 2018; Qamruzzaman, 2022a), and the image of the destination (Zhang et al., 2015; Becken et al., 2017; Deng et al., 2017). Others, on the other hand, concentrate on the demand for global tourists, including tourist arrivals, the number of visitors, international tourism revenues, urban activities, and the demand for outgoing tourists (Yan et al., 2020; Li and Qamruzzaman, 2022b). This study will concentrate on global tourist demand, particularly, in terms of the number of arriving visitors and their duration of stay.

Institutional, political–economic stability, and governmental effectiveness have documented key determinants for tourism development which can be observed through the direct, indirect, and dynamic channels. Through the active engagement of financial intermediation, capital creation, and foreign contribution to the construction of infrastructure, amongst other things, good governance guarantees that economic growth is carried out in an equal manner. (Law and Azman-Saini, 2012; AlBassam, 2013; Fayissa and Nsiah, 2013; Khalid and Shafiullah, 2021; Akadiri et al., 2022; Qamruzzaman, 2022a). The dynamic effects of good governance on tourism development can be explained by the lower level of investment causing a downward trend in aggregated economic progress and, eventually, a lower level of income generation. According to Olatunji and Falabi (2014), ineffective governance increases the higher degree of corruption, tarnishing the economic image in the international arena. The final results appear with a lower level of long-run foreign investment. In another study, Das and Dirienzo (2010) established that corruption hinders a nation's ability to compete in the tourism industry in two key ways: it tarnishes the national image and has a detrimental influence on the kind of business environment that is crucial to the success of the tourism industry.

As a determinant of environmental sustainability, Kirikkaleli and Adebayo (2021) documented the role of renewable energy consumption and financial development in environmental protection. In another study, Shan et al. (2021) suggested strengthening fiscal decentralization, lowering non-renewable energy prices, and improving institutional quality to check the deteriorating environmental quality in the study sample and other regions worldwide.

With the consideration of existing literature, we have noticed the following limitations. First, referring to the existing literature, it is manifested that researchers have investigated the nexus of tourism-led environmental sustainability, but the impact of environmental quality and tourism development has been ignored. The present study has focused on addressing the role of a quality environment in the tourism development process in BRIC nations. Second, existing literature postulates that empirical studies have been initiated focusing on environmental sustainability, good governance, and globalization under the symmetric environment. At the same time, the present study focused on both symmetric and asymmetric frameworks in exploring the variable's elasticities on tourism development.

3 Theoretical framework and model specification

Per capita income and relative pricing, according to Naudé and Saayman (2005) and Lv and Xu (2017) are two variables that influence tourist demand. According to classical theory, demand is influenced by relative price and income. Individual income positively correlates with tourist demand, whereas relative prices

TABLE 1 Proxy measures of research variables.

Variable	Notation	Proxy	Reference	Source
Tourism development	TOR	International tourism, receipts (current US$)	Osinubi et al. (2021)	
Good governance	GG	Government effectiveness	Qamruzzaman (2021); Yang et al. (2021); ALI et al. (2022); Qamruzzaman (2022b)	WGI
Globalization	GLO	Globalization index	Kearney and Policy (2006); Ahmed and Le. (2020); Aluko et al. (2021)	KOF Index
Environmental quality	EQ	Co2 emission per capital	Adebayo (2022); Adebayo et al. (2022)	WDI
Financial development	FD	Financial development index		IMF
Foreign direct investment	FDI	FDI inflows as a % of GDP		WDI

(as measured by the overall price level) negatively correlate with tourist demand. Tourist demand is estimated using the log of tourism revenues (Alola et al., 2019; Awosusi et al., 2022), relative prices are approximated using inflation, and individual income is represented by GDP per capita. The relationship is explained in Eq. 1.

$$\text{TOR}|\text{GDP, INF} \tag{1}$$

To account for the effects of other interesting variables, the study re-specifies Eq. 1 into Eq. 2 with the inclusion of good governance, globalization, and environmental quality. The motivation of the study was to explore the impact of good governance, globalization, and environmental quality on tourism development in BRIC for the period 1990–2021. For empirical assessment, the generalized relations can be exhibited as follows.

$$\text{TOR}|\text{GG, UR, EQ,} \tag{2}$$

where TOR stands for tourism development, GG exhibits good governance, UR explains urbanization, and EQ stands for environmental quality. Apart from the target variables, the study considered a list of control variables, that is, economic growth (Y), financial development (FD), and financial openness (FDI). Eq. 1 can be reproduced with the inclusion of control variables in the following manner.

$$\text{TOR}|\text{GG, GLO, EQY, FD, FD.I.} \tag{3}$$

The variables are transformed with a natural log before target model estimation (Andriamahery and Qamruzzaman, 2022; Xia et al., 2022). After transformation, the baseline target model can be rewritten in the following ways.

$$TOR_t = \mu_1 + \beta_1 GG_i + \beta_2 GLO_i + \beta_3 EQ_i + \beta_4 Y + \beta_5 FD_i + \beta_6 FDI_i + \epsilon_i \tag{4}$$

The long-run coefficients can be addressed by the value of $\beta_1 to \beta_6$. The value of μ_1 explains the constant term in the equation. The measurement of each variable is displayed in Table 1.

3.1 Estimation strategy

3.1.1 Unit root test

An appropriate econometric technique section is appropriately guided by the research variable selection and their inherent properties; thus, the application of the stationary test has become one of the pre-assessment in the literature. We have considered several unit root tests following the ADF test offered by Dickey and Fuller (1979), the P–P test familiarized by Phillips and Perron (1988), the GF-DLS test following Elliott et al. (1996), and the KPSS test introduced by Kwiatkowski et al. (1992a). The Ng–Perron unit root test was performed in this study (Ng and Perron, 2001). The results of the unit root test are displayed in error! Reference source not found.

3.1.2 Bayer–Hanck combined cointegration test

The study implemented the cointegration test by following the framework proposed by Bayer and Hanck (2013), commonly known as the combined cointegration test. The proposed cointegration test consists of four conventional tests of cointegration familiarized by Banerjee et al. (1998), Peter Boswijk (1994), Johansen (1991), and Engle and Granger (1987a) with the null hypothesis of a no-cointegration test, the following Fishers' equation is considered in deriving the test statistics for detecting long-run association.

$$EG - JOH = -2[LN(PEG) + LN(PJOH)], \tag{5}$$

$$EG - JOH - BO - BD = -2[LN(PEG) - \ln(PJPH) + \ln(PBO) + \ln(PBDM)], \tag{6}$$

where PBDM, PBO, PJOH, and PEG stand for the significance levels of Banerjee et al. (1998), Boswijk (1995), Johansen (1991), and Engle and Granger (1987) respectively.

