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ECONOMIC GROWTH, FOREIGN DIRECT INVESTMENT, RENEWABLE ENERGY, AND INFLATION: A MULTI-FACTOR ANALYSIS OF TOURISM DEVELOPMENT IN VIETNAM

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ABSTRACT

Understanding the factors that drive tourism growth is essential for crafting effective economic policies. This study explores the factors influencing Vietnam's tourism growth from 1990 to 2020, focusing on economic growth, foreign direct investment in tourism, renewable energy consumption, and inflation. The ARDL bound test, ECM, and Granger causality test were used to analyze these relationships. The results indicate long-term associations between economic growth, FDI, inflation, renewable energy consumption, and tourism development. Economic growth positively impacts tourism growth, while renewable energy consumption negatively impacts it. FDI in tourism does not significantly contribute to overall tourism growth. Inflation also contributes to a decrease in tourism growth. Granger causality tests show unidirectional causality between tourism revenue and economic growth, FDI, inflation, and renewable energy use. This study identifies important determinants of tourism growth in Vietnam and provides policy suggestions. It also highlights directions for future research.

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INTRODUCTION

Tourism is critical to international growth and community strength because it facilitates cultural interchange, creates job opportunities, and promotes sustainable (Liu et al., 2025). Economic growth is important in propelling numerous sectors, with its impact on tourism being particularly significant (Jawaid et al., 2024). Tourism benefits from and contributes to overall economic development as an industry that is strongly linked to economic trends. The relationship between tourism and economic growth has become a crucial study area, particularly in Asian nations (Hoang, 2023).

However, tourism's burgeoning growth affects the environment and poses issues for environmental sustainability (Qamruzzaman, 2025). Intense use of tourism activities has caused greenhouse gas emissions, leading to global warming and degradation (Yuedi et al., 2023). Governments and policymakers are concerned about the tourism industry's significant detrimental effects on environmental quality. The immense process of diverse economic activities leads to natural exploitation and produces a large amount of emissions (Danish & Wang, 2019). Globalization induces flourishing trade, and steady capital flows boost global tourism. Furthermore, the Sustainable Development Goals (SDGs) provide a framework for making efforts that growth is inclusive and sustainable, encouraging travel that promotes economic progress while protecting social and natural resources.

The nexus of economic growth, Foreign Direct Investment (FDI), renewable energy, and inflation in the context of tourism development in Vietnam indicates a complicated link that significantly influences the country's economic landscape (Azam et al., 2018; Godil et al., 2020). Research indicates that FDI can boost economic growth by increasing local capital, facilitating technology transfer, and improving human capital formation (Alfaro et al., 2004; Belloumi, 2014; Jibran et al., 2024; A. Xu et al., 2024). FDI is also essential for boosting economic expansion. According to studies by Jahanger et al. (2022) and Rahman et al. (2024) and Joo et al. (2022) FDI inflows have the potential to boost the nation's GDP and economic expansion. By bringing cutting-edge technologies and expertise to host economies like China, Hong Kong, and Japan, FDI boosts economic growth.

FDI inflows are crucial in financing renewable energy projects in emerging nations like Vietnam, Thailand, and Malaysia (Trung et al., 2025). Furthermore, FDI can help advance renewable energy innovations, strengthen local capacity, and open new markets for renewable energy products and services. Citizens in industrialized countries choose green

products and services promoting renewable energy and environmental protection (Banerjee, 2022; Lu et al., 2023).

Economic growth has been demonstrated to be positively impacted by renewable energy. It implies that economic growth is positively correlated with the amount of renewable energy consumed. Reducing the negative externalities linked to the use of fossil fuels, increasing energy security, and diversifying the energy supply are all ways to promote renewable energy (Khan et al., 2024; Nguyen & Nguyen, 2021). According to Borg et al. (2022) and Pata (2021a, 2021b), renewable energy development can foster creativity, transfer new technology, and support industrial development.

The relationship between economic growth, foreign direct investment inflows, inflation, and renewable energy is examined. In order to comprehend how these aspects interact and influence one another, these topics will summarize the main conclusions from pertinent studies (C. Chen et al., 2022; Tran et al., 2025; Xuan, 2025). The need for more research is highlighted by the fact that, despite the body of research on tourism, economic growth, and environmental variables, there is still a lack of knowledge regarding how these elements interact in Vietnam's tourism industry (Kongbuamai et al., 2020).

Current research identifies two critical gaps; a lack of comprehensive understanding regarding the interconnected impact of economic growth, FDI, renewable energy, and inflation on Vietnam's tourism development in both short and long terms and an absence of studies addressing the country's specific economic challenges and opportunities in this context. This study addresses these gaps through two key research questions: 1) How do economic growth, FDI, renewable energy, and inflation influence Vietnam's tourism development in different regions and segments over time? 2) What challenges and opportunities do Vietnam face in its tourism development, and what policies can effectively address them, considering the complex interplay of these factors?

This study enhances our grasp of tourism development in two crucial ways: (i) by exploring the tourism sector's reliance on economic growth, renewable energy, FDI, and inflation, offering positive insights into drivers of tourism growth, and (ii) by examining the correlation between tourism and environmental degradation through CO2 emissions, aiding in the assessment of environmental impacts and the promotion of sustainable practices. The study innovates by (iii) integrating tourism development with economic, environmental, and financial indicators, offering a holistic

perspective on factors influencing tourism success. Additionally, (iv) focusing on Vietnam as a case study contributes to the limited research on tourism development in Southeast Asia. Methodologically, utilizing the ARDL Bound Test, ECM, and Granger Causality Test, this research bridges existing literature gaps regarding these factors' impact on Southeast Asian tourism.

The structure of the study is as follows: A review of the literature is given in Section 2, and data, economic modeling, and methodology are covered in Section 3. The empirical results, justifications, and robustness checks are presented in Section 4. Policy recommendations are included at the end of Section 5.

LITERATURE REVIEW

Tourism and Economic Growth

Tourism is an important driver of economic growth in many developing and growing countries, including Vietnam (Naseem, 2021; Singh & Alam, 2024). The effective and efficient management of numerous economic sectors and businesses is required to ensure employment, income, and long-term growth—SDG 8 gives a roadmap to doing this. One of the important pillars of growth and development in SDG 8 is its focus on tourism, which is recognized as the fastest-growing industry globally (Wani et al., 2024). In particular, SDG 8.9 highlights how crucial it is to maximize tourism's advantages while maintaining the industry's resilience and sustainability. The goal thus aims to "develop and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products by 2030 in [each country]."

Tourism plays a significant role in preserving the environment, creating jobs, reducing poverty, and boosting the economy. Tourism has significant economic benefits since it creates jobs and revenue while encouraging sustainable habits (Ren et al., 2019; Scheyvens et al., 2021; A. Xu et al., 2024). In addition to boosting revenue, tourism draws in foreign investment, which lowers poverty and deters youth migration in developing nations (Sadekin, 2025).

Balaguer and Cantavella-Jordá (2002) conducted a seminal study that formalized the tourist-led growth hypothesis (TLGH), which links tourism to economic growth. TLGH, which is based on the export-led development hypothesis, proposes that rising tourism drives economic

growth. Most studies support TLGH, demonstrating that tourism has a positive and considerable impact on growth, while the results vary depending on variables such as national data, methodology, and periods. Recent research (Assaf & Tsionas, 2019; Dogan & Zhang, 2023; Isik et al., 2018; Raza et al., 2021; Saayman & Botha, 2017) uses non-linear and non-parametric methods to reveal fresh findings that may contradict existing models. These studies examine the value of tourism using international tourist arrivals, tourist expenditure, or tourist arrivals per citizen, yielding differing conclusions due to the various measurements of tourism development. Another empirical strand of work uses symbolic time series analysis to investigate variations in the relationship between tourism and economic growth (Brida et al., 2020). They discover similar patterns when countries are divided into groups, stressing the importance of tailoring models to specific groups.

