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Nexus between environmental sustainability, good governance, financial inclusion, and tourism development in Bangladesh: Evidence from symmetric and asymmetric investigation

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Over the past decade, tourism's contribution to economic Section progress has emerged as an alternative avenue for socio-economic development, especially in the productive economy with natural beauty. On the other hand, the potential effects of tourism on the environment have also been unveiled in the literature, along with macroeconomic misbehavior due to erratic environmental changes. However, the study's impetus is to inspect the reaction of tourism contribution to Bangladesh's economy from 1991–2019 with ecological sustainability, good governance, and financial inclusion in the empirical assessment. With the implementation of both linear and non-linear frameworks, the present study has explored the elasticities of core explanatory variables on explained variables; for directional causality, the novel Fourier Toda and Yamamoto causality test has been executed. According to the combined cointegration test, Bangladesh has a long-run association between environmental sustainability, good governance, financial inclusion, and tourism development. Inferring from long-run symmetric and asymmetric cointegration, the test statistics revealed statistically significant at a 1% level, suggesting the long-run relations in the established empirical model. Considering the linear autoregressive disoriented lagged, the study established a negative and statistically significant linkage between environmental sustainably and tourism contribution, suggesting that the excessive inflows of carbon emission that environmental degradation dwindles the progress of tourism contribution. Whereas a positive and statistically significant influence runs from good governance and financial inclusion to tourism development, the suggestion of easy access to financial services and effective institutional activities prompts tourism activities, especially in the long-run. The asymmetric investigation established non-linearity in the empirical model for the long and short-run. In terms of asymmetric coefficients, the study unveiled the positive and negative shocks of environmental sustainability exposed negatively and statistically significant. In contrast, the asymmetric shocks of financial inclusion and good governance established positive and statistically substantial Bangladesh tourism development in the long and short-run. The directional causality assessment revealed bidirectional causality running between explanatory variables to tourism development.

KEYWORDS

environmental sustainability, good governance, financial inclusion, tourism development, autoregressive disoriented lagged, nonlinear autoregressive disoriented lagged, Bangladesh I

1 Background of the study

The economic advantages of tourism to a nation or a province, state, department, municipality, or another local region within a country consist of sales and output, labor wages, and employment. Tourism is "the actions of individuals going to and staying in locations outside their customary environment for less than 1 year for pleasure, business, or other objectives" (Carrascal Incera and Fernández, 2015). Tourists provide vital funds to local businesses, governments, and citizens; moreover, companies that service visitors and those that supply them are crucial to the local economy, and its executives, authorities, employees, and dependents must recognize this to make informed private and public policy choices (Wang et al., 2022). Tourism boosts local economies by creating jobs and generating revenue *via* increased output and visitor spending. The tourist multiplier is the total increase in output, labor pay, and employment in a region due to interindustry links. The economic impact of tourism is measured by a "multiplier," which directly affects the number of money tourists spend in a certain area (Li and Qamruzzaman, 2022a; Xiao and Qamruzzaman, 2022).

The importance of the tourism industry to the economy has grown in recent decades, and so has the number of foreign tourists. The World Travel and Tourism Council estimates that As a result of continued limits to mobility, the travel and tourism sector's contribution to the global GDP will drop from 10.3% in 2019% to 5.3% in 2020, even though it contributed 10.3% in 2019. In 2021, the share reached 6.1% after having previously been at 5.9%. In addition, the revenue from tourism has provided an additional channel for exports, which has aided the balance of payments in many countries. Profits from tourism have grown into a significant industry, contributing to a rise in the number of people employed, the purchasing power of families, and tax revenue collected by governments throughout the world. Regarding tourism's nexus to several economic, the study documented two vines of evidence in the literature. First, the positive association that tourism development accelerated economic growth (Alam, 2022a; Toubes and Araújo-Vila, 2022; Wu et al., 2022a; Wu et al., 2022b), financial development (Kumar, 2014), foreign direct investment (Arain et al., 2020), capital formation, poverty reduction and human capital development (Thrane, 2008). The second line of empirical studies has explained the destructive nature of tourism development in the economy through environmental degradation by increasing carbon emissions (Liu et al., 2011). However, in terms of tourism growth determents, the existing literature has exposed several economic factors that positively influence tourism's contribution to the economy, such as foreign direct investment (Ivanovic et al., 2011). There is ample evidence that tourism benefits host communities directly and indirectly by generating new products and services, increasing local economies, and generating new revenue streams (Archer and Fletcher, 1996). However, some of these benefits could have unintended negative effects on other people and production variables (Hassan et al., 2022). The economy's structure (the volume of imports required in the manufacturing process) and the commodities purchased by visitors influence the leakage. Understanding how tourist spending impacts labor and capital revenues distribution to the various socio-economic actors is crucial to properly account for distributional effects (Wattanakuljarus and Coxhead, 2008).

The present study has considered environmental sustainability, financial inclusion, and good governance in tourism development. According to existing literature, the nexus between tourism-led environment has produced one directional investigation in most cases which is the impact of tourism development on the environment and documented adverse association, suggesting that the detrimental role of tourism in the process of environmental degradation (Raza et al., 2017; Shahbaz et al., 2021; Teng et al., 2021); Villanthenkodath et al., (2022b), however, the positive effects of tourism on carbon reduction has established in the literature as well (Tong et al., 2022). The role of institutions and economic freedom in explaining observed economic growth and performance disparities is an important study area. The economic literature has shifted from focusing on inputs and technology to a wider understanding of growth conditions (Gwartney et al., 1999). Good governance is required to provide (Dixit, 2009) the protection of property rights, the enforcement of contracts, and collective action. According to Khan et al., (2021), the beneficial effects of good governance stem mostly from two sources. First, it decreases transaction costs, making markets more efficient. Second, excellent governance allows markets to "overcome persistent market shortcomings in distributing assets, obtaining productivity-enhancing technology, and preserving political stability in circumstances of rapid societal transition".

Financial inclusion allows businesses and entrepreneurs in the tourist industry to access official financing sources and bolster the money they need for their endeavors. According to Ayyagari et al., (2011), having access to financial resources is directly connected to the phenomenon of innovation, which, in turn, drives economic development *via* an increase in productivity. In developing nations with prevalent bank-based financial systems, bank-based financial inclusion significantly simplifies the process of financial inclusion. It contributes to a more rapid acceleration of economic development *via* inclusive growth (Dai et al., 2022). Furthermore, mobile payment systems have made significant strides toward global adoption in the recent decade. As the mobile phone has become an indispensable component of an individual's day-to-day existence, it has grown more ingrained in their travel experiences in recent years. Through financial inclusion, travelers are given much-needed access to mobile payment systems, allowing them to hassle-free pay for the travel-related goods and services they purchase (Yang et al., 2021). Additionally, small and medium-sized businesses (SMEs) in the tourist industry with access to money and giving people access to mobile payments and transfers are two crucial components of a sustainable tourism development strategy, especially in developing nations. Low and middle-income small and medium-sized enterprises (SMEs) in the tourist industry rely heavily on backward and forward connections to the global value chains in the industry, and this is only possible with access to financing (Alam et al., 2022c).

The potential contribution of the study is as follows; first, it refers to the nexus between environmental degradation and tourism; existing literature predominately focuses on tourism's impact on the environment; however, the potential role of environmental sustainability, which is the reduction of carbon emission on tourism development, has yet to investigate extensively. On this note, the present study has implemented the empirical relationship between environmental sustainability and tourism development to document the possible effects on tourism contribution. Second, according to the literature, easy access to financial services, efficient financial intermediation, and good governance have positively influenced tourism. On the other hand, the possible effects of

environmental degradation on tourism have yet to be extensively investigated and completely ignored in terms of tourism development in Bangladesh. The study intended to mitigate the literature gap by exploring fresh insight. Third, it is apparent in the existing literature that financial development and good governance influenced environmental quality; thus, the present study considered the interactive term between ecological sustainability and financial inclusion (ES*FI) and environmental sustainability and good governance (ES*GG) for documenting the mediating effect on tourism development.