TABLE 2 Null hypotheses for all three tests are defined as follows.

Co-integration test	Null hypothesis	Alternative hypothesis
F-bound test	$\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$	Any, $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6 \neq 0$
T-test on lagged dependent variable	$\gamma_1 = 0$	$\gamma_1 \neq 0$
F-test on the lagged independent variable	$\gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$	Any, $\gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6 \neq 0$

3.1.3 Autoregressive distributed lagged

The long-run association in the empirical literature has been implemented with several conventional cointegration tests such as Engle and Granger (1987b), Johansen (1998), and Johansen-JuseliusJuselius (1990); the proposed cointegration test demands research variables' unique order of integration, suggesting that the mixed order of integration that is I (0) or I (1) is not applicable. The prevailing limitation in conventional cointegration tests, in the process of mitigating the problem, Pesaran et al. (2001a) have familiarized the cointegration test with mixed order of variable integration which is commonly known as autoregressive distributed lagged (ARDL). Since then, the ARDL approach has been extensively used in investigating long-run associations in empirical studies (Qamruzzaman and Jianguo, 2018; Qamruzzaman and Karim, 2020a; Qamruzzaman and Karim, 2020b; Qamruzzaman et al., 2020). ARDL estimation possesses certain benefits over traditional cointegration tests, including 1) efficient estimation regardless of the study's sample size (Ghatak and Siddiki, 2001; Rehman et al., 2021; Li and Qamruzzaman, 2022a; Qamruzzaman, 2022b; Xia et al., 2022), 2) capability of handling mixed-order variable integration, and model stability and efficiency can be obtained by selecting appropriate lagged specifications (Pesaran et al., 2001a; Faruqui et al., 2015; Ferdousi and QamruzzamanExport, 2017; Ahmad et al., 2022), and 3) unbiased estimation for both long-run and short-run elasticity (Banerjee et al., 1993).

Following Pesaran et al. (2001a), the generalized ADRL model for the study was considered for detecting both long-run and short-run coefficients by performing the following equation.

$$\begin{aligned}\Delta lnTOR_t = {} & \alpha_0 + \sum_{i=1}^{n}\mu_1 \Delta lnTOR_{t-i} + \sum_{i=0}^{n}\mu_2 \Delta lnGLO_{t-i} \\ & + \sum_{i=0}^{n}\mu_3 \Delta\, lnGG_{t-i} + \sum_{i=0}^{n}\mu_4 \Delta\, ln\, EQ_t \quad + \sum_{i=0}^{n}\mu_5 \Delta\, lnFD_{t-i} \\ & + \sum_{i=0}^{n}\mu_6 \Delta\, lnFDI_{t-i} + \gamma_1 lnTOR_{t-i} + \gamma_2 lnGLO_{t-1} \\ & + \gamma_3 lnGG_{t-1} + \gamma_4\, lnEQ_{t-1} + \gamma_5 lnFD_{t-1} + \gamma_6 lnFDI_{t-1} \\ & + \omega_{1t} \end{aligned} \quad (7)$$

where Δ indicates differencing of variables, while is the error term (white noise), and (t-1) is for the lagged period, and is the long-run coefficient. Based on linear ARDL 11, the long-run coefficient to be available from γ_1 to γ_6 and short-run coefficients to be obtained from $\mu_1$to μ_6 from each empirical model estimation. Long-run association between variables to be tested following the F-test (Pesaran et al., 2001a) and the *t*-test on the lagged level of the dependent variable as suggested by and another additional F-test on the lagged levels of the independent variable(s) as suggested by McNown et al. (2018).

In the ARDL, according to Pesaran et al. (2001b), (Pesaran et al. (1999), the bound testing approach is F-statistics which is established to determine the combined significance of the coefficients on the level. For the lagged dependent variables, the second test is a *t*-test. Under the null hypothesis, the statistics exhibit a nonstandard distribution because no level connection exists regardless of whether the regressors are I (0) or I. (1). However, reporting the F-test statistic for the overall test and the *t*-test statistic for a delayed dependent variable was inadequate for the ARDL test. To avoid the degenerate case, McNown et al. (2018) suggested a second *t*-test or F-test on the lagged independent variables in addition to the ARDL test used by Pesaran et al. (2001a). The use of all three criteria was required to differentiate between cointegration and degenerate instances.

Pesaran et al. (2001a) and Sam et al. (2019) presented two sets of asymptotic critical values, one for I (1) regressors and another for I (0) regressors. If the F-test statistic's value was less than the lower bound critical value or the *t*-test statistic's absolute value was less than the absolute lower bound critical value, the null hypothesis of "no long-run connection" could not be rejected. This indicated that there was no long-run connection between the variables. By contrast, if the F-test statistic's value exceeded the upper limit critical value or the *t*-test statistic's absolute value exceeded the upper bound critical value, the null hypothesis may be rejected (Meng et al., 2021; Miao and Qamruzzaman, 2021; Zhang et al., 2021). This indicated the existence of long-run connections between the variables. Finally, if the test statistic's value was neither less than nor higher than the two critical values, indicating that the value lay between the two critical values,

TABLE 3 Unit root test.