The hypothesis that tourism significantly boosts economic growth is continuously supported by research conducted in various geographical areas. Increases in indicators connected to tourism and GDP growth are strongly correlated, according to empirical data. For instance, Colak and Lu (2022) discovered that in nations participating in the Belt and Road Initiative, a 1% increase in tourism revenue corresponds to a 0.15 percentage point gain in GDP. Similar findings were published by Khanal and Khanal (2022), who discovered that a 1% increase in tourist arrivals in Nepal translates into a 1.15% increase in GDP, and Al-mulali et al. (2014), who noted a long-term beneficial influence of tourism earnings on GDP in Middle Eastern countries.

Other studies from different regions, such as Europe (Paci & Marrocu, 2014), the Caribbean (Cannonier & Burke, 2019), and Italy (Colacchio & Vergori, 2023), also emphasize the beneficial effects of tourism on regional economic growth. Studies from India, where tourism significantly boosts economic growth and revenue production, provide evidence of this wider benefit (Godara & Fetrat, 2022). This perspective is further supported by Gong and Chen (2023), who demonstrate how financial development and green growth encourage sustainable tourism in ASEAN economies. In a similar vein, Wang and Zhao (2024) stress the significance of improved tourism and logistics coordination in order to attain superior economic development in China's Anhui Province. Furthermore, Chen et al. (2024) highlight the dynamic importance of tourism in economic growth by demonstrating how well digital travel vouchers increased tourism in China during the COVID-19 epidemic. This corpus of work demonstrates tourism's important role in propelling

economic expansion, especially in emerging nations. It indicates a consistently favorable but regionally diverse relationship between tourism and economic development.

Tourism contributes significantly to global economic growth and foreign exchange revenues (Brida & Risso, 2010). Extensive research has investigated the complex relationship between tourism and economic growth, supporting the tourism-led growth hypothesis and bidirectional relationships between the two (Perles-Ribes et al., 2017). Studies examining this relationship in various countries reveal diverse causal patterns, ranging from unidirectional to bidirectional relationships between tourism development and economic growth (Naseem, 2021) Several studies have emphasized the positive contribution of tourism to GDP growth, capital formation, and overall economic growth (Sequeira & Nunes, 2011). Studies based on Romanian data and Italian data have also confirmed the growth-led tourism hypothesis (GLTH) in the long run (Nathaniel & Khan, 2020). Despite the extant literature, there remains a research gap that warrants more exploration, particularly in the context of Vietnam. A new study strategy is required to bridge this gap and investigate the specific dynamics of tourism and economic growth in Vietnam.

Tourism and FDI

Due to globalization, FDI has made major contributions to economic progress and transformation in recent decades (Adeleye et al., 2022). FDI promotes the transfer of foreign assets, technology, and skills, increasing productivity and competitiveness in host countries. This influx of cash boosts economic growth and promotes job creation and infrastructure development, making it an essential component of modern economies (Zvezdanovic Lobanova, 2024).

The relationship between FDI and tourism is complex, with far-reaching ramifications for economic growth across multiple regions. According to research, there is a bidirectional causal relationship between FDI and tourist development, which means that increasing FDI can improve tourism infrastructure and services. In contrast, a thriving tourism sector can attract more FDI. This dynamic is evident in regions like Africa and Asia, where stable political environments and economic progress are critical for fostering the relationship. Studies show a significant positive relationship between FDI inflows and tourism development, particularly in Africa, where political stability and economic growth are vital for attracting investments (Adeola & Evans, 2020). In Asia, FDI has been related to

increased foreign tourist departures, demonstrating that tourism investment can result in more visitors (Paul et al., 2022). Tourism variables, such as receipts and arrivals, are crucial for improving the favorable benefits of FDI on economic growth, particularly in upper-middle-income nations (Bayram et al., 2023). The ASEAN area illustrates that both FDI and tourism arrivals contribute significantly to economic growth, emphasizing the necessity of a strong tourism sector to attract investment (Azam et al., 2020).

Studies of well-known tourist sites show that technological progress and globalization are also significant elements that increase the allure of locations for foreign direct investment and tourism (Jabeen et al., 2024). On the other hand, although FDI has the potential to boost tourist and economic expansion, it can also result in environmental deterioration. Hence, a balanced approach to development is required, giving sustainability equal weight with economic goals (Azam et al., 2020).

Several studies have explored the relationship between FDI and tourism, revealing bidirectional and causal links between FDI, tourism, and economic growth (Lee, 2021). Studies on tourism-FDI relationships vary. (Salleh et al., 2011) found that tourism affects FDI in Malaysia and Thailand, not Hong Kong. Samimi et al. (2013) noted a long-run link in developing countries. Chen and Chen (2017) found that increased tourism boosts FDI in China. However, Khoshnevis Yazdi et al. (2017) found no causal link in 27 EU countries. Adeola et al. (2020) found only long-term reciprocity in Africa. Despite numerous studies on the relationship between FDI and tourism in various countries, no specific study has been conducted in Vietnam. As a result, this study is required to explore the influence of FDI on tourism in Vietnam.

Tourism and Renewable Energy

Tourism and energy are two variables that have recently drawn the attention of academics in the environmental literature. Energy has become a vital component of economic expansion. Every nation's economic activity is driven by energy. In fact, statistics records reveal that carbon dioxide emissions from energy usage and industrialization represented nearly 89% of total greenhouse gases from the energy sector in 2021(IEA, 2021). The majority of energy used worldwide comes from fossil fuels. The empirical result of IEA (2025) advocated that carbon dioxide emissions rose with overall energy use. Another study undertaken by Abokyi et al. (2019) revealed that fossil fuels positively impact Carbon dioxide emissions.

Furthermore, it has been noted that carbon dioxide emissions are increased by energy intensity (Namahoro et al., 2021) and power consumption (Rahaman et al., 2022).

Energy is an essential commodity for economic activity and cannot be omitted despite its impact on carbon dioxide emissions and environmental health (Mitić et al., 2023; Ongan et al., 2023). In this light, incorporating renewable energy sources has been widely accepted in many industries. Globally, tourism consumption of its product and services immensely contributes CO2 emissions through intensive energy consumption (Solarin, 2014). Tourism couples with tremendous pressure from energy use, leading to environmental catastrophe (Agyeman et al., 2022; Ehigiamusoe et al., 2023).

Though tourism and economic growth are positively correlated (Tian et al., 2021), other studies point out that tourism-related activities significantly negatively influence the environment (Zhang & Yang, 2023). Adopting renewable energy is considered a potential solution to mitigate the tourism sector's environmental impact (Yuedi et al., 2023). Despite the tourism industry contributing 5% to global greenhouse gas emissions, a research gap exists in understanding the environment's relationship with tourism, particularly compared to studies on GDP and energy (Mehmood et al., 2021). Bridging this gap is crucial as countries strive for sustainable growth in their tourism industries worldwide.

Tourism and Inflation Rate

Tourism is one of the world's largest and fastest-growing sectors (Badulescu et al., 2020). It stimulates economic growth by producing jobs, earning foreign exchange, and encouraging infrastructural development. Tourism is a "currency-earning sector" that promotes innovation and development. It connects to other industries, causing a ripple effect (Badulescu et al., 2020). International tourism creates foreign cash, improving the balance of payments and allowing for modern technology procurement. Tourism also encourages investment in new infrastructure and increases competition, leading to job creation and overall living standards.

Galí and Gertler (1999) describe inflation as a prolonged increase in general prices that reduces the purchasing power of money. While it can stimulate economic activity, maintaining optimal inflation levels is crucial for sustainable growth. Central banks employ monetary policies, like interest rate adjustments, to manage inflation. The inflation rate affects

tourism development in different ways, such as deciding the cost of travel, consumer spending power, exchange rates in currency, and tourism growth stability leading to decreased travel demand and investment in tourism (Athari et al., 2021; Meo et al., 2018; Naidu et al., 2017).

The relationship between tourism revenues, inflation, and economic growth has also been explored. Countries experiencing inflation may attract more tourists, subsequently increasing tourism revenues. This study investigated the indirect connection between tourism revenues, inflation, and economic growth. High inflation can adversely affect the hotel, entertainment, and tourism industries, leading to increased operational costs and potential losses for electric companies. Conversely, low inflation may result in falling interest rates, which may not benefit investment portfolios (Pham-Do & Pham, 2020). To mitigate these risks, effective risk assessment and control mechanisms are essential.

Hypothesized Relationships

From the literature review, some hypotheses are formed as follows:

H1: Economic growth positively impacts tourism development in Vietnam.