Conferring to the study findings, it is obvious that tourism development in Bangladesh relies on environmental quality improvement, suggesting that carbon emissions cause ecological degradation, which leads to a negative impression of tourism progress. On the other hand, the connection between financial inclusion, good governance, and tourism development has been exposed positively and statistically significant, indicating that financial inclusion is easy to access financial services from financial institutions, and efficient financial intermediation entices international tourism arrivals; as a result, the process of tourism development has intensified. For good governance, it is confirmed an ambiance for political stability and institutional effectiveness, accelerating tourism development trends by protecting tourists' interests. The asymmetric investigation established non-linearity in the empirical model for the long and short-run. In terms of asymmetric coefficients, the study unveiled the positive and negative shocks of environmental sustainability exposed negatively and statistically significant. In contrast, the asymmetric shocks of financial inclusion and good governance established positive and statistically substantial Bangladesh tourism development in the long and short-run. The directional causality assessment revealed bidirectional causality between explanatory variables and tourism development.

The remaining structure of the paper is as follows: The literature survey and hypothesis development are available in Section II. The variables definition and methodology of the study are explained in Section III. Section IV deals with the mode of estimation and interpretation. Discussion of the study is reported in Section V. finally, the conclusion and policy implications are exhibited in Section VI.

2 Literature survey

The tourism literature has mostly focused on questions about the link between economic expansion and the expansion of the tourism industry. Increasing tourists means more money and jobs, which may boost a country's economy. The tourist-led growth (TLG) concept, popularized by (Balaguer and Cantavella-Jordá, 2002), is only one-way tourism influences economic development. Regarding tourism development, two studies have been initiated, that is, the impact of tourism on several economic factors and the determinants of tourism development.

2.1 Environmental sustainability and tourism

The nexus between tourism and environmental sustainability, inferring the existing literature, is the domain of study findings available. First, a growing number of studies have revealed a detrimental role of tourism development in the economy is environmental degradation (Raza et al., 2017; Sharif et al., 2020; Teng et al., 2021; Andriamahery and Qamruzzaman, 2022; Villanthenkodath et al., 2022a; Li and Qamruzzaman, 2022b; Ma and Qamruzzaman, 2022; Xia and Qamruzzaman, 2022). For example, in the case of India (2022a) exploded the role of tourism development in the process of losing the environmental quality with the application of ARDL bound testing approach for the period 1995Q1–2018Q4. The study documented a positive and statistically significant association between tourism development and the level of carbon emission into the ecosystem, suggesting the contributory role of tourism development in environmental degradation. Further evidence in the study of Villanthenkodath et al., (2022a) shows that an increase in tourism negatively influences ecological quality. Still, a shift in the economy's basic structure has a positive impact, and a break in the series implies that tourism has very little effect on carbon emissions. Moreover, the study has established that economic expansion improves environmental quality. However, the usage of energy is found to decrease the ecological rate. Many international organizations and institutions have produced reports highlighting the potential positive effects sustainability may have on tourist development and the processes related to the economic growth of destinations. These organizations have tried to justify why vacation spots should put money into becoming more environmentally friendly. UNEP found in 2011 that the tourism industry was more interested in investing in environmental sustainability. In another UNWTO report, sustainable tourism is called an "instrument to support economic and social improvement" (2013: 12). For its part, the Global Sustainable Tourism Council is working to show that eco-friendly tourism is profitable by minimizing damage to natural areas, boosting the local economy, and protecting irreplaceable cultural relics (Gharib et al., 2022).

The term "environmental quality" describes how well-maintained the area's natural characteristics are and how easily they can be damaged by human activity (Mihalič, 2000). The connection between tourism and the natural world is frequently disregarded as irrelevant and seldom subjected to in-depth study. Despite this, it is obvious that people's perspectives on the environment have undergone significant shifts with time, particularly concerning tourism and numerous other facets of human growth (Butler, 2000). Regarding a nation's overall economic health, the tourism industry is crucial. However, the tourist sector and the environment are increasingly interrelated. The success of the tourist business depends on the natural and built environments being in good condition. Even though tourism may benefit the environment, the two are frequently considered independent (Rabbany et al., 2013). The influence on the environment, which has both favorable and unfavorable elements, is constantly evolving due to the ongoing growth of tourism. There are many different ways in which tourism can contribute to the preservation of the natural environment. Tourism can safeguard endangered areas and the natural environment. Visitors' entrance fees can maintain and manage ecologically complex regions. Further, governments may collect the funds they need for environment management *via* charges, tax payments, taxes on the sale or rental of leisure equipment, and royalty payments for events like hunting and fishing. This revenue can be utilized toward various comprehensive preservation initiatives and activities, such as

paying park ranger salaries and the upkeep of park facilities (Camarda and Grassini, 2003). Tourism has the potential to significantly contribute to the protection of the environment, the preservation and restoration of biological diversity, and the responsible use of natural resources. It is possible that national parks and wildlife preserves would be established to protect natural areas and pristine landscapes because of their aesthetic value (Hamid et al., 2022).

Even though tourism has a beneficial effect on economic expansion, it also significantly affects CO2 emissions. The more appealing a destination is (typically as a result of its great biological or cultural values), the more likely it is to become popular, and the greater the likelihood that it will become degraded as a result of heavy visitation, which may result in a decrease in the overall quality of the experience (Hillery et al., 2001). Environmental costs are associated with tourism, including transportation, attractions, and hotels. These costs include pollution from tourist traffic, rude conduct from visitors, and excessive energy use. (Zhao and Min Li, 2018). According to (Rabbany et al., 2013), some direct environmental impacts are affected by a country's tourism sector. To name a few: deteriorating water and air quality, excessive noise pollution, excessive solid waste and littering, altered and fragmented ecosystems, effects on animals, impacts on aesthetics and culture, loss of biological variety, ozone depletion, and climate modification. In modern economies, private amenity construction inside public protected areas threaten conservation as a result of tourism. In underdeveloped nations, tourism is utilized to fund conservation initiatives in public and privately maintained or communal areas (Buckley, 2011).

The previously described negative consequences of tourism on the environment not only harm or disturb the natural and cultural resources upon which tourism development relies but also influence tourists' experiences. This brings up the challenge of improving tourists' experience while reducing the damage they cause to the surrounding environment (Zhong et al., 2011). The tourist sector has already started preparing to lessen the impact of its activities. This includes industry- and government-led initiatives, financial contributions, enhanced environmental planning and management, public education and outreach campaigns, and stricter preservation, protection, and disclosure mandates (Rabbany et al., 2013). In addition (Paramati et al., 2017), found that the environmental damage in Western Europe is lessened because of tourism. The introduction of environmentally friendly technology and ecologically responsible tourist activities were highlighted as potential sources of tourism's ameliorative influence on environmental deterioration. According to (Zhong et al., 2011), the natural and social/cultural settings significantly determine how successful a destination's tourist industry will be. Therefore, it is of the utmost importance to maintain or even increase the quality of the tourist environment at a given site. Pollution can degrade the attraction of natural elements such as spectacular landscapes, biological hydrologic structures, clean water, healthy air, and wildlife (Mihalič, 2000).

This should not be used as an excuse to disregard the importance of environmental quality in a more general sense. Generally, tourists will not return to polluted, unclean, or unpleasant sites if comparable alternatives are available at similar prices (Butler, 2000). Environmental quality is an important part of perceived quality, which is a crucial variable for customers because it can significantly influence the likelihood of re-visiting and boost the profitability and attractiveness of tourism destinations. According to (Sadat and Chang, 2016), there is a significant connection between the environment's quality and the satisfaction level experienced by tourists. Therefore, increased tourist satisfaction and favorable impressions of the surrounding environment would benefit the likelihood of a return visit.