	At level				After first difference			
	ADF	GF-DLS	PP	KPSS	ADF	GF-DLS	PP	KPSS
For Brazil								
TOR	−2.29	−2.2614	−1.8734	0.5903***	−9.4329***	−6.1187***	−5.2914***	0.0189
GG	−2.0262	−2.0949	−1.3679	0.6776***	−5.2991***	−9.0623***	−7.247***	0.0209
EQ	−0.7966	−0.9151	−0.4382	0.9026***	−6.6663***	−6.8835***	−7.4367***	0.0189
UR	−2.3599	−0.3252	−2.1706	0.7873***	−8.9086***	−5.7118***	−9.4576***	0.0192
FD	−2.3815	−0.2782	−1.142	0.6756***	−6.6163***	−6.2132***	−7.4502***	0.021
FDI	−1.5889	−2.2768	−0.6346	0.67***	−9.5224***	−8.2706***	−5.7601***	0.0196
For Russia								
TOR	−2.2702	−2.4654	−2.456	0.6807***	−7.7372***	−5.5478***	−9.3409***	0.0206
GG	−0.6436	−1.788	−1.7278	0.702***	−6.2066***	−8.856***	−9.1647***	0.0202
EQ	−2.2853	−2.0228	−0.9555	0.8901***	−8.5751***	−9.5383***	−9.2377***	0.019
UR	−1.5063	−1.378	−0.5517	0.7243***	−9.0376***	−8.1289***	−6.2837***	0.0213
FD	−2.3633	−2.4123	−2.5343	0.6246***	−5.9506***	−8.1115***	−5.4072***	0.0193
FDI	−0.8264	−0.3602	−2.4633	0.7079***	−6.4588***	−6.0314***	−9.0069***	0.0195
For India								
TOR	−1.2015	−1.8505	−1.584	0.9283***	−9.1003***	−7.1956***	−5.5958***	0.0189
GG	−1.3475	−1.1506	−2.4761	0.931***	−5.911***	−9.1125***	−9.4654***	0.0191
EQ	−0.6678	−1.6429	−1.2221	0.8725***	−7.6846***	−9.0465***	−7.495***	0.0209
UR	−1.7759	−1.4134	−0.2873	0.5968***	−6.4197***	−5.7157***	−9.5703***	0.0204
FD	−1.0198	−2.4177	−1.237	0.634***	−7.7372***	−7.4705***	−8.6441***	0.0196
FDI	−1.4756	−1.7166	−0.8546	0.8489***	−5.7846***	−6.7779***	−8.2887***	0.0191
For China								
TOR	−1.7863	−0.5675	−2.4948	0.6686***	−7.7155***	−9.0693***	−8.0102***	0.0216
GG	−0.7506	−0.3815	−0.64	0.7074***	−7.9964***	−8.1678***	−8.6933***	0.021
EQ	−1.1701	−1.6725	−2.2512	0.751***	−6.822***	−8.5282***	−7.4636***	0.0197
UR	−1.5645	−1.0466	−2.0859	0.6649***	−8.0318***	−6.6971***	−7.2047***	0.0204
FD	−0.7907	−2.3475	−1.4991	0.7962***	−9.0298***	−8.7549***	−8.4969***	0.0206
FDI	−1.2339	−0.4035	−1.3597	0.7699***	−7.8858***	−8.1102***	−9.3555***	0.0212

Note: the superscript ***/**/* explain the significant level at a 1%, 5% and 10% respectively.

the conclusion about the long-run associations between the variables was ambiguous (Qamruzzaman and Ferdaous, 2014; Qamruzzaman, 2015; Qamruzzaman and Ferdaous, 2015; Qamruzzaman and Jianguo, 2017). For hypothesis see Table 2.

The study implemented the following equation with error correction terms to capture the short-run dynamics.

$$\Delta lnTOR_t = \alpha_2 + \sum_{i=1}^{n}\beta_1\Delta lnTOR_{t-i} + \sum_{i=0}^{n}\beta_2\Delta lnGLO_{t-i} + \sum_{i=0}^{n}\beta_3\Delta lnGG + \sum_{i=0}^{n}\beta_6\Delta \ln EQ_t + \sum_{i=0}^{n}\beta_7\Delta lnFD_{t-i} + \sum_{i=0}^{n}\beta_7\Delta lnFDI_{t-i} + \rho ECT_{t-1} + \omega_{1t}. \quad (8)$$

We used a variety of diagnostic tests. First, we used the Harvey test to see whether the residuals of the enhanced ARDL model were heteroscedastic. Second, we used the Breusch–Godfrey serial correlation LM test to see whether the residuals were serially correlated. Third, we utilized the Ramsey RESET test as a model specification test. Fourth, we used the Jarque–Bera normality test to determine the normality of the model residuals. Finally, we checked for model stability using the cumulative sum (CUSUM) and CUSUM of square tests.

3.1.4 Nonlinear autoregressive distributed lagged

The study considered a nonlinear framework following Shin et al. (2014) empirical assessment for detecting the asymmetric impact of economic policy uncertainty and financial inclusion on remittances. For gauging the asymmetric effects of environmental quality (EQ), good governance (GG), and globalization (GLO) on tourism development (TOR), the following generalized equation is to be implemented:

$$TOR_t = \left(\pi^+ EQ^+_{1,t} + \pi^- EQ^-_{1,t}\right) + \left(\beta^+ GG^+_{1,t} + \beta^- GG^-_{1,t}\right) + \left(\gamma^+ GLO^+_{1,t} + \gamma^- GLO^-_{1,t}\right) + \delta_i X_t + \varepsilon_t, \quad (9)$$

where $\pi^+, \pi^-, \beta^+, \beta^-, and\, \gamma^+, \gamma^-$ stand for the long-run asymmetric coefficient of environmental quality, good governance, and globalization. The asymmetric shock of independent variables can be derived in the following manner.

$$\begin{cases} POS(EQ)_{1,t} = \sum_{k=1}^{t} lnEQ_k^+ = \sum_{K=1}^{T} MAX(\Delta lnEQ_k, 0) & POS(GG)_{1,t} = \sum_{k=1}^{t} lnGG_k^+ = \sum_{K=1}^{T} MAX(\Delta lnGG_k, 0) \\ NEG(EQ)_t = \sum_{k=1}^{t} lnEQ_k^- = \sum_{K=1}^{T} MIN(\Delta lnEQ_k, 0) & NEG(GG)_t = \sum_{k=1}^{t} lnGG_k^- = \sum_{K=1}^{T} MIN(\Delta lnGG_k, 0) \end{cases},$$

$$POS(GLO)_{1,t} = \sum_{k=1}^{t} lnGLO_k^+ = \sum_{K=1}^{T} MAX(\Delta lnGLO_k, 0),$$

$$NEG(GLO)_t = \sum_{k=1}^{t} lnGLO_k^- = \sum_{K=1}^{T} MIN(\Delta lnGLO_k, 0).$$