H2: FDI in tourism has a significant direct effect on tourism growth.

H3: Renewable energy consumption positively impacts tourism growth.

H4: Inflation negatively influences tourism growth.

METHODOLOGY

Theory-based development

Two main theories can be used to understand the relationship between tourism and economic growth: the Economy-Driven Tourism Growth (EDTG) by Eugenio-Martin et al. (2008) and the Tourism-Led Growth (TLG) offered by Balaguer and Cantavella-Jordá (2002).

Growth Driven by Tourism asserts that the growth of the tourism industry significantly contributes to economic expansion (Shahzad et al., 2017). According to this hypothesis, a nation can experience significant economic gains by drawing tourists. These advantages include producing foreign exchange profits, opening job opportunities, and boosting different economic sectors, including retail, hospitality, and transportation. The influx of revenue from tourism activities is believed to contribute significantly to overall economic expansion (Comerio & Strozzi, 2018;

Seghir et al., 2015). Tourist spending on accommodations, local products, and services circulates throughout the economy, potentially resulting in more investment, infrastructure development, and higher living conditions for the local population (Seghir et al., 2015). Regions with less developed economies, larger economic sizes, and broader geographic territories are more likely to see tourism-driven growth (Lin et al., 2018). Thus, the TLG theory contends that tourism can be a significant driver of economic development, particularly in developing countries.

The TLG hypothesis highlights tourism's importance in encouraging economic growth. In contrast, the Economy-Driven Tourism Growth (EDTG) hypothesis suggests that a country's economic development is vital in nurturing tourism growth (Cárdenas-García et al., 2024). In order to support a flourishing tourism industry, economies tend to invest in crucial infrastructures (Rehman Khan et al., 2017). Additionally, economic expansion frequently results in higher government expenditures for marketing and tourism promotion, which can significantly raise a nation's profile in the international travel industry (Eugenio-Martin et al., 2008).

The Framework

Based on the literature review, theories, and hypothesis relations, the conceptual framework can be represented diagrammatically as follows in Figure 1:

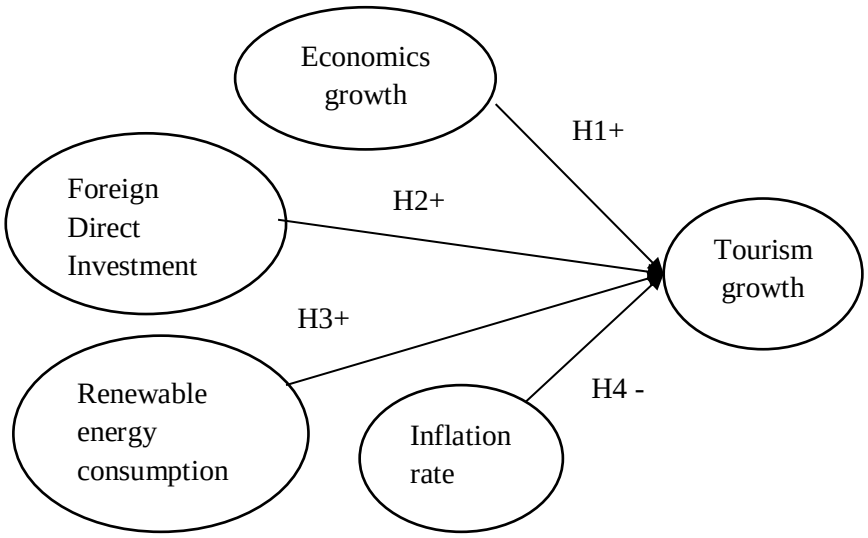

Figure 1. *Conceptual framework of the study*

Data and Functions Description

This study aims to examine the influence of economic growth, FDI, renewable energy, and inflation on Vietnamese tourism from 1990 to 2020, with total tourism revenue serving as the primary indicator. Data is based on accurate tourism statistics from the Ministry of Culture, Sports, and Tourism (2025). The General Statistics Office of Vietnam (GSO, 2024) reports GDP growth, which reflects economic performance. FDI data, which show the relationship between tourism development and investment, are acquired from the same source. Given the critical link between environmental preservation and tourism growth, data on renewable energy usage is obtained from the World Bank. Vietnam's General Statistics Office collects inflation rate statistics, which impacts tourism development differently.

Model

From the literature review and with the intent to conduct a thorough study, we built a model to determine the effects of the above-mentioned variables on tourist growth, as shown in Figure 2. The authors collect and illustrate data describing variables that come from different sources.

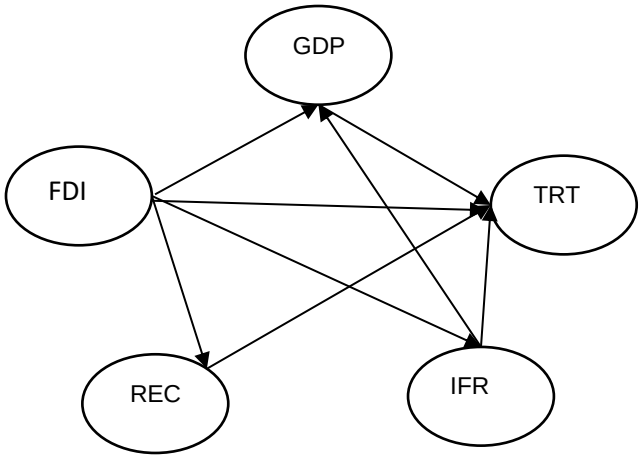

Figure 2. *Initial research model*

$$TRT = f(GDP, FDI, REC, IFR) \quad (1)$$

Equation (1) describes the functional relationship between dependent and independent variables. In this study, the model was converted to a logarithmic form to resolve the difficulties of heteroskedasticity, scale equivalence, data acuity, and autocorrelation.

$$\ln TRT_t = \delta 0 + \delta 1 \ln GDP_t + \delta 2 \ln FDI_t + \delta 3 REC_t + \delta 4 \mathrm{IFR}_t + \varepsilon_t \quad (2)$$

The econometric model is presented in equation (2). The following variables are included: natural logarithm (Ln), GDP, FDI, REC, total tourism receipts (TRT), natural logarithm (Ln), and inflation rate (IFR). The subscript t signifies the time dimension, δ 0 is the intercept term, and δ 1 to δ 4 denote the regressors' elasticities, with εt representing the stochastic error component.

Empirical methodology

The appropriate technique for time series analysis depends on the stationarity of the variables. Standard methods like OLS or VAR models can be used if all variables are stationary. However, if all or some variables are nonstationary, these methods may not be suitable. In such cases, differencing the variables to achieve stationarity can lead to information loss. This also applies to series with a mixed order of integration (Shrestha & Bhatta, 2018).

This research employed the ARDL bound testing approach to analyze the short- and long-term relationships between tourism revenue, economic growth, FDI, renewable energy, and inflation rate. This model was chosen for its ability to capture both short-term and long-term effects simultaneously, its suitability for small samples, its robustness with mixed-order integration variables, and its ability to mitigate potential endogeneity issues (Pesaran et al., 2001).

The ARDL model is as follows:

$$\Delta LnTRT_t = \beta 0_i + \sum_{i=1}^{p} \alpha_i \Delta \ln TRT_{t-i} + \sum_{i=0}^{q} \beta 1_i \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \beta 2_i \Delta \ln FDI_{t-i} + \sum_{i=0}^{q} \beta 3_i \Delta REC_{t-i}$$
$$+ \sum_{i=0}^{q} \beta 4_i \Delta \mathrm{IFR}_{t-i} + \lambda_1 \ln TRT_{t-1} + \lambda_2 \ln GDP_{t-1} + \lambda_3 \ln FDI_{t-1} + \lambda_4 REC_{t-1} + \lambda_5 \mathrm{IFR}_{t-1} + \varepsilon t \quad (3)$$

Where p and q are the dependent and independent variables' respective lag lengths, α is the tourism industry's overall revenue's lag period coefficient, β0 is the intercept, the vector β is the short-run coefficients, λ is the long-run coefficients and ε is the component of the error term.

The comprehensive econometric process consists of three sequential steps: (i) conducting time series unit root analysis, (ii) performing cointegration analysis, and (iii) estimating long-run and short-run elasticities.

