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Does Tourism Promote Human Development in Vietnam? Evidence from Time Series Analysis

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Abstract

This research's goal is to examine the relationship between tourism growth and human development in Vietnam and the possible mechanisms behind it. An annual series of data from 1993 to 2020 was collected. The Autoregressive Distributed Lag (ARDL) approach was used to explore the cointegration relationship between the variables. The Toda – Yamamoto Granger non-causality test was used to explore the causal nexus between tourism and human development. The empirical results from the cointegration test suggested that in the long run, the tourism sector and human development have a positive and significant relationship and that government expenditure has a negative impact on human development in Vietnam. Also, the causality outcomes suggested there is a bilateral linkage between tourism and human development. As one of the first papers to examine the impact of tourism on human development in Vietnam, this study can provide policy-makers and other decision-makers with meaningful implications for the evaluation and improvement of people's lives and well-being, given the increasing role of tourism in the socio-economic context of Vietnam.

Keywords: *Tourism Growth, Human Development, Quality Of Life, Economic Growth, ARDL, Government Role, Vietnam.*

Introduction

A wealth of research has been conducted to explore the nexus of economic growth and tourism in several economies. These include systematic reviews (Brida, Cortes-Jimenez, & Pulina, 2016) and country-specific empirical studies (Mitra, 2019; Ivanov & Webster, 2007; Kumar, N. Kumar, R. R. Kumar & Stauvermann, 2019).

According to Cárdenas-García, Brida, & Segarra (2024), "economic growth" - usually measured through GDP - is a different concept from "economic development" and should not be used interchangeably. Sen (1999) argued that economic prosperity is no more than one of the means to enrich human lives, making it insufficient to achieve the valuable ends. Biagi, Ladu & Royuela (2017) also agreed that the association between tourism and a broader definition of development should be more deeply investigated and that using GDP per capita is inadequate.

In contrast to the vast majority of analyses focused on the tourism-economic growth relationship, very little research has been done on the potential of tourism as a tool for human development. Some of the pioneers in this area of research are Croes (2012), Rivera (2017), Biagi et al. (2017), Sharma, Mohapatra, and Giri (2020).

To help fill this shortage in the existing literature, this paper would be one of the first papers in Vietnam to examine the relationship, both short- and long-term, between Vietnam's tourism

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industry and human development with other crucial macro variables: government expenditure and exchange rate which are likely to have an effect on human development utilizing time-series data between 1993 and 2020.

Literature Review

Tourism and Economic Development

Tourism-Led-Growth Hypothesis: Numerous studies have examined the economic impact of tourism using the Tourism-Led-Growth (TLGH) hypothesis. According to the TLGH, an increase in tourism will inevitably result in an increase in the overall economy. This suggests that a country's economy tends to grow when tourism activity expands (Tang & Tan, 2018; Croes, 2013; Chiu & Yeh, 2017; Pigliaru & Lanza, 2000; Algieri, 2006; Chang, Khamkaew, & McAleer, 2012; Durbarry, 2004).

Croes, Ridderstaat, Bak & Zientara (2021) inferred a theory with 2 important tenets. According to the first tenet, money from tourism affects industries that are either directly or indirectly related to the tourism experience. This results in more job creation, increased income, and investment throughout the economy. According to the second tenet, robust tourism affects business ventures that promote economic expansion.

Numerous scholars concur that measuring economic growth is a crucial aspect of assessing development (Easterly, 2001; Drèze & Sen, 1991). However, one of the most fascinating aspects of the present development study is that it is not limited to economic growth; it also examines the multifaceted influence of several economic channels on human growth, poverty, and income inequality (Sharma et al., 2020).

Tourism and Human Development

Human Development Index (HDI)

HDI is a composite measure for three aspects of human capability: health, education, and standard of living.

The primary tenet of the HDI represents Sen's concept: while income is unquestionably significant, it is not the only measure of human development. It's also essential for holistic development to incorporate the capacity to take advantage of rights and freedoms - such as the right to political expression, the right to an education, gender equality, resource access, and social inequality reduction (Stryzhak, Akhmedova, Postupna, Shchepanskiy, & Tiurina, 2021).

Previous Findings

Croes (2012) made the first attempt to study the impact of tourism on locals. By applying the Granger representation theorem (test cointegration), Error Correction Model (test short-term relationship), and Granger causality test (test mutual interaction), the author discovered a beneficial relationship between tourism and human development. There are two additional benefits to this relationship: as human development performance increases, so do tourism services, which in turn increases tourism revenue.