Now, Eq. 9, transformed into asymmetric long-run and short-run coefficient assessment as follows:

$$\begin{aligned} \Delta TOR_t = {} & \partial U_{t-1} + \left(\pi^+ EQ^+_{1,t-1} + \pi^- EQ^-_{1,t-1}\right) + \left(\beta^+ GG^+_{1,t-1} + \beta^- GG^-_{1,t-1}\right) + \left(\gamma^+ GLO^+_{1,t-1} + \gamma^- GLO^-_{1,t-1}\right) + \delta X^*_{1,t-1} \\ & + \sum_{j=1}^{m-1} \lambda_j \Delta TOR_{t-j_0} + \sum_{j=1}^{n-1} \left(\pi^+ \Delta EQ^+_{1,t-1} + \pi^- \Delta EQ^-_{1,t-1}\right) \\ & + \sum_{j=1}^{n-1} \left(\mu^+ \Delta GG^+_{1,t-1} + \mu^- \Delta GG^-_{1,t-1}\right) \\ & ++ \sum_{j=0}^{m-1} \left(\beta^+ \Delta GLO^+_{1,t-1} + \beta^- \Delta GLO^-_{1,t-1}\right) + \sum_{j=0}^{m-1} \mu \Delta X^*_{1,t-1} \\ & + \varepsilon_t. \end{aligned} \quad (10)$$

A standard Wald test with a null symmetry hypothesis is implemented to detect long-run and short-run asymmetry. Only the insignificant test statistics will confirm the asymmetric association in the long and short runs. Furthermore, the asymmetric long-run cointegration to be assessed by following F-bound testing, joint primality test, and tBDM test, the higher test statistics relative to the critical value will confirm asymmetric cointegration in the empirical model.

4 Model estimation and interpretation

Empirical estimation with time series data needed to be confirmed with an elementary assessment of the order of integration assessed by implementing the stationary test. Following the existing literature, the study has performed unit root tests by following the ADF test (Dickey and Fuller, 1979), GF-DLS test (Elliott et al., 1996), PP test (Phillips and Perron, 1988), and KPSS test (Kwiatkowski et al., 1992b). The results of the unit root test are displayed in Table 3. Referring to the test statistics, it is apparent that all the variables are stationary after the first difference, and none of the variables are exposed to stationary after second-order differentiation, which is desirable for robust econometric assessment.

4.1 Bayer–Hanck cointegration test

Nest's study has implemented the newly offered cointegration test, widely known as the combined cointegration test, introduced by Bayer and Hanck (2013). Table 4 shows the long-run association test results with all five possible models. Compared to the test statistics and critical value at a 5% significance level, it is revealed that the rejection of the null hypothesis is no cointegration. The conclusion has been supported by both test statistics derived from EG-JOH and EG-JOH-BO-BDM. Once the long-run association has been established, we move to assess the elasticity of globalization, good governance, and environmental quality on tourism development in BIRC nations through linear and nonlinear assessments in the following section.

4.2 Empirical model estimation with autoregressive distributed lagged

The result of long-run cointegration with the ARDL framework is displayed in Table 5. Taking into account the test statistics of $F_{overall,}$ $t_{DV,\ and}$ F_{IDV}, it is manifested that the null hypothesis of no-cointegration has been rejected; alternatively, the long-run association between tourism development, environmental quality, globalization, good

TABLE 4 Results of combined cointegration test.

EG-JOH	Brazil	Russia	India	China	CV
TOR|EQ	13.923	14.156	13.548	13.046	**11.229**
TOR|EQ, GG	11.175	11.068	11.099	11.06	**10.895**
TOR|EQ, GG, and GLO	10.759	10.837	11.165	11.355	**10.637**
TOR|EQ, GG, GLO, and FDI	10.954	10.894	10.896	10.865	**10.576**
TOR|EQ, GG, GLO, FDI, and FD	10.625	10.543	10.543	10.672	**10.419**
EG-JOH-BO-BDM					
TOR|EQ	32.386	30.676	29.158	32.461	21.931
TOR|EQ, GG	26.665	23.429	27.026	24.167	21.106
TOR|EQ, GG, and GLO	21.991	22.598	22.127	23.314	20.486
TOR|EQ, GG, GLO, and FDI	21.087	21.016	20.879	21.883	20.143
TOR|EQ, GG, GLO, FDI, and FD	20.895	20.882	20.846	20.883	19.888

TABLE 5 Results of long-run cointegration.

		Brazil	Russia	India	China	
Tor| *GLO, GG, EQ, FD, FDI*	$F_{overall}$	11.095***	9.939***	15.254***	9.737***	
	t_{DV}	−5.391***	−6.931***	−6.817***	−6.254***	
	F_{IDV}	10.408***	10.058***	8.847***	6.313***	
Critical value: K = 5	1%		5%		10%	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
Pesaran, Shin and Smith (Banerjee et al., 1998)	5.095	6.77	3.673	5.002	3.087	4.277
Narayan (Ahmad et al., 2022)	−3.96	−5.13	−3.41	−4.52	−3.13	−4.21
Sam, McNown and Goh (Qamruzzaman and Karim, 2020b)	3.58	5.91	2.46	4.18	2	3.47

Note: the superscript ***/**/* explain the significant level at a 1%, 5% and 10% respectively.

governance, foreign direct investment, and financial development has been established. The conclusion of the long-run association is valid for all four sample countries. Now we are moving to gauge the elasticity both in the long-run and short-run.

The results of long-run and short-run coefficients are displayed in Table 6, where panel–A deals with long-run coefficients and panel–B deals with short-run coefficients and the residual diagnostic test is displayed in panel–C.

Referring to long-run assessment, the study documented the negative and statistically significant association between environmental quality and tourism development in Brazil (a coefficient of −0.1298), Russia (a coefficient of −0.1749), India (a coefficient of −0.1837), and China (a coefficient of −0.1447). The study findings suggest that environmental disequilibrium has created adversity in tourism development. More precisely, a 10% additional carbon emission in the environment can adversely cause the present trend in tourism development by 1.298% in Brazil, 1.749% in Russia, 1.837% in India, and 1.447% in China, respectively. Our study findings align with existing literature (Jermsittiparsert, 2019). In the case of short-run assessment, the study confirmed the adverse connection between environmental quality and tourism development in Brazil (a coefficient of −0.0603), Russia (a coefficient of −0.0593), India (a coefficient of −0.068), and China (a coefficient of −0.0516).