Testing Stationary of Time Series

The initial stage of analyzing time series data is the examination of stationarity since regression analysis outcomes can be misleading or inconsistent if a stochastic trend can be seen in the potential regressors. If at least one regressor and the dependent variable show a stochastic trend or no cointegration between both time series, the empirical regression results become spurious and deceptive.

Due to the small sample size (n=30) available for Vietnam, we employed stationarity tests, namely the Phillips and Perron (1988) and Augmented Dickey-Fuller (ADF) tests (Dickey & Fuller, 1979). These tests are exceptionally reliable for large samples but can still be applied to smaller datasets. If our sample size were even smaller, the KPSS test by Kwiatkowski et al. (1992) would be a better option for assessing stationarity. The ADF and PP tests are based on the null hypothesis that the variables have constant mean, auto-covariance, and non-constant variance. The statistical results of these tests allow us to conclude whether the variables are stationary or not.

Johansen Cointegration Test

After determining the stationarity of the time series data, a cointegration test is performed to assess the presence of a long-term relationship between the variables. This test indicates whether the series move together over time, suggesting a stable equilibrium that the economic system gradually converges towards. Even if all variables are integrated in the same order, the Johansen maximum likelihood test (Johansen, 1988) is employed to confirm cointegration.

Autoregressive Distributed Lag (ARDL) Bound Test for the Long Run

The ARDL approach offers several advantages for conducting bounds cointegration tests, particularly its ability to handle issues like evaluating long-term assumptions and endogeneity. It can effectively detect long-term relationships regardless of the integration order of the variables and also provides estimates for both long-run and short-run elasticities. The bounds testing method also offers superior performance compared to multivariate approaches in small samples (Pesaran et al., 2001). Unlike ECM and OLS, the ARDL approach employs unbalanced error correction parameters to assess long-term relationships between variables. This enables its use with the ARDL bounds technique, effectively identifying the long-run

association (Sun et al., 2017). From equation (3), we have a model for the long run as follows:

$$\Delta LnTRT_t = \lambda_{0i} + \lambda_1 \ln TRT_{t-1} + \lambda_2 \ln GDP_{t-1} + \lambda_3 \ln FDI_{t-1} + \lambda_4 REC_{t-1} + \lambda_5 \mathrm{IFR}_{t-1} + \varepsilon t \quad (4)$$

The Wald test, or F-statistics, is crucial in the ARDL test to determine a long-run association between variables. Null hypothesis: No long-run relationship exists among variables. Alternative hypothesis: A long-run relationship exists among variables.

To determine the significance of the calculated F-test, it's compared to critical values based on the assumed order of the explanatory variables: Zero for lower bounds and one for upper bounds. The null hypothesis holds if the F-statistic falls below the lower bound, indicating no long-term relationship. Inconclusive results arise when the F-statistic falls between the bounds. The lag order must be established using the AIC before estimating the long-run specification.

Error Correction Model (ECM) for Short Run

Short-run parameters are derived in the final stage by estimating an error correction model (ECM) associated with long-run estimated parameters. Equation (5) expresses this connection as follows:

$$\Delta LnTRT_t = \beta 0_i + \sum_{i=1}^{p} B_{1i} \Delta \ln TRT_{t-i} + \sum_{i=0}^{q} \beta_{2i} \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \beta_{3i} \Delta \ln FDI_{t-i} + \sum_{i=0}^{q} \beta_{4i} \Delta REC_{t-i}$$
$$+ \sum_{i=0}^{q} \beta_{5i} \Delta \mathrm{IFR}_{t-i} + \lambda ECT_{t-1} + \omega t \quad (5)$$

Where λ represents of error correction term (ECT) and ωt is the error component associated with ECM.

ARDL Diagnostic Test

To ensure a robust and unbiased estimate, the model's goodness-of-fit is measured by R2, aiming for a value close to one. Durbin-Watson statistics assess for autocorrelation (ideal value near two). The Jarque-Bera test evaluates the normality of errors, while the Breusch-Pagan-Godfrey test checks for heteroscedasticity, aiming for a high probability value to support homoscedasticity. Finally, CUSUM and CUSUMQ tests ensure parameter stability across data subsamples.

Granger Causality Test

After analyzing both the independent variables' long- and short-term elasticity, the Granger causality test by Granger (1969) becomes crucial for establishing causal relationships between the time series. This method identifies the nature (positive or negative) of the relationship and whether the dependent variable affects the independent variables, allowing us to determine the causal connections between each variable in this study.

RESULT

Descriptive statistics and correlation matrix

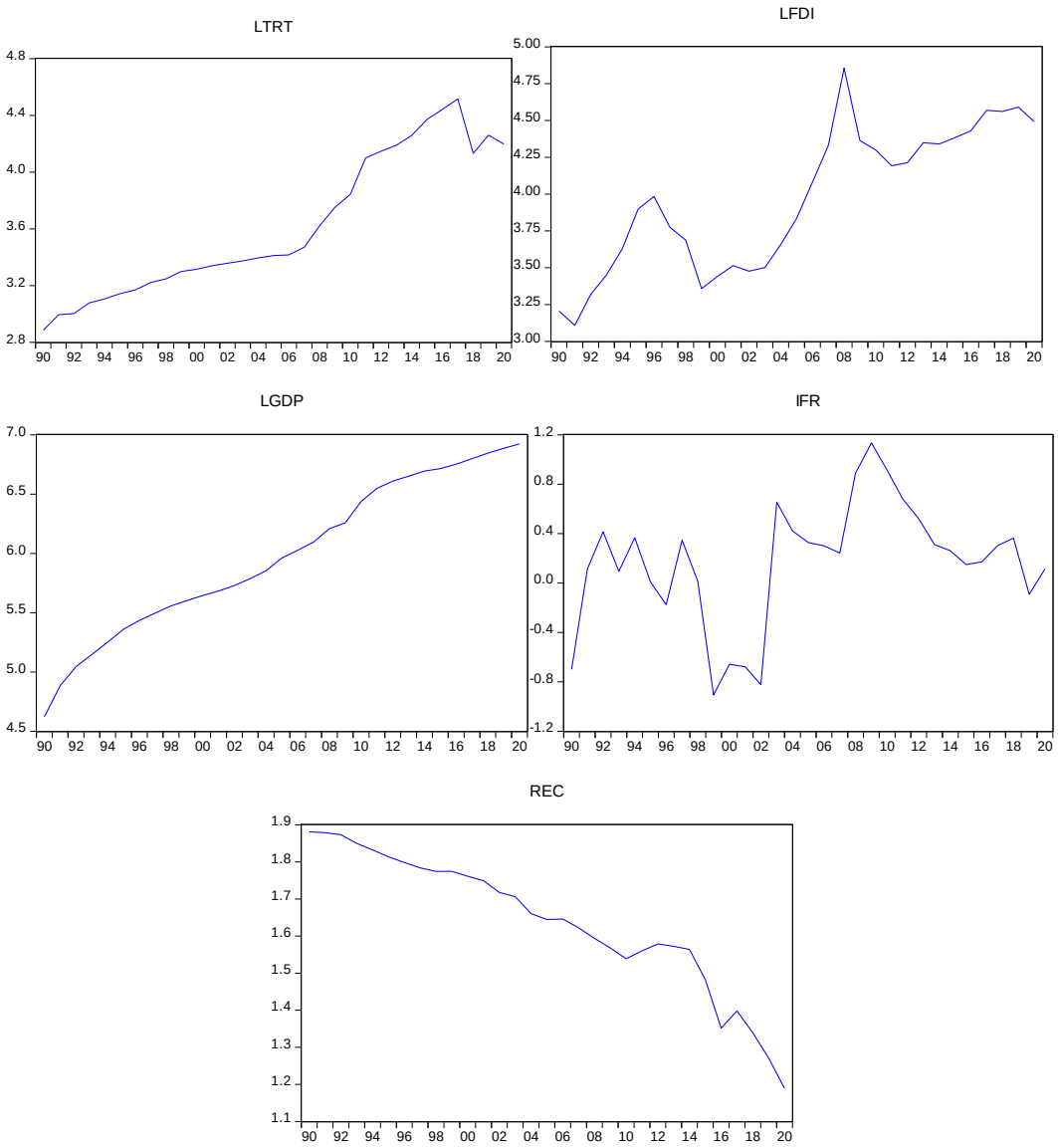

Figure 3. *Trend analysis of analyzed variables. The figure is drawn by the Eviews program*