The vast majority of the tourism literature that analyzes the host-tourism relationship focuses on residents' quality of life (QoL) and, more specifically, how they perceive the impacts of tourism. The fundamental premise of this research is that people's "positive" attitudes toward tourists will determine how well tourism affects their well-being and, thus, the success of a tourism location

(Perdue, Long, & Allen, 1990). For example, according to Andereck, Valentine, Vogt, & Knopf (2007), the southwestern United States Anglo and Hispanic inhabitants benefit economically from tourism. However, they disagree with the additional effects, including those that are environmental and sociocultural. Andereck and Nyaupane (2011) demonstrate that positive resident opinions in Arizona are influenced by the frequency of interactions between residents and visitors as well as the local impact of tourism on employment. This area of study bases its hypothesis on the idea that "social relations involve an exchange of resources among social actors; social actors seek mutual benefits from the exchange relationship" (Ap, J. 1990).

Positive Impact

There is strong consensus among researchers that the growth of tourism does present a long-term positive effect on human development and QoL (Cárdenas-García et al., 2024; Biagi et al., 2017; Perdue & Gustke, 1991; Milman & Pizam, 1988; Renda, da Costa Mendes, & do Valle, 2011).

Using an empirical examination of panel data from 63 countries between 1996 and 2008, Biagi et al. (2017) found a positive effect of tourism on human development in destination countries.

Woo, Kim, & Uysal (2015) support the bilateral nexus between tourism and human development, a relationship hardly examined by existing studies. While most of them only investigated how tourism development affects local inhabitants' QoL, Woo et al. (2015) discovered that QoL has a favorable effect on locals' perceptions of future tourism growth.

Similarly, Kubickova, Croes, & Rivera (2017) investigated the bidirectional connection between tourism competitiveness and QoL by applying the Johansen cointegration test and Vector Error Correction Model (VECM) in a panel data investigation of Central America. Long-term tourism competitiveness is influenced by QoL as much as QoL is influenced by tourism competitiveness. A study by Tosun, Timothy, & Öztürk (2003) similarly found that Turkish regions with higher frequencies of HDI experience increased tourism numbers in contrast to other locations in the country with lower HDI. There are a few other studies that found the bilateral causal linkage between tourism and HD, which confirmed certain positive effects of HDI on tourism development. Since a workforce with better education and a healthier lifestyle may be more productive and energetic, happy countries tend to attract more foreign visitors who are willing to spend more money there (Gholipour, Tajaddini, & Nguyen, 2016; Ridderstaat, Croes, & Nijkamp, 2016).

Meng, Li, & Uysal (2010) conducted a case study of China from 1990 to 2006 to examine the relationship and potential effects of tourist development on 17 possible measures of regional citizens' QoL. Using post hoc Tukey tests and analysis of variance (ANOVA) as the primary technique, the authors found that compared to citizens in medium- or low-level tourist development regions, citizens in areas with the highest rates of tourism growth had noticeably "better lives”.

Using a questionnaire survey structured around a Likert scale to examine the impact of tourism on QoL in Iran**,** Aref (2011) agreed that tourism had a favorable effect on the QoL of inhabitants.

It has been noted that tourism development positively impacts human development by expanding global connections, knowledge, and technology diffusion (Katunian, 2019). However, its degree and scope depend on several factors, including the nation's overall economic growth, the social and political climate, the standard of living of the citizens, and each person's particular abilities

(Biagi et al., 2017; Khan, Bibi, Lorenzo, Lyu, & Babar, 2020).

Negative Impact

The rising tourism industry may put a strain on the available natural resources, resulting in negative effects on human development and QoL, such as an increase in crime, pollution, and traffic (Schubert, 2010; Raza & Shah, 2017; Lee & Syah, 2018). The cost of living rises due to increased demand for lodging, and prices for local products and utilities rise as a result of tourist arrivals. Congestion and environmental stress may also develop (Biagi & Detotto, 2014; Andereck et al., 2007).

Ridderstaat et al. (2016) discovered a bilateral causal link between tourism and human development. The relationship between tourism expansion and human development appeared weak in their analysis using an error-correction approach. In contrast, the impact of human development on tourism growth was rather significant through indirect or direct paths. According to Ridderstaat et al. (2016), the existing research on tourism development mostly covers the income aspect of human development without taking into consideration other aspects such as health, education, equality, etc. Thus, tourism development likely has a negative effect on human development in the short run and the negative impacts of tourism may cancel out the human development gains over time.