In the case of globalization, the study documented a positive and statistically significant linkage to tourism development in the selected BRIC nations. In particular, a 10% improvement in economic and financial global integration can intensify tourism development by 1.585% in Brazil, 1.651% in Russia, 0.325% in India, and 0.558% in China, respectively. The study findings postulate that economic internationalization has emerged as a boost to tourism industry development. In the short run, globalization's impact has been positive but statistically significant in all nations except Brazil (a coefficient of 00517). The study documented that good governance plays a critical role in tourism development, indicating the positive and statistically significant tie between them in BRIC nations. Specifically, a 1% development in governmental effectiveness increases tourism development in Brazil by 0.0624%, in Russia by 1.931%, in India by 1.495%, and by 1.833% in China, respectively.

TABLE 6 Long-run and short-run coefficients: ARDL estimation.

	Brazil	Russia	India	China
Panel–A: long-run coefficient				
EQ	−0.1298 (0.0268) [−4.8448]	−0.1749 (0.0407)[−4.2879]	−0.1837 (0.0798) [−2.3024]	−0.1447 (0.081) [−1.7853]
GLO	0.1585 (0.0324) [4.8837]	0.1651 (0.0473) [3.489]	0.0325 (0.0097) [3.3468]	0.0558 (0.0161) [3.4633]
GG	0.0624 (0.0085) [7.3449]	0.1931 (0.0182) [10.592]	0.1495 (0.0178) [8.3992]	0.1833 (0.0996) [1.8403]
FDI	0.1602 (0.0204) [7.8301]	0.121 (0.0269) [4.4933]	0.1042 (0.0481) [2.1657]	0.0959 (0.0182) [5.2598]
FD	−0.3257 (0.04) [−8.1289]	0.0941 (0.0153) [6.1304]	0.0859 (0.0511) [1.6808]	0.1796 (0.0581) [3.0877]
C	25.554 (0.6161) [41.4709]	7.7075 (0.4512) [17.0822]	−2.3454 (0.533) [−4.4002]	39.0718 (7.9084) [4.9405]
Panel–C: short-run coefficients				
ΔEQ	−0.0603 (0.0331) [−1.8212]	−0.0593 (0.0331)[−1.8212]	−0.068 (0.0326) [2.0877]	−0.0516 (0.0914) [−0.5646]
ΔGLO	0.0517 (0.0049) [10.4342]	0.0521 (0.0495) [1.0434]	0.0245 (0.0439) [0.0557]	0.0183 (0.0468) [0.3923]
ΔGG	0.0139 (0.0026) [5.2226]	0.0179 (0.0066) [2.0859]	0.0787 (0.0498) [1.5799]	0.0436 (0.0159) [2.7273]
ΔFDI	−0.0292 (0.0014) [−12.3453]	−0.0252 (0.0104) [−2.796]	0.0745 (0.0586) [1.2699]	0.0377 (0.0356) [1.0572]
ΔFD	0.1031 (0.0154) [6.6892]	0.0316 (0.0154) [2.054]	0.0137 (0.0172) [0.7976]	0.0039 (0.0045) [0.863]
C	−0.5891 (0.082) [−7.1789]	0.0919 (0.0207) [4.4372]	−0.3125 (0.0255) [−12.2469]	−0.0175 (0.0079) [−2.2044]
Panel–C: residual diagnostic test				
x^2_{Auto}	0.581	0.776	0.867	0.718
x^2_{Het}	0.676	0.779	0.638	0.748
x^2_{Nor}	0.688	0.718	0.574	0.667
x^2_{RESET}	0.562	0.844	0.599	0.816

Referring to control variables' impact on tourism development in the long-run (short-run); according to coefficients, it is apparent that foreign direct investment has a positive (negative) association with tourism development. In the case of financial development, the study established a positive (positive) tie to tourism development in BRIC nations. The study has performed several residual diagnostic tests to confirm the model's efficiency and consistency (as shown in panel–C). Referring to test statistics from a diagnostic test, and the model is free from serial correlation, residuals are normally distributed, have no heteroskadacity, and are internally consistent in estimation. Furthermore, the CUSUM test and CUSUM of the square test reveal the model construction stability.

The next study extended the elasticity assessment with the implementation of asymmetric ARDL, including the asymmetric shocks of good governance, environmental quality, and globalization. The results of the nonlinear assessment are displayed in Table 7, which include asymmetric cointegration results in panel–A, the long-run coefficients in panel–B, the short-run coefficient in panel–C, and the residual diagnostic results in panel–D, respectively.

Long-run cointegration with the asymmetric framework, according to the test statistics derived from $F_{overall}$, t_{DV}, and $F_{IDV,}$ has confirmed the rejection of the null hypothesis, implying the long-run cointegration in the empirical association. Once the long-run asymmetric cointegration has revealed, the study moves in evaluating the asymmetric effects of globalization, good governance, and environmental quality on tourism development.

Referring to asymmetric long-run coefficients; as shown in panel–B in Table 7. Environmental quality measured by carbon emission has revealed a negative and statistically significant linkage to tourism development in BRIC nations. More precisely, environmental degradation, which is a 10% augmentation of carbon emission in the environment, results in adverse effects on the present state of tourism development in Brazil by 1.658%, Russia by 1.258%, India by 1.886%, and China by 1.544%. However, a 10% environmental development through carbon reduction, according to coefficient, it is unveiled that environmental quality improvement will result in tourism development in Brazil by 0.551%, Russia by 0.851%, India by 0.769%, and China by 0.731%. In the short-run, the positive shock in environmental quality was negative and statistically significant, indicating that environmental degradation discourages international tourists from visiting an economy

TABLE 7 Results of nonlinear ARDL assessment.