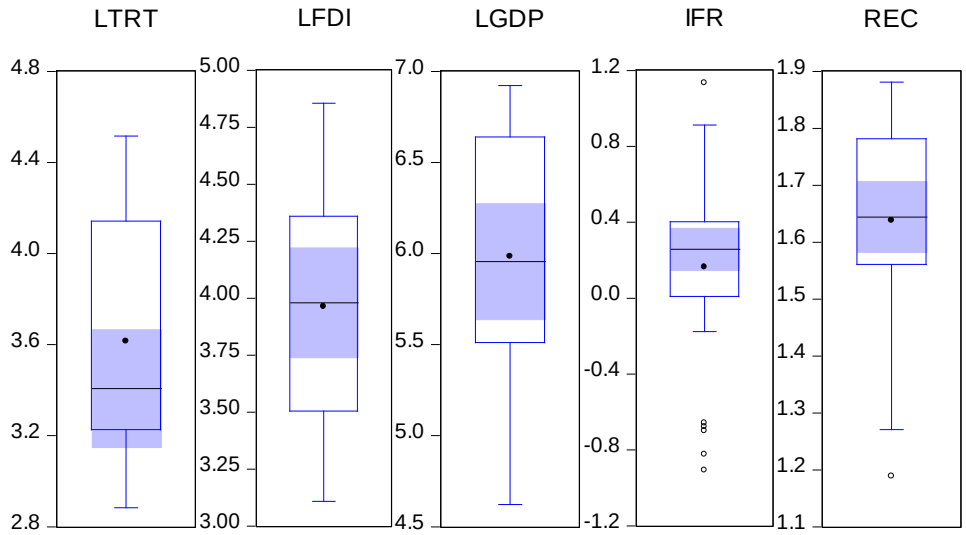

Figure 4. *Box chart summary of selected variables. Note: The Eviews program draws the figure*

The presented data suggests normality and linearity, making the ARDL approach suitable for assessing short- and long-term effects. Stable investment and immediate economic growth are observed, with most variables exhibiting positive skewness except tourism revenue growth. The variables show an upward trend except for the inflation rate and renewable energy consumption. The correlation matrix reveals positive relationships among most variables, with no evidence of multicollinearity. Figure 3 and 4 further summarize these findings visually.

Table 1. *Descriptive statistics*

	LTRT	LGDP	LFDI	REC	IFR
Mean	3.614512	5.984111	3.964168	1.637922	0.164170
Median	3.410918	5.960947	3.983865	1.645913	0.262451
Maximum	4.516219	6.922652	4.855681	1.881280	1.134177
Minimum	2.884094	4.622784	3.108700	1.189116	-0.906578
Std. Dev.	0.500796	0.658140	0.483951	0.185826	0.499950
Skewness	0.401683	-0.193462	-0.071200	-0.687812	-0.532873
Kurtosis	1.715978	1.956095	1.757904	2.721678	2.998016
Jarque-Bera	2.963222	1.600953	2.018977	2.544328	1.467096

Note: The authors analyze the results via Eviews and the Stata program

Tables 1 and 2 provide valuable insights into the state of the tourism industry in Vietnam and the factors that influence it. The data suggests that the industry is growing but is also subject to external factors such as inflation and renewable energy policies. It is important to continue to monitor these trends and develop policies that support sustainable and responsible tourism development in Vietnam.

Table 2. *Correlation matrix (or covariance analysis)*

Variables	LTRT	LGDP	LFDI	REC	IFR
LGDP	0.958657	1.000000			
	[18.14188]	-----			
	(0.0000)	-----			
LFDI	0.820436	0.873290	1.000000		
	[7.727636]	[9.652721]	-----		
	(0.0000)	(0.0000)	-----		
LREC	-0.899773	-0.932476	-0.832591	1.000000	
	[-11.10427]	[-13.90111]	[-8.094841]	-----	
	(0.0000)	(0.0000)	(0.0000)	-----	
LIFR	0.319226	0.373609	0.519374	-0.295216	1.000000
	[1.813998]	[2.169010]	[3.272977]	[-1.663950]	-----
	(0.0800)	(0.0384)	(0.0028)	(0.1069)	-----

Note: The values in [ ] and ( ) denote t-statistic and probability, respectively. The authors analyze the results via Eviews and the Stata program.

Result of Unit Root Tests

Table 3. *Stationary analysis*

Variable	Constant		Constant and trend	
	Level (O)	First difference (I)	Level (O)	First difference (I)
ADF Test statistics				
LTRT	-0.912761	-5.692033*	-1.548913	-5.601030*
LFDI	-1.403038	-4.756866*	-2.112798	-4.719735*
LGDP	-3.608715**	-4.899317*	-1.627759	-4.717952*
IFR	-2.978234*	-6.149335*	-2.850841	-5.998127*
REC	1.890366	-4.464414*	-0.364581	-4.980467*
PP test statistics				
LTRT	-0.916709	-5.690290*	-1.716571	-5.606269*
LFDI	-1.403038	-4.762078*	-2.112798	-4.725192*
LGDP	-2.693005	-5.011359*	-3.480415	-4.696297*
IFR	-3.106167*	-6.209005*	-3.026653	-6.044819*
REC	2.727915	-4.462133*	-0.185450	-4.949303*

Note: *, **, and *** denote significance levels of 1%, 5%, and 10%, respectively. The authors analyze the results via Eviews and the Stata program.

Before analyzing causality in time series, the stationarity of variables must be determined. This study used the widely employed ADF and PP tests to assess the presence of a unit root in the research data series, with results presented in Table 3, including tests with constant and constant linear trends. The empirical analysis reveals that all variables are

nonstationary at level but become stationary at their first difference (I(1)), indicating the suitability of the ARDL test for further analysis. This is consistent with the recommendation of Pesaran et al. (2001), who suggested the ARDL test for models with mixed order of integration.

Results of ARDL Bound Test and Johansen Cointegration Test

This study utilizes the ARDL bound testing technique to analyze the long-run relationship between tourism revenue, economic growth, FDI in tourism, inflation rate, and renewable energy consumption. The estimated F-statistic (Table 4) exceeds the upper bound (at a 1% significance level), rejecting the null hypothesis of no cointegration and confirming the existence of a long-run equilibrium among the variables.

Table 4. *Result of ARDL bound test*

F-Bounds Test		Null Hypothesis: No levels relationship			Cointegration
Test Statistic	Value	Significant	I(0)	I(1)	
F-statistic	5.299687	10%	2.2	3.09	
K	4	5%	2.56	3.49	yes
		2.5%	2.88	3.87	yes
		1%	3.29	4.37	yes

Note: Akaike Information criterion (lag 2), ARDL model (4,4,4,3,3). The authors analyze the results via Eviews and the Stata program.

The optimal lag structure (Table 5) is determined as ARDL (4, 4, 4, 3, 3) based on the AIC criterion. Both the trace test and maximum eigenvalue test statistics indicate statistically significant long-run cointegration relationships, further supporting strong long-run associations between Vietnam's economic growth, foreign direct investment in tourism, inflation rate, renewable energy consumption, and tourism development.

Table 5. *VAR lag order selection criteria*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	19.7394	NA	0.249	-1.01651	-0.780	-0.942
1	161.294	224.535	0.829	-9.05478	-7.640	-8.611
2	207.471	57.323*	2.287*	-10.5153*	-7.922*	-9.703*

* Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error SC: Schwarz information criterion

AIC: Akaike information criterion HQ: Hannan-Quinn information criterion

Note: The authors analyze the results via Eviews and the Stata program.

Result of the Long-Run and Short Run Elasticity Estimate

The ARDL model confirms the cointegration relationship through the ECM, showing a 44.86% annual convergence from short-run to long-run stability (negative sign), as demonstrated in Table 6. The authors have proceeded further to calculate the dynamic impact of regressors on tourism. Long-term estimates are present in Table 7, and Table 8 shows the results of the short-term estimates of variables.