H1Environmental Sustainability augments tourism development

2.2 Financial inclusion and tourism development (literature review)

Access to institutional funding, such as bank loans, may help tourism-related firms and entrepreneurs grow and thrive. Access to capital, according to Ayyagari et al. (2011), is a direct result of a country's rate of innovation, which in turn drives access to capital *via* an increase in productivity. In emerging countries with mostly banking financial systems, bank-based financial inclusion is a significant enabler of financial inclusion, accelerating economic development through inclusive growth (Swamy, 2012). Over the last 10 years, there has been an explosion in the use of mobile payment systems. Because mobile phones have become so pervasive in people's everyday lives, they have also become an integral part of the way that people travel. It is crucial to have a variety of mobile payment methods available for tourists so that they may purchase products and services while they are traveling. Financial inclusion (FI) has been highlighted as a growth-promoting element for emerging nations. (Abubakar et al., 2020). According to (Girón et al., 2021), a greater degree of financial inclusion raises the amount of official savings in nations, which boosts their growth. The concept of financial inclusion reflects that the development of any economy is contingent on individuals from all socioeconomic levels having access to banking and other financial services. Over the past few decades, financial and banking regulators, governments, and academia have all paid close attention to financial inclusion. It is now one of the essential pillars of sustainable development. (Carrillo-Hidalgo and Pulido-Fernández, 2016; Qamruzzaman and Wei, 2019b).

As far as we know, most researchers concentrate on how tourism affects financial inclusion (Carrillo-Hidalgo and Pulido-Fernández, 2019b). Stated tourism is one of the most important weapons for assuring economic growth, improving the quality of life, and eliminating poverty and inequality in developing countries. This study examined the World Bank's role in inclusive tourism financing as a sustainable development strategy. Through a descriptive analysis of more than 92 projects in different fields, they found that the World Bank's tourism funding could benefit from a stronger emphasis on financial inclusion, allowing it to more efficiently and effectively achieve its goals of reducing poverty and fostering development (Panggabean and Sipahutar, 2019). Demonstrates how the tourism sector may promote economic growth by providing a range of job possibilities and generating foreign revenue in Indonesia, which is then utilized to stimulate other economic activities. They stated that tourism promotes the usability of local products and focuses on developing local communities, thus ensuring financial inclusion. Financial and social inclusion are impacted by tourism (Kumar et al., 2020).

Shi et al., (2020) claim that low-income families benefit greatly from gender-sensitive financial inclusion. Similarly, the economic

prosperity of low-income families in the regions around tourist locations benefits greatly from a tourism business that considers gender. The importance of financial inclusion in the growth of sustainable tourism is growing. Non-etheless, there are no studies examining the relationship between financial inclusion and the expansion of the tourism sector in the existing empirical research. However, very few works of literature concentrate on the opposing notion that it is essential to ensure financial inclusion to boost tourism. Financial inclusion's effect on tourist growth was studied (Shi et al., 2020) using data from 1995–2016 from 24 developed and 21 developing countries. The findings, which feature policy recommendations and useful ideas, demonstrate that financial inclusion has a major effect on various facets of tourism growth. The results also suggest that the impact is significantly magnified in emerging and developed markets (Carrillo-Hidalgo and Pulido-Fernández, 2016). Have proposed a technique for determining if the performance of International Financial Institutions regarding tourism financing is inclusive. Promoting financial inclusion is essential if tourism is a driver of economic growth. According to their research, while financial intermediaries fund governments and large businesses, none of these institutions' financing practices, financing volumes, or non-financial actions promote financial inclusion for the poor. Financial inclusion in sustainable wealth creation for developing and developed countries was studied using the GMM model (Gao et al., 2022). The results demonstrate that financial inclusion affects various elements that contribute to the expansion of China's tourism sector. Raising people's financial literacy and strengthening the security of technologically-based financial instruments are other effective means of facilitating financial inclusion. Promoting rural tourism may be seen as one of the most crucial factors in extending financial inclusion, alongside agricultural development (Singh, 2022). This article will investigate the factors that motivate financial inclusion and ensure long-term tourism development in Bangladesh. To that end, we hypothesize that the financial inclusion index—which measures factors including the availability, development, and performance of financial institutions and markets—has a salutary impact on the travel industry. This is because the elimination of credit and liquidity limitations for tourist sector players is a direct result of improved access to financial institutions and markets. Therefore, these parties may purchase tourism-related products and services at reduced costs.

H2Financial inclusion positively influences tourism development.

2.3 Good governance and tourism development

A country's tourism growth can be quantified using an index that considers both inbound and outbound tourist spending and the sector's contribution to total employment. Good governance is characterized by government efficiency, political stability, high-quality rules, the rule of law, citizen participation, and individual accountability (Khan et al., 2021). Governance aims to maintain a good relationship between the rulers and the ruled. Even though most academics interchangeably refer to both governance and good governance, good governance is crucial for accomplishing long-term development objectives. Accountability and transparency, the absence of violence and political stability, the efficacy of governmental policy, the eradication of corruption, the standard of governance, and the formation of the rule of law are the six factors that support good governance in every community (Ali, 2015).

Shortly, governance will surely take center stage in the development and policy of tourism destinations. The findings of this research highlight the importance of using independent categorical variables to aid in the creation and evaluation of explanatory claims, the explanation of conceptual statements, and the promotion of comparative analysis and policy learning. Furthermore, it has established connections between the literature on governance in political science and public policy and the specific challenges faced by the tourism sector. The relationship between policy actors and steering modes, as well as the balance between state intervention and self-regulation, serve as the basis for the categorical variables in this study. The resulting matrix identifies four different governance systems, including hierarchies, markets, networks, and communities. Rather than occurring in a vacuum, tourism governance must be viewed as operating within particular frameworks or representations of governance (Hall, 2013).

Social capital, political capital, and their interplay determine the importance of governance and long-term tourism sustainability (Nunkoo, 2017). In contrast to neoclassical philosophy, which stresses and is limited to market links, good governance notions acknowledge the importance of non-market forces, such as local communities and civil society, to the development process. Governance frameworks encourage local communities and civil society, usually excluded from tourism policymaking, to participate in tourism planning as legitimate partners. The author concludes that trust and power should cooperate rather than act alone. The synergistic view of social capital can positively affect sustainable tourism development and governance by altering formal institutions and the rule of law.

(Khan et al., 2021) used data from the World Development Indicators (WDI) to demonstrate that governance favors tourism development and its constituent parts. Additionally, it is found that all governance metrics encourage the growth of the tourism industry. On the other hand, tourism in developing nations is severely harmed by terrorism, environmental degradation, and corruption. However, trade openness and tourism have a good association. The comparative study by (Daryaei et al., 2012)between OECD nations and developing countries reveals that the OECD countries are ahead of developing countries in various good governance indexes, which is the cause of the rising visitor numbers in these countries. A significant impact is created on the country's tourism industry's growth through strong governance established by the study.

To be effective, a set of tourism policies must be conceptually and thematically solid and founded on the realities of existing and forthcoming issues. The 2010 Bangladesh Tourism Policy, however, is not as well written. This study emphasizes the importance of the government's commitment to the development of the policy-motivated tourism industry in the country, with active participation from the private sector and non-profit organizations, as well as the training of tourism industry human resources to develop their skills in tourism policy-making, planning, and management. It is critical to stimulate both governmental and private sector investments in tourism infrastructure and services. The fundamental goal of Bangladesh's tourism strategy should be the expansion of innovation and entrepreneurship. Establishing a "Tourist Safety Force" as part of the country's law enforcement authorities and implementing zoning restrictions in environmentally sensitive areas

are key steps that can improve the sustainability and security of Bangladeshi tourism. Smart tourist policies are critical, but so are the skills and resources required to implement them. To compete with local and international competition, Bangladesh's tourism sector needs drastically strengthen its marketing and branding (Hassan and Kokkranikal, 2018).