	Brazil	Russia	India	China
Panel–A: asymmetric long-run cointegration				
$F_{overall}$	14.144***	10.949***	9.123***	12.399***
t_{DV}	−7.112***	−6.484***	−5.387***	−6.647***
F_{IDV}	7.94***	9.065***	6.795***	8.265***
Panel–A: long-run coefficient				
EQ_POS	−0.1658 (0.0891) [−1.8599]	−0.1258 (0.0891) [−1.8599]	−0.1886 (0.0384) [−4.9075]	−0.1544 (0.0383) [−4.0264]
EQ_NEG	−0.0551 (0.0265) [−2.0728]	−0.0851 (0.0265) [−2.0728]	−0.0769 (0.0467) [−1.6468]	−0.0731 (0.0016) [−45.6901]
GG_POS	0.0716 (0.0175) [4.0892]	0.1716 (0.0751) [2.2837]	0.0831 (0.0406) [2.0454]	0.0989 (0.0272) [3.6292]
GG_NEG	0.0651 (0.0293) [2.2157]	0.1651 (0.0893) [1.8471]	0.0527 (0.0197) [2.6721]	0.1265 (0.0559) [2.2624]
GLO_POS	0.2253 (0.0787) [2.8605]	0.1253 (0.0487) [2.8605]	0.1885 (0.0414) [4.5506]	0.0333 (0.0141) [2.3583]
GLO_NEG	0.0923 (0.0427) [2.1615]	0.0999 (0.0427) [2.3401]	0.1178 (0.0812) [1.451]	0.0468 (0.0265) [1.7651]
FD	0.2247 (0.0206) [10.8637]	0.0824 (0.0206) [3.9871]	0.0929 (0.0253) [3.6632]	0.0616 (0.0357) [1.725]
FDI	0.1072 (0.05) [2.1434]	0.1072 (0.05) [2.1434]	0.079 (0.0329) [2.4005]	0.1415 (0.0514) [2.7526]
C	15.2656 (0.321) [47.5561]	15.2656 (0.321) [47.5561]	−8.5077 (0.3804) [−22.3634]	8.6203 (0.857) [10.0583]
Panel–C: short-run effects				
EQ_POS	−0.0497 (0.0076) [−6.4727]	−0.0436 (0.0134) [−3.2384]	−0.0999 (0.033) [−3.0195]	−0.064 (0.0465) [−1.3775]
EQ_NEG	−0.0301 (0.6743) [−0.0446]	−0.1026 (0.0751) [−1.3647]	−0.0332 (0.0194) [−1.7065]	−0.0335 (0.0518) [−0.6465]
GG_POS	0.0417 (0.0075) [5.5013]	0.0497 (0.0479) [1.0375]	0.0395 (0.0421) [0.9371]	−0.0883 (0.0443) [−0.5488]
GG_NEG	0.0042 (0.0012) [3.4653]	0.0343 (0.0051) [6.7257]	0.074 (0.0296) [2.4996]	0.0309 (0.0742) [0.417]
UR_POS	−0.04 (0.0196) [−2.0406]	0.0497 (0.0168) [2.9584]	−0.0195 (0.0013) [−14.3438]	0.0597 (0.0225) [2.6491]
UR_NEG	0.0436 (0.0034) [12.5882]	0.043 (0.0074) [5.7832]	0.0992 (0.0045) [21.9186]	0.0902 (0.0277) [3.2551]
FD	−0.026 (0.0027) [−9.452]	0.0744 (0.0275) [2.7001]	0.0436 (0.0346) [1.2588]	0.0131 (0.006) [2.1827]
FDI	0.1072 (0.0479) [2.2382]	−0.0206 (0.0634) [−0.3261]	−0.026 (0.0075) [−3.4597]	0.0772 (0.004) [19.1718]
ect.	−0.343 (0.0605) [−5.6686]	−0.4105 (0.0449) [−9.1315]	−0.1497 (0.0479) [−3.1247]	−0.323 (0.0187) [−17.2552]
Panel–D: Wald and residual diagnostic test				
W_{LR}^{EQ}	5.114	9.534	5.131	8.068
W_{LR}^{GG}	5.203	13.259	11.842	13.545
W_{LR}^{GLO}	3.678	11.178	5.916	10.061
W_{ER}^{EQ}	11.136	12.929	3.898	13.501
W_{ER}^{GG}	8.166	13.427	8.768	8.091
W_{SR}^{GLO}	5.934	11.546	3.146	12.818
x_{Auto}^2	0.833	0.621	0.644	0.613
x_{Het}^2	0.622	0.743	0.488	0.824
x_{Nor}^2	0.829	0.711	0.812	0.755
x_{RESET}^2	0.606	0.506	0.867	0.579

Note: the superscript ***/**/* explain the significant level at a 1%, 5% and 10% respectively.

with a higher carbon concentration. The study postulated that environmental quality has acted as an incubator role in tourism development, suggesting environmental hazard and ecological imbalance have created negative propaganda and discouraged international visitors, which eventually causes an adverse influence on tourism development.

TABLE 8 Toda–Yamamoto causality test (k = 3).

	TOR	GG	EQ	GLO	FDI	FD	Causality
Panel–A: for Brazil							
TOR	—	2.896	10.778***	3.172	7.944*	9.031**	TOR→GG; EQ←→TOR; TOR→GLO; FDI←→TOR; FD←→TOR; GG→EQ; GLO→GG; GG→FDI] GG→FD; GLO←→EQ; FDI→EQ; FD→EQ; FDI←→GLO; FD←→GLO; FD←→FDI
GG	5.263*	—	4.028	6.183*	3.784	5.666	
EQ	10.276***	11.458***	—	11.747***	10.913***	6.135*	
GLO	7.988*	4.306	10.117***	—	11.572***	9.738**	
FDI	7.248*	7.467*	4.085	8.882**	—	7.477*	
FD	6.201*	8.974**	4.383	7.169*	12.718***	—	
Panel–B: for Russia							
TOR	—	6.643*	7.745*	4.387	10.399***	3.918	GG→TOR; EQ→TOR; FDI←→TOR; FD→TOR; GG→EQ; GG←→GLO; GG←→FD; GLO→EQ; FDI←→EQ; FD→EQ; GLO→FDI; FDI←→GLO
GG	5.871	—	4.524	8.235**	2.992	6.085*	
EQ	2.913	9.935**	—	8.607**	9.326**	5.312	
GLO	9.085**	11.898***	5.115	—	5.571	11.691***	
FDI	6.211*	4.19	10.72***	6.918*	—	5.702	
FD	12.218***	9.564**	10.157***	9.25**	4.805	—	
Panel–C: for India							
TOR	—	11.895***	6.662*	2.699	7.09*	13.062***	GG→TOR; TOR←→EQ; TOR→GLO; FDI←→TOR; FD←→TOR; GG→EQ; GLO←→GG; FDI←→GG; FD←→GG; GLO←→EQ; FD→EQ; GLO→FDI; FD→GLO; FDI←→FD
GG	3.075	—	4.474	9.059**	9.713**	9.757**	
EQ	9.178**	12.84***	—	8.136**	3.229	6.27*	
GLO	10.054***	6.778*	6.735*	—	5.245	7.417*	
FDI	8.154**	12.365***	3.513	6.477*	—	12.195***	
FD	9.951**	6.818*	3.742	2.649	7.201*	—	
Panel–D: for China							
TOR	—	13.178***	6.751*	7.818*	12.143***	8.968**	GG←→TOR; EQ←→TOR; GLO←→TOR; FDI→OR; TOR←→FD; GG→EQ; FDI←→EQ; FD→EQ; FDI←→GLO; GLO→FD; FD→FDI
GG	11.751***	—	3.317	3.709	4.877	11.783***	
EQ	8.909**	5.457	—	3.438	11.749***	2.691	
GLO	12.95***	12.635***	11.011***	—	6.108*	2.672	
FDI	3.405	5.04	10.06***	8.94**	—	6.678*	
FD	7.228*	6.727*	8.554**	12.835***	5.262	—	