Table 6. *Result of Johansen cointegration test*

Unrestricted cointegration rank test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.872723	113.9251	69.81889	0.0000
At most 1 *	0.691931	54.14472	47.85613	0.0114
At most 2	0.400940	19.99921	29.79707	0.4229
At most 3	0.160986	5.139798	15.49471	0.7938
At most 4	0.001705	0.049498	3.841466	0.8239
Unrestricted cointegration rank test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.872723	59.78038	33.87687	0.0000
At most 1 *	0.691931	34.14551	27.58434	0.0062
At most 2	0.400940	14.85941	21.13162	0.2989
At most 3	0.160986	5.090301	14.26460	0.7304
At most 4	0.001705	0.049498	3.841466	0.8239
* Denote rejection of the hypothesis at the 0.05 level				

Note**:** The authors analyze the results via Eviews and the Stata program

Table 7. *Result of ARDL in the long run*

Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	2.334221	0.778806	2.997181	0.0401**
LFDI	0.678641	0.323935	2.094990	0.0422**
REC	6.656368	2.958747	2.249725	0.0377**
IFR	-0.282920	0.225434	-1.255006	0.0278**
C	-24.58409	10.61188	-2.316657	0.0814**
EC = LTRT - (2.3342*LGDP + 0.6786*LFDI + 6.6564*LREC -0.2829*LIFR -24.5841)				

Note: * refers 1%, ** refers 5%, and *** refers 10% level of significance. The authors analyze the results via Eviews and the Stata program

The long-run ARDL results demonstrate that economic growth significantly and positively affects tourism revenue, with a coefficient of 2.33%. This suggests that a 1% increase in GDP growth leads to approximately a 2.33% increase in tourism receipts. The magnitude of this elasticity implies that Vietnam's tourism sector is highly responsive to

economic expansions, which aligns with findings in other emerging economies but shows a stronger sensitivity compared to countries like Thailand or Malaysia, where tourism elasticities typically range between 1.5% and 2.0%. Interestingly, renewable energy consumption exhibits a large positive elasticity (6.65%), indicating that renewable energy initiatives could strongly enhance Vietnam's attractiveness to eco-conscious tourists. However, the unusually high magnitude warrants cautious interpretation, as it could reflect both genuine growth effects and unobserved factors such as government subsidies or large-scale energy-tourism projects. FDI also positively affects tourism in the long run, albeit in a smaller way (0.67%). At the same time, inflation negatively impacts tourism growth, confirming the expectation that rising prices erode tourism competitiveness.

Table 8. *Short run dynamic relationship results of ARDL – ECM*

Variable	Coefficient	Std. Error	F? t-Statistic	Prob.
D(LGDP)	1.068182	0.347534	3.073601	0.0372**
D(LFDI)	0.006247	0.033385	0.187119	0.0307**
D(REC)	0.025412	0.150427	0.168934	0.0040 *
D(IFR)	-0.006046	0.015002	-0.402990	0.0076 *
CointEq(-1)	-0.448699	0.080529	-5.571874	0.0051 *
R-squared	0.980850	Mean dependent var		0.041475
Adjusted R-squared	0.944677	S.D. dependent var		0.104108
S.E. of regression	0.024487	Akaike info criterion		-4.346618
Sum squared resid	0.005397	Schwarz criterion		-3.482727
Log likelihood	76.67934	Hannan-Quinn criter.		-4.089738
F-Statistics	2.299687	Durbin-Watson stat		2.232047
Prob (F-statistics)	0.000000			

Note: * refers 1%, ** refers 5%, and *** refers 10% level of significance. The authors analyze the results via Eviews and the Stata program

Short-run dynamics, presented in the ECM model, reveal important nuances. Although economic growth positively impacts tourism in the short run (1.07%), the effect size is smaller than in the long run, suggesting that tourism revenues take time to capitalize on economic expansions fully. FDI's short-run impact on tourism is minimal (0.006%), indicating that while investment projects might eventually enhance tourism infrastructure, their benefits manifest gradually rather than immediately. Renewable energy consumption also shows a minimal short-term coefficient (0.025%), contrasting with its larger long-term effect, possibly reflecting delays between energy investments and improved tourist experiences. The error correction term (ECT) is negative and significant (-0.4487), implying that approximately 44.87% of any deviation from the long-run equilibrium is corrected within one year. This suggests a moderate speed of adjustment,

meaning that shocks in the tourism sector are absorbed reasonably quickly, stabilizing towards long-term growth paths.

Robustness Check for Stability of ARDL Model

The model's high R-squared value (0.9808) indicates that approximately 98% of the variation in tourism revenue is explained by economic growth, FDI, renewable energy consumption, and inflation. While high R^2 values in time series models with trending variables are common, this exceptionally strong fit suggests that the chosen predictors are highly relevant to Vietnam's tourism performance. Diagnostic tests confirmed the validity and reliability of the tourism growth models, demonstrating the absence of heteroskedasticity, serial correlation, and deviations from normality. CUSUM and CUSUMSQ procedures further confirmed model stability, ensuring the accuracy and robustness of long-run elasticity estimates. Moreover, the statistical significance of each variable and consistency with expectations support the conclusion that economic growth, tourism investment, inflation, and environmental protection influence tourism development in Vietnam. The results are illustrated in Table 9 and Figures 5 and 6. This finding aligns with prior research demonstrating the positive impact of these factors on long-term economic growth (Bui Minh & Bui Van, 2023; Lisha et al., 2021).

Table 9. *Diagnostic test*s

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	1.627167	Prob. F (22,4)	0.3433	No heteroskedasticity
Obs*R-squared	24.28627	Prob. Chi-Square (22)	0.3324	
Scaled explained SS	0.426155	Prob. ChiSquare (22)	1.0000	
Heteroskedasticity Test: ARCH				
F-statistic	2.543180	Prob. F(1,24)	0.1239	No heteroskedasticity
Obs*R-squared	2.491136	Prob. Chi-Square(1)	0.1145	
Breusch-Godfrey Serial Correlation LM Test				
F-statistic	1.617448	Prob. F(2,2)	0.3821	No serial correlation
Obs*R-squared	16.68461	Prob. Chi-Square(2)	0.0002	
Ramsey RESET Test				
F-statistic	64.05508	Probability	0.4234	Model stability
Jarque-Bera Normality test				
Jarque-Bera	1.885485	Probability	0.3895	Normality exists
Note: The authors analyze the results via Eviews and the Stata program.				

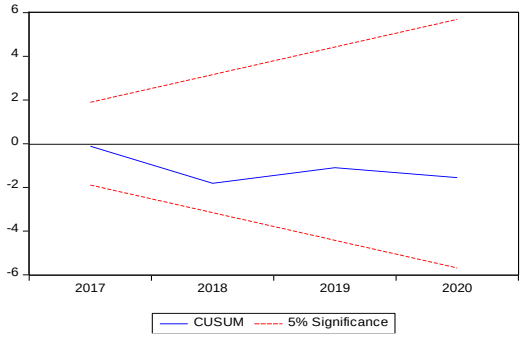

Figure 5. *The CUSUM of the recursive residual plot. The Eviews program draws the figure*

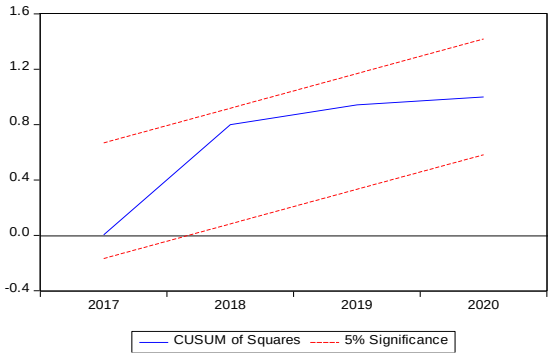

Figure 6. *The plot of CUSUMSQ of the residual plot. The figure is drawn by the Eviews program*

Granger Causality Analysis

The results of the Granger causality test from the study reveal several unidirectional causal relationships between the variables analyzed. Economic growth Granger-causes tourism revenue, indicating that changes in economic growth can predict changes in tourism revenue, but not vice versa. Similarly, foreign direct investment (FDI) in tourism and renewable energy consumption both Granger-cause tourism revenue, suggesting that changes in these factors can predict changes in tourism revenue. Inflation also Granger-causes tourism revenue, indicating that inflation can predict changes in tourism revenue. However, tourism revenue does not Granger-cause economic growth, FDI, renewable energy consumption, or inflation.