Poor maintenance of the destination's environment and resources; inadequate tourist facilities, activities, and infrastructures; security and safety concerns; a lack of a dedicated cell or body to guarantee the quality of tourism products and services; a lack of coordination and partnership among tourism stakeholders; an ineffective marketing strategy; and an insufficient budget are all factors that slow down the development of tourism in Bangladesh as a whole (Muneem et al., 2020; Manigandan et al., 2022). Working cooperatively with 15 ministries, this strategy includes 11 sectors to cover. They also classified the nation's tourism into seven regions, each corresponding to a different local government division. After thorough research and a comparison of Bangladeshi and Bhutanese tourist policies, it was concluded that Bangladesh should adopt the "Low Volume, High Value" approach used by The Kingdom of Bhutan (Karim, 2014).
H3Good governance accelerates tourism development

3 Data and methodology of the study

3.1 Theoretical development and model specification

Existing literature dealing with the determinants of tourism development, the present study intends to explore the effects of c environmental sustainability, financial inclusion, and good governance on tourism development in Bangladesh. Based on the literature, the generalized relationship between ES, FI, GG, and TD, along with the control variables, is as follows:

$$TD \int ES, FI, GG, FDI, TO \tag{1}$$

With the mediating effects of clean energy, i.e (ES*FI, GG*ES), the above equation has been enlarged and represented as follows:

$$TD \int ES, FI, GG, FDI, TO, (ES*FI), (ES*GG) \tag{2}$$

TD denotes tourism development, CE for clean energy, and ES explains environmental sustainability, FDI for foreign direct investment, GE for governmental effectiveness, and ED for education. Moreover, the mediating role of clean energy through ES and FDI on TD has been addressed with the inclusion of interactive terms. The above Eqs. 1, 2 can reproduce in the following manner after log operation.

$$TD_t = \alpha_0 + \beta_1 CE_t + \beta_2 ES_t + \beta_3 FDI_t + \beta_4 GE_t + \beta_5 ED_t \tag{3}$$

$$TD_t = \alpha_0 + \gamma_1 CE_t + \gamma_2 ES_t + \gamma_3 FDI_t + \gamma_4 (ES*CE) + \gamma_5 (FDI*CE) + \gamma_6 GE_t + \gamma_7 ED_t \tag{4}$$

Where α_0 is constant, the coefficient of $\beta_1 \ldots\ldots\ldots\ldots \beta_5$ explain the relations of CE, ES, FDI, GE, and ED on tourism development. Furthermore, the interactive effects can be found with the coefficient of γ_4 *and* γ_5.

3.2 Financial inclusion

According to existing literature, the measurement of financial inclusion in empirical assessment has revealed two lines of consideration. A group of researchers employed single proxies, and another considered the financial inclusion index with multiple proxies (Qamruzzaman and Wei, 2019a; 2019b; Chuc et al., 2021; Eggoh and BangakÃ, 2021). By following Sarma (2008), the study measured financial inclusion by constructing an index with the three aspects of financial inclusion, such as accessibility, availability, and financial service usage (see Table 1 for details proxies).

The study implemented Principal Component Analysis (PCA), which is widely utilized by, e.g., Jia et al., (2021); Qamruzzaman et al., (2021). The application of PCA is an effective and simple tool in reducing dimensions but retaining the properties of the original data set. The following Eq. 5 has been implemented for index development.

$$FII = \sum W_i FI_{it} \tag{5}$$

Where *FII* denotes the financial inclusion index, *Wi* for principal component weight, FI_{it} for financial inclusion value at t period. The results of PCA for variables selection with eigenvalue are displayed in Table 2, and factors for index construction report in Table 3, along with the coefficient score matrix.

3.3 Estimation strategy

3.3.1 Unit root test

It is essential to check the series utilized in the econometric model for stationarity if one wishes to guarantee reliable conclusions and avoid the risk of erroneous regression. Before examining the long-term dynamics, it is necessary to determine the correct integration sequence. To verify the presence of unit roots throughout the series that goes into the construction of our model, we resorted to two distinct methods. The research unit's properties in the time series assessment have played a pivotal role in selecting the appropriate econometrical techniques for deriving the coefficients of the explanatory variables (Meng et al., 2021). Following the existing literate, the study has performed several stationary tests, which are commonly known as the ADF test (Dickey and Fuller, 1979), the P=P test (Phillips and Perron, 1988), the DF-GLS test (Elliott et al., 1996), the KPSS test (Kwiatwski et al., 1992).

3.4 Bayer-combined cointegration test

As a means of testing the null hypothesis of no cointegration relationship, we use the joint test statistics established by Bayer and Hanck (2013). The Engle and Granger test, the Johansen test, the Peter Boswijk test, and the Banajee test are all rolled into one new combined cointegration test. One of the numerous benefits of this strategy is that it may provide model-specific cointegration findings. The Bayer-Hanck test evaluated the level of significance associated with each cointegration equation using Fisher's formulas in the way described below.

$$EG - JOH = -2[LN(PEG) + LN(PJOH)]$$

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

TABLE 1 Variables definition and data sources.

Variables	Notation	Definition	Data sources
Remittances	*Rim*	Personal remittances received to GDP (%)	WDI World Bank, (2022)
Economic policy uncertainty	EPU	Economic Policy uncertainty index	Baker, Bloom, and Davis (2016)
Financial inclusion index (FII) Authors' construction with the following fours proxies			
ATMs per 100,000 adults			World Development Indicator World Bank, (2022)
Number of commercial bank branches per 100,000 adults			
Number of depositors from commercial banks per 1,000 adults			
Number of borrowers from commercial banks per 1,000 adults			
Trade openness	TO	The sum of imports and export as a % of GDP	
Exchange rate	EX	Real exchange rate	

Note: WDI, for World Development Indicators.

TABLE 2 Results of PCA for financial inclusion index.

Principal components	Eigenvalue	Cumulative (%)	Eigenvalue	Cumulative (%)
	India		China	
Components–1	1.9452	.5942	1.7812	.7515
Components–2	.9845	.7925	.8641	.8451
Components–3	.8452	.8944	.5125	.9531
Components–4	.7954	1.000	.4481	1.0000

PEG, PJOH, PBO, and PBDM represent the probability of different model cointegration tests in Eqs. 6, 7. If the approximate Fisher statistic exceeds the criteria established by Bayer and Hanck (2013), we may conclude that cointegration exists. In addition to the Bayer and Hanck combined cointegration tests, the Johansen cointegration test is applied as a robustness check in a multivariate situation. The Johansen test determines the number of cointegrating vectors between variables. Cointegration cannot occur without each cointegrating vector. The Johansen et al. (1990) techniques consider calculating all feasible cointegrating vectors between the variables.

3.5 Autoregressive disoriented lagged (ARDL) and augmented–autoregressive disoriented lagged

To validate cointegration, the ARDL bound test was put to use in this investigation. This method uses either the Wald test or the joint F-statistic to determine whether the variables are cointegrated. Comparing the probability of cointegration with the likelihood that the model does not integrate yields some interesting insights. Only if the F-statistic is larger than the required upper limit would it be possible to reject the null hypothesis that there was no integration. Following M. Hashem Pesaran et al., (2001), the generalized ADRL model for the study was considered for detecting both long-run and short-run coefficients by performing the following equation.

$$\begin{aligned}\Delta lnTD_t = {} & \alpha_0 + \sum_{i=1}^{n}\mu_1\Delta lnTD_{t-i} + \sum_{i=0}^{n}\mu_2\Delta lnCE_{t-i} + \sum_{i=0}^{n}\mu_3\Delta lnES_{t-i} \\ & + \sum_{i=0}^{n}\mu_4\Delta ln\,FDI_t + \sum_{i=0}^{n}\mu_5\Delta lnGE_{t-i} + \sum_{i=0}^{n}\mu_6\Delta lnED_{t-i} \\ & + \gamma_1 lnTD_{t-i} + \gamma_2 lnCE_{t-1} + \gamma_3 lnES_{t-1} + \gamma_4\, lnFDI_{t-1} \\ & + \gamma_5 lnGE_{t-1} + \gamma_5 lnED_{t-1} + \omega_{1t} \end{aligned} \quad (6)$$