Note: the superscript ***/**/* explain the significant level at a 1%, 5% and 10% respectively.

The study documented asymmetric shocks of good governance that have a positive (negative) variation and statistically significant relationship with tourism development in Brazil with a coefficient of 0.0716 (0.0651), Russia with a coefficient of 0.1716 (0.1651), India with a coefficient of 0.0831 (0.0527), and China with a coefficient of 0.0989 (0.1265). In particular, the study findings suggest that a 10% positive (negative) innovation in good governance may result in

tourism development accelerated (degraded) in Brazil by 0.716% (0.651%), Russia by 1.716% (1.651%), India by 0.831% (0.527%), and China by 0.989% (1.265%), respectively. In the short run, positive shocks in good governance have revealed positive and statistically significant ties with tourism development in Russia, India, and China, but positive and statistically significant connections are documented for Brazil. Moreover, the negative shocks in good governance have positively connected to tourism development in BRIC nations. Considering the asymmetric coefficients of good governance on tourism development, it is undoubtedly confirmed that governmental effectiveness ensures economic and financial stability for fostering equitable development, eventually supporting tourism development in the long and short runs.

Referring to globalization effects on tourism development, the study has documented positive and statistically significant linkage, suggesting the positive (negative) variation in global integration will result in acceleration (declination) in the tourism development in BRIC nations. In particular, a 10% change in globalization will produce positive (adverse) effects on tourism development in Brazil by 2.253% (0.923%), Russia by 1.253% (0.999%), India by 1.885% (1.178%), and China by 0.333% (0.468%), respectively. Furthermore, in the short run, the study established that positive shock in globalization was positively tied to Russia (a coefficient of 0.0343) and China (a coefficient of 0.0597), whereas a negative association was revealed for Brazil (a coefficient of −0.04) and India (a coefficient of −0.0195). On the other hand, the negative variations unveiled positive and statistically significant ties to tourism development in BRIC nations. The study findings suggest the global economic integration.

The assessment of the asymmetric association between environmental quality, good governance, and globalization on tourism development in BRIC has been confirmed with the standard Wald test, and their results are displayed in panel–C. According to the test, statistics derived from the Wald test have found the rejection of the null hypothesis that is no-asymmetric relations. Alternatively, the Wald test confirmed the asymmetric association both in the long-run and short-run. Furthermore, the study has performed several residual diagnostic tests.

Next, the study implemented the causality test by following the non-granger causality framework offered by Toda. The causality test results are displayed in Table 8 and documented several directional associations among research variables. Focusing on the target variables, the study revealed feedback hypothesis holds in explaining the causality between environmental quality and tourism development [EQ←→TOR] in Brazil, India, and China, and good governance and tourism development [GG←→TOR] in India, and globalization and tourism development [GLO←→TOR] in China. Furthermore, the unidirectional causality runs from tourism to good governance [TOR→GG] in Brazil, whereas causality runs from good governance to tourism development [GG→TOR] in Russia, India, and China. In the case of globalization to tourism development [GLO→TOR], the study established unidirectional causal effects in India, while tourism led to globalization [TOR→GLO] found in Brazil.

5 Discussion

The present study investigates the impact of globalization, good governance, and environmental quality on tourism development in BRIC nations with symmetric and asymmetric frameworks. Environmental quality, measured by the carbon emission into the environment, negatively affects tourism development. Alternatively, improving environmental quality through carbon reduction positively boosts tourism development in BRIC nations. The study finding has suggested that environmental adversity characterized by excessive heat, ecological imbalance, and natural resource destruction demotivated international tourist to visit that economy. According to long-run coefficients for environmental quality on tourism development, it is evident that a 10% reduction in carbon emission in the economy will result in tourism development by tourism development of 1.298% in Brazil, 1.749% in Russia, 1.837% in India, and 1.447% in China, respectively. Our study findings are in line with existing literature by Jermsittiparsert, 2019), Sajjad et al. (2014), and Suharyono and Digdowiseiso (2021). The relationship between air pollution and tourism may be investigated at local and macro levels. Based on a study of China residents in the United States and Australia, Becken et al. (2017) discovered that the perceived danger of air quality in China is adversely connected to travel intent and assessment of the destination. According to Peng and Xiao (2018), air pollution significantly negatively influences visitor happiness and a location's reputation. According to Deng et al. (2017), industrial gas emissions in Chinese provinces were highly and negatively connected with the worldwide inbound tourism industry. Xu and Reed (2017) linked China's low inbound tourism to the country's high levels of air pollution in a second study.