Additionally, economic growth uniquely drives renewable energy consumption, highlighting a specific policy implication for sustainable development in Vietnam. These findings underscore the importance of economic growth, FDI, renewable energy consumption, and inflation as predictors of tourism revenue, while tourism revenue itself does not significantly influence these factors. The results are illustrated in Table 10, and the final result is illustrated in Figure 7.

Table 10. *Granger causality test*

Null Hypothesis (H0)	Obs	F-Statistic	Prob.	Inference
LGDP ≠ LTRT	29	3.89471	0.0343**	Reject H0 at 5% level
LTRT ≠ LGDP		0.53908	0.5902	Accept H0
LFDI ≠ LTRT	29	1.80889	0.0155**	Reject H0 at 5% level
LTRT ≠ LFDI		1.15162	0.3330	Accept H0
REC ≠ LTRT	29	2.75953	0.0834***	Reject H0 at 10% level
LTRT ≠ REC		0.56655	0.5749	Accept H0
IFR ≠ LTRT	29	2.25600	0.0125**	Reject H0 at 5% level
LTRT ≠ IFR		1.24571	0.3057	Accept H0
LFDI ≠ LGDP	29	3.39957	0.0500**	Reject H0 at 5% level
LGDP ≠ LFDI		1.50650	0.2419	Accept H0
REC ≠ LGDP	29	0.46545	0.6334	Accept H0
LGDP ≠ REC		1.11323	0.0344**	Reject H0 at 5% level
IFR ≠ LGDP	29	4.27186	0.2598	Accept H0
LGDP ≠ IFR		0.88716	0.4249	Accept H0
REC ≠ LFDI	29	1.36474	0.2746	Accept H0
LFDI ≠ REC		0.07593	0.9271	Accept H0
LIFR ≠ LFDI	29	0.28488	0.7546	Accept H0
LFDI ≠ IFR		0.91796	0.4129	Accept H0
IFR ≠ REC	29	0.91181	0.4153	Accept H0
REC ≠ LIFR		0.30743	0.7382	Accept H0

Note: * refers 1%, ** refers 5%, and *** refers 10% level of significance. "≠" means "…is not a Granger causality for…". The authors analyze the results via Eviews and the Stata program.

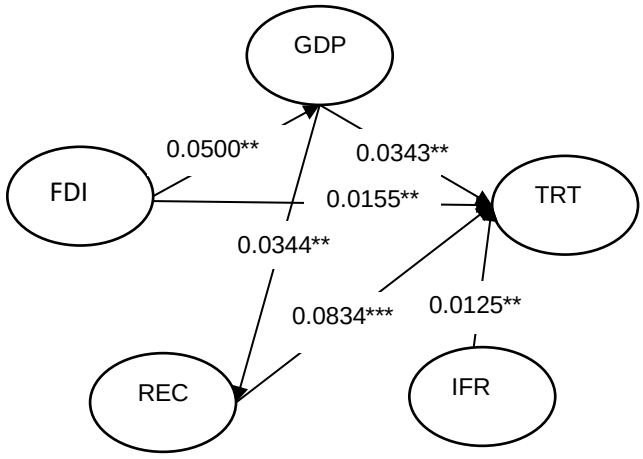

Figure 7. *Granger causality test. The figure is illustrated by authors from analyzed results of Eview program. Note: * refers 1%, ** refers 5%, and *** refers 10% significance level*

DISCUSSION

This study identifies a unidirectional causal relationship between economic growth, tourism FDI, inflation, renewable energy consumption, and tourism revenue. Interestingly, GDP growth uniquely causes renewable energy consumption, contrasting prior research by Ben Jebli et al. (2019b) and Dogan and Aslan (2017). This finding suggests that economic growth

in Vietnam directly drives the adoption of renewable energy, potentially due to government policies promoting green growth or greater awareness of environmental sustainability among businesses and consumers. This unique causal relationship highlights the context of Vietnam's economic and environmental landscape, where economic growth acts as a key catalyst for renewable energy transition, contrasting with other contexts where the relationship may be bidirectional or even driven by renewable energy influencing economic growth.

Moreover, the Granger causality analysis also indicates that tourism development in Vietnam predominantly follows broader macroeconomic trends rather than leading them. In particular, GDP growth Granger-causes tourism growth, reinforcing the Economy-Driven Tourism Growth (EDTG) hypothesis for Vietnam. FDI and inflation also Granger-cause tourism revenue, highlighting the importance of stable investment climates and controlled inflation for sustaining tourism development. The absence of reverse causality suggests that tourism is not yet strong enough to independently stimulate GDP growth or attract further FDI inflows at this stage, in contrast to the bidirectional relationships in some other Asian economies. Policymakers must, therefore, focus on strengthening macroeconomic fundamentals as a prerequisite for tourism sector expansion.

An intriguing finding is the negative correlation between renewable energy consumption and tourism in the simple correlation matrix, which later turns positive in the ARDL estimates. This suggests that bivariate relationships may mask underlying dynamics and that renewable energy initiatives — when controlling for other factors — indeed support tourism growth. Initially, renewable energy investments may disrupt local communities or landscapes during construction phases, explaining the negative simple correlation. However, over time, these projects likely enhance Vietnam's image as a sustainable destination, thus driving long-term tourism revenue growth. This underlines the importance of adopting multivariate approaches when studying complex sectoral interactions.

Renewable energy positively impacts tourism growth by appealing to eco-conscious travelers who seek sustainable experiences, enhancing brand image and attracting tourists, generating cost savings and economic benefits, ensuring long-term environmental sustainability, and complying with government regulations (Isik et al., 2018). This positive influence translates to increased revenue and growth for the tourism industry. Furthermore, it has been supported by empirical studies such as Osorio et

al. (2023), and Irfan et al. (2023). However, other studies (e.g., Mehmood et al., 2021; Solarin, 2014) have found initial disruptions or transitional lags in the benefits of renewable energy on tourism. This study shows that each 1% growth in variable renewable energy is relatively associated with a 6.65% and 0.025% increase in tourism revenue, based on the estimated model of the long run and short run, respectively.

Renewable energy is pivotal in driving tourism growth in Vietnam by promoting sustainability, enhancing destination appeal, and supporting eco-friendly practices. As global travelers increasingly prioritize environmentally conscious destinations, Vietnam's investment in renewable energy infrastructure—such as solar farms, wind power projects, and hydropower—positions the country as a leader in sustainable tourism. This transition reduces the carbon footprint of tourism-related activities, aligning with global sustainability goals and attracting eco-conscious tourists. Additionally, renewable energy projects, like wind farms in Binh Thuan or solar parks in Ninh Thuan, serve as unique attractions, blending technology and nature. These developments also provide reliable and clean energy for hospitality services, ensuring operational efficiency while preserving natural resources. By integrating renewable energy with cultural and natural heritage tourism, Vietnam strengthens its reputation as a sustainable destination, fostering long-term tourism growth and contributing to regional economic development.

The symbiotic relationship between economic growth and tourism development in Vietnam is underscored by a notable 2.33% long-run and 1% short-run increase in total tourism revenue for every 1% economic growth. This dynamic connection is fueled by factors such as heightened disposable incomes spurred by economic prosperity, enabling increased spending on travel. Improved infrastructure, including transportation networks and airports, makes Vietnam more accessible to tourists. Economic growth also catalyzes the creation of diverse tourist attractions, from cultural sites to entertainment venues, prolonging tourist stays and boosting revenue. The nation's positive international image as a stable and appealing destination is further solidified during economic prosperity. Moreover, strategic government policies, technological advancements in travel, and a concerted effort to facilitate tourism through measures like visa facilitation contribute to a flourishing tourism industry in Vietnam. These findings are supported by existing research such as Lisha et al. (2021), Aydin, (2022) and Hung and Hieu (2022) further strengthen the understanding of the intertwined nature of these two sectors in Vietnam.