For interactive terms:

$$\begin{aligned}\Delta lnTD_t = {} & \alpha_0 + \sum_{i=1}^{n}\mu_1\Delta lnTD_{t-i} + \sum_{i=0}^{n}\mu_2\Delta lnCE_{t-i} + \sum_{i=0}^{n}\mu_3\Delta lnES_{t-i} \\ & + \sum_{i=0}^{n}\mu_4\Delta ln\,FDI_t + \sum_{i=0}^{n}\mu_5\Delta ln(ES^*CE)_{t-i} \\ & + \sum_{i=0}^{n}\mu_6\Delta \ln\,(FDI^*CE)_t + \sum_{i=0}^{n}\mu_7\Delta lnGE_{t-i} + \sum_{i=0}^{n}\mu_8\Delta lnED_{t-i} \\ & + \gamma_1 lnTD_{t-i} + \gamma_2 lnCE_{t-1} + \gamma_3 lnES_{t-1} + \gamma_4\, lnFDI_{t-1} \\ & + \gamma_5 \ln\,(ES^*CE)_{t-1} + \gamma_6 \ln\,(FDI^*CE) + \gamma_7 lnGE_{t-1} \\ & + \gamma_8 lnED_{t-1} + \omega_{1t} \end{aligned} \quad (7)$$

3.6 Asymmetric autoregressive disoriented lagged estimation

In the recent literature, the application of asymmetric framework has been extensively used in effective policy

formulation (Lingyan et al., 2021; Xu et al., 2021; Li and Qamruzzaman, 2022b; Xia et al., 2022). Asymmetric framework assists in exploring the elasticity of explanatory variables through the decomposition that is positive and negative shocks, which reveals fresh evidence s over the conventional relations. The study considered a non-linear framework following Shin et al., (2014a). The following generalized model is to be implemented.Where β^+, β^-, γ^+, γ^-, π^+, and π^- for the long-run pavements. The coefficient of β^+ and β^- specifies the effect of positive and negative shocks in CE, ES and γ^+ and γ^- denotes the asymmetric effects of FDI on RE. Furthermore, the coefficients of δ_i measures the effects of control variables in the equation.

The asymmetric shock of financial inclusion, i.e., FI^+; FI^-, environmental sustainability, i.e., ES^+; ES^-, and Good Governance (GG^+; GG) can be derived in the following manner.

$$\begin{cases} POS(FI)_{1,t} = \sum_{k=1}^{t} lnFI_k^+ = \sum_{K=1}^{T} MAX(\Delta lnFI_k, 0) \\ NEG(FI)_t = \sum_{k=1}^{t} lnFI_k^- = \sum_{K=1}^{T} MIN(\Delta lnFI_k, 0) \end{cases} : \begin{cases} POS(ES)_{1,t} = \sum_{k=1}^{t} lnES_k^+ = \sum_{K=1}^{T} MAX(\Delta lnES_k, 0) \\ NEG(ES)_t = \sum_{k=1}^{t} lnES_k^- = \sum_{K=1}^{T} MIN(\Delta lnES_k, 0) \end{cases}$$

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

Now, Eq. 8 is transformed into asymmetric long-run and short-run coefficient assessment as follows:

$$\begin{aligned} \Delta TD_t = {} & \partial U_{t-1} + \left(\beta^+ FI_{1,t-1}^+ + \beta^- FI_{1,t-1}^-\right) + \left(\gamma^+ ES_{1,t-1}^+ + \gamma^- ES_{1,t-1}^-\right) \\ & + \left(\pi^+ GG_{1,t-1}^+ + \pi^- GG_{1,t-1}^-\right) + \delta X_{1,t\pm 1}^* + \sum_{j=1}^{m-1} \lambda_j \Delta TD_{t-j_0} \\ & + \sum_{j=1}^{n-1} \left(\pi^+ \Delta FI_{1,t-1}^+ + \pi^- \Delta FI_{1,t-1}^-\right) \\ & + \sum_{j=0}^{m-1} \left(\pi^+ \Delta ES_{1,t-1}^+ + \pi^- \Delta ED_{1,t-1}^-\right) \\ & + \sum_{j=0}^{m-1} \left(\beta^+ \Delta GG_{1,t-1}^+ + \beta^- \Delta GG_{1,t-1}^-\right) + \sum_{j=0}^{m-1} \mu \Delta X_{1,t\pm 1}^* \varepsilon_t \end{aligned} \quad (8)$$

A standard Wald test will be performed using the null symmetry hypothesis to detect asymmetry over the long and short term. Only very small sample sizes can establish unequal long-term and short-term associations. Furthermore, if the test statistics are larger when compared to the critical value, then the asymmetric long-run cointegration that is to be tested by following F-bound testing, Joint Primality testing, and tBDM testing will be validated in the empirical model.

3.7 Fourier Toda and Yamamoto causality test

According to the existing literature, the conventional granger causality test offered by. Has misconception and failed to address the issue of structural changes in the data, thus producing spurious estimation in some instances. To overcome the limitation of conventional casualty tests, The Granger (1969) causality test was used by the research team to investigate the potential for causation between the various macroeconomic variables. However, the Granger test and many other causality tests in the literature, including those by Toda and Yamamoto, overlook structural discontinuities in the series. This is the case even though the Granger test was developed (TY; (Toda and Yamamoto, 1995). Enders and Jones (2016) illustrated that problems with misspecification might arise in the VAR model if there is an inability to account for structural fractures. Consequently, there is an increased likelihood that the correct null hypothesis may be incorrectly rejected. Nazlioglu et al., (2011) created the Fourier TY causality tests to correct this deficiency with the expansion of the trigonometric term. The VAR model may be replicated in the following ways:

$$y_t = \alpha(t) + \beta_1 y_{t-1} + \cdots + \beta_{p+d} y_{t-(p+d)} + \varepsilon_t \quad (9)$$

$$y_t = \alpha(t) + \beta_1 y_{t-1} + \cdots + \beta_{p+d} y_{t-(p+d)} + \vartheta_1 \sin\frac{2k\pi t}{T} + \vartheta_2 \cos\frac{2k\pi t}{T} + \varepsilon_t \quad (10)$$

The null hypothesis for Fourier–TY test is no causality between variables (H_0: $\beta_1 = \beta_2 \ldots\ldots\ldots\ldots\ldots \beta_P = 0$)

4 Results and interpretation

4.1 Unit root test

Econometric empirical nexus assessment with time series data demands detecting variables' static properties in selecting the appropriate econometrical techniques for efficient and consistent estimation. The study has implemented several unit root tests, such as the ADF test, which is familiarized by Dickey and Fuller (1979), the GF-DLS test, which is offered by Elliott et al. (1996), and the PP test, which is introduced by -Phillips and Perron (1988), in documenting the stationary attributes of the research data set with the null hypothesis of not stationary and for KPSS-Kwiatkowski et al. (1992) with the null of stationary. Table 4 exhibited the results of the stationary test and established that all the variables are stationary after the first difference, and neither has exposed stationary after the second difference.

The study has extended the unit root test with the implementation of the second-generation unit root test announced by Ng and Perron (2001), and the results are displayed in Table 5. In terms of test statistics, that is MZa, MZt, MSB, and MPT derived from estimation, and it is apparent that all the test statistics are statistically significant at a 5% significance level, indicating the variables are stationary after the first difference.

The following study implemented the novel combined cointegration test, introduced by Bayer and Hanck (2013), with the integration of the existing conventional cointegration test in authenticating the long-run association between tourism development, financial inclusion, good governance, and environmental quality in Bangladesh. Table 6 exhibits the results of the cointegration test. Refers to the test statistics, it is manifested that the null hypothesis of no-cointegration is rejected in all model assessments; alternatively, the study establishes a long-run association between tourism and explanatory variables.

Next, the study assesses the long-run cointegration by implementing the linear framework proposed by M Hashem

TABLE 3 Results of Components score coefficient matrix.

Financial inclusion index proxies[1]	Factor score coefficient	
	India	China
FI_1	.6845	.5548
FI_2	.4533	.4591
FI_3	.5214	.4655
FI_4	.4112	.3512

Pesaran and Smith (1995) and further developed by M. Hashem Pesaran et al. (2001)and the non-linear framework offered by Shin et al. (2014a). The results of the long-run cointegration test under the symmetric and asymmetric framework are available in Table 7. The test statistics derived from the symmetric (asymmetric) assessment that is $F_{overall}$ = *11.203* (*12.062*), $t_{DV=-5.69(-4.857),}$ and F_{IDV} = 8.688 (8.761) revealed statistically significant at 1% level, indicating the rejection of the null hypothesis of no-cointegration. Study findings suggest long-run association under the symmetric and asymmetric framework environment. In the following section, the study evaluates the explanatory variables magnfititutes on tourism development under a symmetric and asymmetric framework.