The study established a positive and statistically significant connection between globalization and tourism development in BRIC nations, which is valid for both symmetric and asymmetric assessment. According to coefficients, the study advocated that global economic and financial integration has played a critical role in tourism development with effective innovation in marketing activities, knowledge sharing, and infrastructural development. Because we live in a time of globalization, tourism, which represents a large share of the contemporary economy of the whole world, is unavoidably being enmeshed in such an overwhelming process, which is happening for several reasons. The worldwide flows of cash, information, and services within the tourist industry are likely to be substantially more frequent and intensive than most other businesses and economic sectors (Theuns, 2014). This is a result of the fact that engaging in

activities associated with international tourism inevitably involves transporting visitors across national boundaries, in addition to the required adjustments in space and time (Theuns, 2008).

For good governance, the study documented positive and statistically significant connections to BRIC nations' tourism development in the long and short-run assessments. Furthermore, the asymmetric shocks of good governance that is positive and negative variation have established positive and statistically significant interlinkage both in the long run and short run. Precisely, in the long run, a 10% positive (negative) innovation in good governance may result in tourism development accelerated (degraded) in Brazil by 0.716% (0.651%), Russia by 1.716% (1.651%), India by 0.831% (0.527%), and China by 0.989% (1.265%), respectively. In the short run, positive shocks in good governance have revealed positive and statistically significant ties with tourism development in Russia, India, and China, but positive and statistically significant connections are documented for Brazil. Moreover, the negative shocks in good governance have positively connected to tourism development in BRIC nations. Considering the asymmetric coefficients of good governance on tourism development, it is undoubtedly confirmed that governmental effectiveness ensures economic and financial stability for fostering equitable development, eventually supporting tourism development in the long and short runs. Our findings align with existing literature, for instance, Sou and Vinnicombe (2021), Xu et al. (2021). Existing literature has postulated that inefficient institutional quality, corruption, and political instability unmined tourism growth prospects in the long run, which eventually degraded equitable tourism-led economic growth (Del Monte and Papagni, 2001; de Vaal and EbbenInstitutions, 2011; Faheem et al., 2019; Andriamahery and Qamruzzaman, 2022; Xia et al., 2022; Zhuo and Qamruzzaman, 2022). The study of Sou and Vinnicombe (2021) advocated that good governance accelerates tourism development through the indirect channel that is governmental effectiveness and political stability which induces foreign capital flows into the economy for infrastructural development, and the tourism industry is one of the targeted industries. Thus, the presence of effective institutional quality, governmental effectiveness, and practices not only augments industrial development but also assists in sustainable economic progress. Furthermore, Osinubi et al. (2021) advocated that excessive corruption's absence of good governance has negatively tied to Nigeria's tourism development.

6 Conclusion and policy recommendation

The impact of tourism development has been extensively established in the literature, and on the other side, the key macro determinants for tourism development has been investigated. However, the conclusive evidence focusing on the contributory factors for tourism development has yet to be revealed. The motivation of the study was to gauge the role of environmental quality, good governance, and globalization in tourism development in BRIC nations for the period 1990–2021. Exploring the fresh insight, the study has implemented both linear and nonlinear frameworks following Pesaran et al. (2001a) and Shin et al. (2014). The key summary findings are as follows.

Combined cointegration test statistics show a long-run association between EQ, GG, and GLO and tourism development in BRIC nations. Furthermore, the long-run association in the empirical estimation is established in both linear and nonlinear framework assessments. Referring to linear assessment, the study documented the positive and statistically significant linkage between good governance and globalization, implying that political stability, governmental effectiveness, and accountability have been revealed as boosting factors for tourism development. Moreover, global economic and financial integration opens a window for tourism development by inducing the economy's international tourism. On the other hand, environmental degradation, which is the carbon emission in the economy, adversely affects tourism development, indicating that the healthy and amicable ambiance positively triggers tourism development in the long run. According to the test statistics of the standard Wald test, it is obvious that there is an asymmetric association between explanatory variables such as EQ, GG, and GLO and tourism development in the long-run and short-run assessment. The directional causality test documented bidirectional causality in explaining the causality between environmental quality and tourism development [EQ←→TOR] in Brazil, India, and China, good governance and tourism development [GG←→TOR] in India, and globalization and tourism development [GLO←→TOR] in China. Furthermore, the unidirectional causality runs from tourism to good governance [TOR→GG] in Brazil, whereas causality runs from good governance to tourism development [GG→TOR] in Russia, India, and China. In the case of globalization to tourism development [GLO→TOR], the study established unidirectional causal effects in India, while tourism led to globalization [TOR→GLO] found in Brazil.

On policy note, considering the empirical findings, the study reached the following suggestion for future development in the tourism sector.

1. According to the research findings, carbon emissions hinder the growth of the tourist industry in BRIC countries, both in the long and short terms. Alternately, it has been demonstrated that a decrease in carbon emissions as part of environmental development would result in a favorable acceleration in tourism growth. In light of this, it is recommended that environmental protection regulations be

formulated and effectively implemented to make the most of the potential for tourism growth.

2. Economic and financial openness offers economic accessibility by offering economic stability, which indicates effective and efficient governmental effectiveness. Furthermore, good governance has played a critical role in corruption reduction in the economy, which leads to long-term tourism development. Therefore, it is suggested that BRIC should ensure governmental effectiveness through institutional quality development, implying economic stability and progressive development in the tourism industry.
3. The opening up of economies and financial markets has been shown to have a major connection in the advancement of economies, due to the large contribution of other industries. The research findings indicated that globalization has a favorable connection to the expansion of tourism, which suggests that economic and financial globalization helps boost tourism. These findings were based on an estimate. According to the research findings, BRIC countries need to demonstrate that they can conduct effective and efficient financial intermediation to advance the current level of globalization. The research indicates that increased financial efficiency and intermediation led to increased capital flows and international commerce. In addition, domestic trade liberalization and foreign ownership involvement in the economy both favorably encourage globalization, leading to tourism growth.

The present study is not out of certain limitations; therefore, further development can initiate future research. First, the present study has considered the tourism receipts as a percentage of GDP as the proxies for tourism development; in the case of future studies, the proxy measure of tourism can be reinvestigated with international tourist arrivals and tourist expenditure. Second, the present study has considered carbon emission as the measure of environmental quality, so the further extension can be executed with the inclusion of air quality as a proxy of environmental quality, which is available in the literature.

Data availability statement

Publicly available datasets were analyzed in this study. These data can be found here: World Bank database.

Author contributions

MQ: Introduction, methodology, and empirical model estimation; CG: Data accumulation, literature survey, first draft preparation, and final Preparation.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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