Stable economic growth fueled by FDI investment significantly drives Vietnam's tourism development. FDI investment plays a significant role in driving the growth and development of the tourism sector in Vietnam. It brings capital, expertise, and innovation, contributing to infrastructure development, diversification of tourism products, job creation, and skill enhancement. Vietnam continues actively attracting FDI in tourism to boost its tourism industry further and promote sustainable development in this sector. In fact, FDI in tourism slightly influences Vietnam's tourism development, with each 1% FDI growth leading to 0.67% and 0.006% increases in long- and short-run tourism revenue, respectively. This aligns with studies by Mao and Yang (2016) and Li et al. (2017). However, Thi Van Khanh (2020) found a slightly negative impact in Vietnam, suggesting FDI's limited contribution to tourism expansion despite its presence.

Inflation in Vietnam presents both challenges and opportunities for tourism development. Negative impacts include reduced domestic demand, deterrence of international tourists, increased operational costs, and reduced investments. However, inflation can also lead to increased government support, greater competitiveness, and a focus on efficiency in tourism businesses (Meo et al., 2018). This study finds that inflation negatively affects tourism development in Vietnam, with a 1% increase in inflation leading to a 0.289% decrease in long-run tourism revenue and a 0.006% decrease in the short run. The inflation rate in Vietnam can affect the country's tourism development. It increases prices for goods and services, including transportation, accommodation, and food. Domestic tourists may opt for more cost-effective travel options as prices rise or prioritize other expenses over tourism activities. Inflation can influence foreign exchange rates, affecting the value of the Vietnam Dong. If inflation is high in Vietnam compared to other countries, it may lead to currency depreciation. This can have mixed effects on tourism, as it may make Vietnam more affordable for international tourists and increase the costs of imported goods and services for the tourism industry.

The findings of this study provide nuanced insights into the theories of Tourism-Led Growth (TLG) and Economy-Driven Tourism Growth (EDTG) by highlighting the transformative role of renewable energy in Vietnam's tourism sector. The positive impact of renewable energy corroborates TLG theory, demonstrating how sustainable energy initiatives enhance destination appeal, attract eco-conscious travelers, and drive tourism revenue. This aligns with empirical evidence, such as Isik et al. (2018) and Osorio et al. (2023), emphasizing the economic benefits of

integrating renewable energy in tourism. Simultaneously, the results challenge the linearity of EDTG theory by showcasing how renewable energy fosters tourism growth independently of traditional economic drivers. The significant increase in tourism revenue attributed to renewable energy growth, as observed in both long- and short-run estimates (6.65% and 0.025%, respectively), underscores its role as a catalyst beyond economic growth alone. This interplay between renewable energy and tourism growth reshapes the understanding of sustainable development within Vietnam's tourism industry, suggesting that investments in green infrastructure comply with environmental regulations and serve as an independent lever for economic and tourism expansion.

Despite the strong results, it is important to acknowledge that other factors not included in the model — such as exchange rates (Athari et al., 2021), political stability (Aydin, 2022), visa policy reforms (Vietnam National Authority of Tourism, 2024), and global tourism trends, like wellness tourism and medical tourism (Fauzi et al., 2024; Smith, 2023)— may also influence Vietnam's tourism development. It acknowledges that other traditional variables — such as population size (D. Xu et al., 2023), education levels (Moscardo, 2015), and urbanization (Raza et al., 2021) — may continue to exert important influences in different contexts. For instance, demographic factors like population growth and human capital development could significantly shape tourism patterns in regions where tourism is more labor-intensive or culturally dependent. Moreover, the study period (1990–2020) does not fully capture post-pandemic dynamics, which may have shifted tourist preferences towards more health-conscious and sustainable destinations. Future studies should consider incorporating these additional factors to obtain a more comprehensive understanding of the drivers of tourism growth in Vietnam.

Regarding the methodological approach, this study employs the ARDL bounds testing framework to capture both short- and long-run relationships, offering robustness to variables of mixed integration orders. However, the potential confounding effects arising from excluding traditional control variables are acknowledged. While including key macroeconomic factors (GDP, FDI, renewable energy, and inflation) captures major influences, omitted variable bias remains a possibility. To mitigate this risk, the model selection process emphasized economic relevance and parsimony, guided by information criteria (AIC) and robust diagnostic tests confirming model stability and validity. Nonetheless, future extensions could adopt instrumental variable techniques, multivariate ARDL models, or dynamic panel approaches to isolate each

factor's independent effects better while controlling for broader economic and social conditions.

CONCLUSION

The study focuses on how Vietnam's tourism industry has grown between 1990 and 2020 in tandem with economic growth, foreign direct investment in tourism, inflation, and the utilization of renewable energy. Using ARDL analysis, the study finds long-term cointegration among the variables. Renewable energy has a negative impact on tourism growth, while economic growth has a small positive impact. FDI slightly positively affects tourism, while inflation negatively impacts it. Granger causality tests show a unidirectional causal relationship between economic growth, FDI, inflation, renewable energy, and tourism revenue.

This study's findings offer direct and timely policy guidance for Vietnam's tourism and economic development strategies. First, given the strong positive relationship between economic growth and tourism revenue, policies should prioritize investments that simultaneously boost both sectors. Specifically, infrastructure projects — such as expanding airport capacity, enhancing transportation networks, and upgrading digital connectivity — are essential to translate economic gains into sustained tourism expansion. These investments are particularly urgent now, as Vietnam seeks to capitalize on post-pandemic recovery momentum and intensify regional competition for international tourists.

Second, the significant long-run impact of renewable energy consumption on tourism growth highlights the need for integrating green infrastructure into tourism development plans. Policymakers should actively promote eco-tourism zones powered by renewable energy, offering incentives for hotels, resorts, and tour operators to adopt solar, wind, and clean energy technologies. As global travelers increasingly demand sustainable experiences, embedding renewable energy into Vietnam's tourism value chain presents a timely opportunity to enhance destination competitiveness and meet international sustainability standards.

Third, while FDI contributes positively but modestly to tourism growth, the government should shift from broad FDI attraction policies to targeted promotion strategies. Priority should be given to high-value FDI projects that develop sustainable tourism assets — such as eco-resorts, cultural heritage conservation, and experiential tourism — rather than purely large-scale commercial developments. Strengthening public-private

partnerships (PPPs) in these areas can maximize FDI's long-term impact on tourism and local communities.

Finally, the identified negative impact of inflation on tourism suggests an urgent need for tighter macroeconomic management. Stable inflation rates are critical to maintaining Vietnam's affordability for both domestic and international tourists. Practical measures include reinforcing monetary policy coordination, ensuring price stability in key tourism services, and monitoring currency fluctuations that may affect travel costs. Given current global inflationary pressures, proactive policy interventions are essential to safeguard Vietnam's tourism recovery and resilience.

This study makes significant theoretical contributions by strengthening the Economy-Driven Tourism Growth (EDTG) hypothesis in an emerging economy like Vietnam. It also extends the Tourism-Led Growth (TLG) framework by highlighting the role of renewable energy as an independent driver of tourism development, suggesting that sustainable energy initiatives can enhance destination attractiveness beyond traditional economic factors. Methodologically, by applying ARDL bounds testing and Granger causality analysis together, the study offers a robust approach to understanding complex, dynamic relationships between tourism, the economy, and the environment.

Practically, the findings provide valuable guidance for policymakers aiming to promote sustainable tourism growth. The study emphasizes the need for economic stability, strategic FDI attraction, renewable energy investments, and inflation control as critical drivers of tourism success. By identifying renewable energy as both an environmental and economic catalyst, the study offers actionable insights for building Vietnam's competitiveness as a sustainable tourism destination. These contributions bridge academic theory with real-world application, offering a clear roadmap for tourism development in Vietnam and similar economies.

This study acknowledges having some potential limitations: (i) limited timeframe (1990-2020); (ii) unidirectional causality requiring further investigation; (iii) findings specific to Vietnam; (iv) alternative models potentially offering different insights; and (v) external factors not explicitly addressed.

From the study's limitations, future research recommendations include: (i) comparative analyses of tourism growth in different contexts; (ii) exploring mediating and moderating factors in the studied relationships; (iii) analyzing tourism demand factors; (iv) investigating

economic factors in sustainable tourism development; (v) employing dynamic and multivariate models; and (vi) evaluating existing tourism policies.

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