4.1.1 For long-run symmetric assessment

The results of long-run coefficients of symmetric assessment displayed in Table 8. The study documented a negative and statistically significant linkage between the nexus between environmental quality, measured by carbon emission, and tourism development (a coefficient of −.1347). Study findings postulated that environmental degradation has adverse effects on tourism development; precisely, a 10% growth in carbon emission will result in a decline in tourism progress by 1.347%. The existing literature supports the findings of an adverse association between environmental quality and tourism development (Green and Hunter, 1992). For good governance (a coefficient of .01625). The study unveiled a positive and statistically significant linkage to tourism in Bangladesh. More precisely, a 10% development in governmental effectiveness will result in tourism development by .1625%, indicating that governmental effectiveness is a thriving factor in tourism development. Our findings align with existing literature (Detotto et al., 2021; Hassan and Meyer, 2022; Yang et al., 2022). The positive and statistically significant tie between financial inclusion and tourism development explained that financial inclusion accelerated the present status of tourism

TABLE 4 Results of unit root test.

	At level				After first difference			
	ADF	GF-DLS	PP	KPSS	ADF	GF-DLS	PP	KPSS
For Brazil								
TOR	−.2573	−1.715	−1.8856	.7984***	−6.7477***	−5.4954***	−7.9486***	.0207
FI	−.9351	−.5654	−1.4497	.7395***	−8.7373***	−7.2702***	−5.6356***	.0188
IQ	−.4616	−1.9925	−1.6997	.8669***	−8.0435***	−5.5837***	−8.3038***	.0213
EQ	−1.3845	−.5183	−1.7074	.802***	−7.7193***	−7.8388***	−6.275***	.0195
TO	−.4214	−2.2674	−2.4592	.7112***	−8.617***	−9.472***	−5.9688***	.0194
FDI	−1.7206	−1.6411	−1.414	.7085***	−7.2408***	−8.4006***	−5.3874***	.0203

TABLE 5 Results of Ng-Perron unit root test.

	At level					At first difference			
	MZa	MZt	MSB	MPT		MZa	MZt	MSB	MPT
TOR	−1.792	−1.1962	.3057	7.8258		−24.6637	−4.1101	.1567	5.1232
FI	−2.6277	−1.0496	.3479	7.888		−21.8082	−4.5576	.1442	3.3834
IQ	−1.9655	−1.733	.2914	8.6769		−18.4287	−4.7	.1292	4.6921
EQ	−2.0994	−.8912	.3569	8.6497		−19.6062	−5.5902	.1534	3.7751
TO	−2.0167	−1.7	.3193	7.6499		−19.8258	−4.5359	.1591	3.5683
FDI	−1.7075	−.7233	.3155	8.7107		−17.1099	−4.925	.1456	4.6622
Asymptotic critical values: Ng and Perron (2001), table 1					1%	−23.8	−3.42	.143	4.03
					5%	−17.3	−2.91	.168	5.48
					10%	−14.2	−2.62	.185	6.67

TABLE 6 Results of combined cointegration test.

	EG-JOH		EG-JOH-BO-BDM	
Model	Statistics	CV	Statistics	CV
$TOR = \int FI$	14.744	11.229	36.861	21.931
$TOR = \int FI, GG$	10.928	10.895	24.468	21.106
$TOR = \int FI, GG, EQ$	11.259	10.637	24.142	20.486
$TOR = \int FI, GG, EQ, FDI$	10.774	10.576	21.325	20.143
$TOR = \int FI, GG, EQ, FDI, TO$	10.774	10.419	20.935	19.888

TABLE 7 Results of long-run cointegration-linear and non-linear framework.

Approach	Model	$F_{overall}$	t_{DV}	F_{IDV}
ARDL	$TOR \int FI, GG, EQ, FDI, TO$	11.203***	-5.69***	8.688***
Non-Linear ARDL	$TOR \int FI^{+}, FI^{-}, GG^{+}, GG^{-}, EQ^{+}, EQ^{-}, FDI, TO$	12.062***	-4.857***	8.76***

development. According to financial inclusion elasticity, it is assumed that a 10% growth in financial inclusion, that is, access to financial services, will boost tourism development by 1.0173%. A study suggests that financial services.

4.1.2 For long-run asymmetric assessment

Table 9 exhibited the results of asymmetric coefficients for the long-run and short-run assessment. The study has implemented the standard Wald test in assessing the asymmetric association between independent variables, including environmental sustainably, good governance, financial inclusion, and tourism development, with a null hypothesis of symmetric association. Concerning the test statistics, (W_{LR}^{ES} = 6.631; W_{LR}^{GG} = 7.224; and W_{LR}^{FI} = 12.145), all the test statistics are statistically significant at a 1% level, confirming the asymmetric association between target variables and tourism development.

The asymmetric shocks that are positive and negative innovation in environmental quality, more precisely increases (decreases) carbon emission in the ecosystem, has revealed a negative (negative) linkage with tourism development, indicating that environmental degradation and adversity deteriorate the speed of tourism development. In particular, a 10% increase (decrease) in carbon emission results in degradation (development) in tourism development by .5491% (1.3639%), suggesting that environmental protection for ecologically balanced offer a conducive ambiance for tourism development. According to the asymmetric coefficients of good governance, measured by governmental effectiveness, positive (negative) variations in good governance established a positive (positive) connection with tourism development, implying that attracting international tourists for tourism development is essential to offer stability to the economy. Particularly, a 10% development (degradation) of governmental effectiveness results in tourism development (degradation) by 1.2687% (1.3431%); in terms of the asymmetric nexus between financial inclusion and tourism development, the study disclosed a positive, statistically significant association between them. Specifically, 10% positive (negative) innovations in financial inclusion augmented (reduced) the movement of tourism development by .3077% (.6369%). Study findings suggest that expansion of financial services in the financial system opens an avenue to get financial services and benefits with ease; the access to financial services prompts financial image in the mind of international tourists, eventually leading to tourism development.

The study has implemented the standard Wald test in assessing an asymmetric association between independent variables, including environmental sustainably, good governance, financial inclusion, and tourism development, with a null hypothesis of symmetric association. Concerning the test statistics, it is apparent that all the test statistics are statistically significant at a 1% level, indicating the confirmation of asymmetric association between target variables and tourism development.

4.1.3 Short-run symmetric assessment

Refers to the short-run elasticities of the independent variables, the study documented adverse effects running from carbon emission to tourism development (a coefficient of-.1039), positive influences from good governance (a coefficient of .0162), and financial inclusion (a coefficient of .1017) and all the coefficient are statistically significant at a 1% level. Study findings suggest that tourism development in Bangladesh will experience development due to a 1% change in carbon emission by −.1039%, good governance accelerates by .0162%, and financial inclusion prompts by .1017%, respectively. The error correction term revealed negative statistically significant (a coefficient of −.3841), explaining the correction of disequilibrium due to shocks in the short-run at a speed of 38.41% per year; alternatively, the long-run equilibrium can be reached in 2.603 years.

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TABLE 8 Results of long-run coefficients: symmetric and asymmetric assessment.

	Symmetric assessment			Asymmetric assessment		
	Coefficient	t-stat	Std. error	Coefficient	t-stat	Std. error
EQ	−.1347	.004255	-31.6282			
EQ^{+}				−.05491	.010802	−5.08313
EQ^{-}				−.13639	.010038	−13.5878
GG	.0162	.002597	6.25864459			
GG^{+}				*.12687*	*.005463*	*23.22352*
GG-				*.134313*	*.004621*	*29.06574*
FI	.1017	.003354	29.84713775			
FI^{+}				.03077	.00477	6.4508
FI^{-}				.06369	.01191	5.3459
FDI	.0672	.0025	25.9764	.07555	.00308	25.1183
FD	.0879	.00918	9.6296	.051848	.006639	7.80961
W_{LR}^{ES}				6.631		
W_{LR}^{GG}				7.224		
W_{LR}^{FI}				12.145		

4.1.4 Short-run asymmetric assessment

A short-run asymmetric association between independent variables, including environmental sustainably, good governance, financial inclusion, and tourism development with a null hypothesis of symmetric association, has been investigated using the standard Wald test. For the test statistics, (W_{SR}^{ES} = 11.531; W_{SR}^{GG} = 10.656; and W_{SR}^{FI} = 8.9413), it is apparent that all the test statistics are statistically significant at a 1% level, indicating the validation of an asymmetric association between target variables and tourism development. The error correction term was negative and statistically significant (a coefficient of −.1608), implying the long-run disequilibrium to be corrected at a speed of 16.08% per year.

Inferring the elasticity of carbon emission on tourism development, the study established asymmetric shocks of environmental sustainability negatively tied with tourism development, and the coefficients are statistically significant. Additionally, the asymmetric coefficients of governmental effectiveness unveiled a positive and statistically significant association with tourism development in Bangladesh. The asymmetric variation of financial inclusion established a similar vine of relations like governmental effectiveness.

4.2 The mediating role of financial inclusion and good governance through environmental sustainability

Next, we moved the empirical investigation with the inclusion of interactive terms for investigating the mediating effects of financial inclusion and good governance. The result of the symmetric, asymmetric assessment with interactive terms is displayed, in Table 10. For symmetric assessment, the coefficient of interactive term between environmental sustainability and good governance (a coefficient of .0917) and environmental sustainability and financial inclusion (a coefficient of .0322) have revealed positive and statistically significant, suggesting the mediating role of good governance and financial inclusion. In terms of asymmetric assessment, the study exposed the asymmetric innovation in interactive terms, that is, the positive and negative variations revealed positively associated with tourism development, especially in the long run.

4.3 Causality test

To document the long-run causal association, the study implemented the non-granger causality test following. The result of the causality test is displayed in Table 11. The study has implemented the non-granger causality framework offered by Toda and Yamamoto (1995) for directional causal assessment, and the results are displayed in Table 11. According to the test statistic from causal assessment, the study documented two vain of association that is bidirectional and unidirectional. For bidirectional causal effects, the study established feedback hypothesis holds in explaining the causal relations between tourism development and good governance (TOR←→GG); tourism development and environmental sustainably (TOR←→ES); financial inclusion and tourism development (FI←→TOR). Furthermore, the study unveils unidirectional causality running from foreign direct investment to tourism development (FDI→TOR) and tourism–led financial development (TOR→FD).

4.4 Robustness test

The study implemented Dynamic OLS, Fully modified OLS, and CCR regression to evaluate the empirical model construction

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TABLE 9 Results of short-run coefficients: symmetric and asymmetric assessment.

	Symmetric assessment			Asymmetric assessment		
	Coefficient	Std.error	T-stat	Coefficient	Std.error	T-stat
EQ	−.1039	.010994	−9.4571			
ES^{+}				−.0501	.0052	
ES^{-}				−.0335	.0079	
GG	.1072	.0053	20.1615			
GG^{+}				.0169	.0046	3.6739
GG-				.0454	.0078	5.8205
FI	.0817	.0033	24.6158			
FI^{+}				.0467	.0076	6.1447
Fi^{-}				.0423	.0039	10.8461
FDI	.0220	.0089	2.4709	.0107	.0065	1.6461
FD	.0710	.0053	13.2711	.0066	.0104	.6346
ECT (-1)	−.3841	.0388	−9.899	−.1608	.002632	−61.0946
Constant	−6.280786	.5007	−12.5440	−1.24555	1.0423	−1.1951
W_{SR}^{ES}				11.531		
W_{SR}^{GG}				10.656		
W_{SR}^{FI}				8.9413		
x_{Auto}^{2}	.869			.618		
x_{Het}^{2}	.655			.836		
x_{Nor}^{2}	.692			.789		
x_{RESET}^{2}	.513			.72		
CUSUM	Stable			Stable		
CUSUM Of Square	Stable			Stable		

consistency and efficiency in estimation. Table 12 exhibited the results of the robustness assessment. According to the sign of the study explanatory variables, the estimation confirmed the same vine of association between explanatory variables: environmental sustainability, financial inclusion, good governance, and tourism development. More specifically, good governance and financial inclusion are positively associated, and carbon emission reveals an adverse tie with tourism development, which aligns with symmetric and asymmetric estimation assessment.

5 Discussion

The study documented a negative and statistically significant linkage between environmental sustainably and tourism development, implying that carbon emission adversely causes tourism development. In terms of symmetric (asymmetric) investigation, the study suggested that a 1% reduction in carbon emission positively affects tourism development by .1039% (.0335%). The study advocated that a controlled environment through carbon emission reduction can contribute to tourism. Our findings align with the existing literature (Ahmed and Laijun, 2014; Tong et al., 2022). Geographical aspects some physical factors, for instance, the location's geography and climate, the amenities offered there, and the marketing and advertising campaigns run by the tourism industry, affect the decisions that travelers make. However, it is vital to maintain the natural environment tourists visit, including natural habitats and local wildlife that is sometimes unique worldwide. As a result, a portion of tourist earnings is used to conserve the visited basic biological ecosystems. Pollution can reduce the appeal of natural elements such as stunning landscapes, natural hydrologic systems, clean water, pure air, and animal variety (Gössling et al., 2013). The competitiveness of most types of tourist destinations depends on maintaining a high degree of overall environmental quality, making it a top priority for destination management. There are many countries around the world where tourism generates significant revenue. The most visited tourist destinations of the world have one feature in common that sets them apart from other destinations: cleanliness. (Alam et al., 2022b).

TABLE 10 Results of Mediation assessment.

Long-run cointegration							
		$F_{overall}$	t_{DV}	F_{IDV}			
ARDL		14.222***	−5.712***	6.644***			
NARDL		6.394***	−5.236***	7.501***			
Panel –B: Long-run coefficients							
	Coefficient	t-stat	Std.error		Coefficient	t-stat	Std.error
LONG RUN							
EQ	.022702	.002999	7.569857	EQ^{+}	*.028658*	*.010834*	*2.645191*
GG	−.10091	.007838	−12.8749	EQ^{-}	*.04785*	*.011707*	*4.087281*
FI	.05114	.009504	5.380882	GG^{+}	*−.12962*	*.003482*	*−37.2246*
FDI	.106394	.003534	30.10591	GG-	*−.09212*	*.011945*	*−7.71192*
FD	.094855	.006539	14.50599	FI^{+}	.064228	.002442	26.30147
				Fi^{-}	.036994	.004128	8.961725
				FI*ES	.056853	.007251	7.840712
				GG*ES	.071946	.011382	6.321033
				FI*ES	.075048	.010955	6.850571
				FI*ES	.051158	.005525	9.259367
GG*ES	.09178	.005734	16.00635	FDI	.027847	.011136	2.500629
FI*ES	.032221	.007164	4.497613	FD	.069324	.007033	9.85696
C	−.09542	.007173	-13.3032	C	−.0658	.002232	−29.4821
W_{LR}^{ES}					3.851		
W_{LR}^{GG}					6.525		
W_{LR}^{FI}					5.489		
$W_{LR}^{ES\$\ GG}$					12.882		
W_{LR}^{ES8FI}					13.656		
Panel –C: Short-run coefficient							
EQ	.0289	.0097	2.9793	EQ^{+}	*−.0185*	*.0106*	*−1.7452*
GG	.0338	.0051	6.6274	EQ^{-}	*−.0587*	*.0028*	*−20.9642*
FI	.0249	.0024	10.375	GG^{+}	*.015*	*.0094*	*−1.5957*
FDI	.0919	.0103	8.9223	GG-	*.0337*	*.0083*	*−4.0602*
FD	.0108	.0025	4.32	FI^{+}	*.0158*	*.0096*	*1.6458*
				Fi^{-}	*.0455*	*.0038*	*11.9736*
				$FI*ES^{+}$	*.0039*	*.0056*	*.6964*
				$GG*ES^{-}$	*.0057*	*.0032*	*1.7812*
				$FI*ES^{+}$	*.0176*	*.0089*	*1.9775*
GG*ES	.0103	.0042	2.4523	$FI*ES^{-}$	*.026*	*.0092*	*2.826*
FI*ES	.0956	.0115	8.313	FDI	*.01*	*.0059*	*1.6949*
				FD	−.24805	.002695	−92.0419

(Continued on following page)

TABLE 10 (*Continued*) Results of Mediation assessment.

Long-run cointegration							
		$F_{overall}$	t_{DV}	F_{IDV}			
Short-run symmetry test							
W_{SR}^{ES}					8.786		
W_{SR}^{GG}					11.952		
W_{SR}^{FI}					5.511		
$W_{SR}^{ES\$\,GG}$					5.452		
W_{SR}^{ES8FI}					4.777		
Residual Diagnostic test							
x_{Auto}^2	.582				.672		
x_{Het}^2	.746				.715		
x_{Nor}^2	.891				.611		
x_{RESET}^2	.698				.672		

TABLE 11 Results of the Toda-Yamamoto casualty test.

	TOR	GG	EQ	FI	FDI	FD	Causalities
TOR		6.744*	10.748***	7.186*	10.931***	5.553	GG←→TOR; ES←→TOR; FI←→TOR; FDI→TOR; TOR→FD; ES→GG; FDI→GG; FD→GG; ES→FDI; FDI→FI
GG	7.048*		6.592*	3.156	10.337***	9.615**	
EQ	8.944**	1.143		0.5	4.637	9.201**	
FI	9.867**	7.18*	1.484		7.914*	4.73	
FDI	2.206	5.493	7.242*	2.125		2.613	
FD	6.419*	5.458	3.26	1.528	1.624		

TABLE 12 Results of the coefficients robustness test.

	OLS			Fully-modified OLS			CCR		
Variables	Coefficient	Std	t-stat	Coefficient	Std	t-stat	Coefficient	Std	t-stat
FI	.1063	.0509	2.0884	.1246	.0605	2.0595	.1379	.0254	5.4291
ES	−.1714	.0772	−2.2202	-.1844	.0365	−5.052	−.1816	.0212	−8.566
GG	.1102	.0237	4.6497	.1684	.0991	1.6992	.1478	.0546	2.7069
FDI	.0842	.0689	1.222	.047	.0115	4.0869	.0862	.095	.9073
FD	.1431	.0837	1.7096	.073	.0121	6.033	.1804	.0195	9.2512

Our study findings established a positive and statistically significant association between financial inclusion and tourism development, validated under both symmetric and asymmetric assessment. Study findings advocate that easy access to financial services offers efficiency in a financial settlement, especially in the case of currency conversion and electronic money transfer in rendering tourism services. The study findings are supported by the literature such as (Shi et al., 2020; Gopalan and Khalid, 2022; Xia et al., 2022). Innovation and financial inclusion are closely intertwined. Increased financial inclusion fosters greater levels of

firm innovation. The tourism industry is getting increasingly competitive; therefore, businesses must provide innovative goods and services. The ability of these businesses to innovate and provide better customer service can therefore be improved by expanding financial inclusion. The rise of promising entrepreneurs in the economy ensures development in the tourism sector. To meet their capital needs, entrepreneurs depend on the financial service industry. Increased access to financial services can stimulate entrepreneurial endeavors. Financial inclusion can promote enterprise growth and a culture of entrepreneurship in the tourism industry, resulting in increased supply and demand for tourism services. From the tourist's standpoint, a higher level of financial inclusion is crucial in the destination. The presence of banks and ATMs are fundamental financial services that contribute to the expansion of tourism (Qamruzzaman and Wei, 2019b; Yang et al., 2021). Increasing the accessibility and utilization of financial services could help provide the right environment for generating higher domestic tourism spending by attracting more tourists and stimulating domestic travel and tourism consumption. Increased financial inclusion can also reduce the tourism industry's excessive risk through the availability and accessibility of insurance and hedging alternatives. Financial inclusion is crucial to enhancing both local and international tourism. As a result, the nation's policymakers should focus on building a strong and resilient financial services industry (Singh, 2022).

Good governance revealed a positive and statistically significant linkage with tourism development in the long-run and short-run assessment under a linear framework. Furthermore, asymmetric assessment established that asymmetric shocks of good governance are positively tied to long-term and short-term tourism development. Our findings align with the existing literature (Kazemian et al., 2021; Khanna and Sharma, 2021; Mishra et al., 2021; Li and Qamruzzaman, 2022a). A country's ability to attract visitors and generate tourism revenue affects its government's standards. The fact that the results are compatible with not just one but two main hypotheses is an important finding. According to theoretical research findings in the tourism industry, offering high-quality public services and amenities is crucial in luring tourists. Second, the quantity of money spent by foreign tourists is positively impacted by the public's confidence in the government's ability to implement policies that promote the growth of the private sector. Good governance is when a government performs all of its duties without corruption or discrimination and within the bounds of the law (Daryaei et al., 2012; Phong, 2014). In every type of planning and decision-making, public institutions, the commercial sector, other civil society organizations, and individuals maintain the right process, method, and management. Good governance is a positive indicator of a nation's health and improves citizens' quality of life (Detotto et al., 2021). The traveler also favors visiting a nation with an effective government. It has been demonstrated by various researchers that the development of tourism and good governance indicators are positively correlated (Gao et al., 2022). The traveler wishes to go to a nation where fighting corruption and fostering economic progress is more successful. Traveling to a nation that upholds correct laws and regulations makes them feel safer and more protected (Carrillo-Hidalgo and Pulido-Fernández, 2019a). For instance, Sri Lanka, a country with a significant tourism industry, is going through its worst period due to poor governance.

6 Conclusion and policy suggestions

Tourism–led economic growth has postulated the importance of tourism for economic growth. On the other hand, the adverse effects of tourism, especially on the environment, also have an assessment. However, the study's imputes is to investigate the effects of carbon emission, good governance, and financial inclusion on tourism development in Bangladesh. The long-run and short-run coefficients of environmental sustainability, financial inclusion, and good governance on tourism development has documented through the execution of ARDL (Pesaran et al., 2001) and non-linear ARDL (Shin et al., 2014b). Furthermore, the directional association assess by employing the Fourier TY casualty test.

According to the study findings, it is apparent that environmental sustainability is carbon emission negatively associated with tourism development both in the long-run and short-run assessment. Whereas the positive linkage revealed between financial inclusions, good governance, and tourism development, suggesting easy access to financial services in the financial system and governmental effectiveness act as a catalyst in augmenting tourism development's force. The asymmetric investigation established non-linearity in the empirical model for the long and short-run. In terms of asymmetric coefficients, the study unveiled the positive and negative shocks of environmental sustainability exposed negatively and statistically significant. In contrast, the asymmetric shocks of financial inclusion and good governance established positive and statistically significant Bangladesh tourism development in the long and short-run. The directional causality assessment revealed bidirectional causality running between explanatory variables to tourism development.

Based on the study findings, the following suggestions have focused on further development in Bangladesh tourism. First, the control of environmental adversity has revealed a positive tie with tourism, indicating that reducing carbon emissions in the ecosystem might accelerate tourism contribution. This study advocated environmental policy formulation and effective implementation for reducing carbon emissions into the environment. Second, an effective institution offers a conducive ambiance for business growth. For sustainable growth in the tourism industry, it is imperative to have governmental effectiveness so that international tourists feel confident in their decision to visit. Third, efficient financial intermediation allows easy access to avail financial services by the citizen. Furthermore, the accessibility of existing financial services also entices international tourists to visit the country.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: World development Indicator, International financial statistics.

Author contributions

YI: Conceptualization: Literature Survey: First Draft Preparation. PM: Conceptualization: Literature Survey: Methodology. NF: Data Collection: Literature Survey: First Draft Preparation. MQ: Data Collection, Methodology; Investigation.

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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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