After using a Limited Information Maximum Likelihood (LIML) approach in a study of Poland**,** Croes et al. (2021) reported a weak and unfavorable relationship between tourist specialty and human development.

Biagi, Lambiri, & Faggian (2012) reviewed existing literature on the link between tourism and the housing sector. They argued that even though tourism is crucial for local economic expansion, at a certain point of tourism development, surging housing prices lead to major social consequences such as affordability, gentrification, and displacement. These consequences may become even more dire due to the physical, topographical, and regulatory quirks of most resort areas.

According to Schubert (2010), tourism creates a bundle of “externalities”, both positive and negative, that should be acknowledged and addressed by the tourism market. The government especially should later impose appropriate taxes to lower the negative effects of tourism. One of these negative externalities is the degradation of natural ecosystems, which consequently reduces the standard of living for locals and visitors.

Recher and Rubil (2020) used monthly panel data to evaluate the adaptability of property crime in relation to tourist arrivals in Croatia from 1998–2016. They discovered another externality: increasing tourism-induced crime over time. In particular, robust evidence shows that if tourism had been the primary factor driving property crime between 2006 and 2016, the quantity of crimes would have increased significantly.

Other Results

The degree of impact tourism has on the expansion of capabilities is a gray area. There are certainly mixed results in the tourism-human development relationship aside from the linear negative or positive effects. Some studies agree with the U-shaped pattern suggested by (Chattopadhyay, Kumar, Ali, & Mitra, 2021; Croes et al., 2021) where HDI tends to decrease during the initial growth of tourism revenue but then increases at higher levels of tourism revenue. Chattopadhyay et al. (2021) theorizes that even though tourism increases jobs and household income, it doesn't necessarily lead to instantly better health and education, which are more closely associated with government distribution. Rivera (2017) studied the intersectionality of the development of humanity, economic expansion, and tourism and presented an unusual finding: tourism has only a modest and inconclusive positive correlation with human development. This finding is similar to Croes's study (2012) of Costa Rica.

Stryzhak et al.'s study (2021) had some confounding results. In countries with greater preferential treatment for national brands, no significant relationship was found between tourism and HDI.

Research Methodology

Model Specification

This study adopts the ARDL cointegration approach created by Pesaran, M. H., & Pesaran, B. (1997) and then expanded by Pesaran, Shin, and Smith (1999, 2001).

The ARDL methodology has comparative advantages versus other cointegration methodologies such as Johansen and Juselius (1990), Engle and Granger (1987), and Juselius (1992). The ARDL technique is stable in a small sample, testing and estimating the hypothesis of long-run coefficients of the variables regardless of whether they are entirely integrated at level I(0), at first difference I(1), or mixed (Pesaran, M. H., & Pesaran, B. 1997). It is devoid of pretesting issues.

The model uses HDI as the dependent variable; tourism receipts (TR) and tourist arrivals (TA) as 2 proxies for tourism development; government expenditure (GOV) and exchange rate (ER) as other control variables. Because the variables are in various units, they are all translated into logarithmic form, expressed as *ln.* The overall research model is specified by two equations as follows:

Model (1): $lnHDI = f(lnTA, lnGOV, lnER)$

Model (2): $lnHDI = f(lnTR, lnGOV, lnER)$

The following part is the ARDL specification for both models:

For model (1)

$$\Delta lnHDI_t = \alpha A_0 + A_1 lnHDI_{t-1} + A_2 lnGOV_{t-1} + A_3 lnER_{t-1} + A_4 lnTA_{t-1} + \sum_{i=1}^{m} a_{1i}\Delta lnHDI_{t-i} + \sum_{i=0}^{n} a_{2i}\Delta lnGOV_{t-i} + \sum_{i=0}^{o} a_{3i}\Delta lnER_{t-i} + \sum_{i=0}^{p} a_{4i}\Delta lnTA_{t-i} + \mu_t \quad (1)$$

For model (2)

$$\Delta lnHDI_t = \alpha A_0 + A_1 lnHDI_{t-1} + A_2 lnGOV_{t-1} + A_3 lnER_{t-1} + A_4 lnTR_{t-1} + \sum_{i=1}^{m} a_{1i}\Delta lnHDI_{t-i} + \sum_{i=0}^{n} a_{2i}\Delta lnGOV_{t-i} + \sum_{i=0}^{o} a_{3i}\Delta lnER_{t-i} + \sum_{i=0}^{p} a_{4i}\Delta lnTR_{t-i} + \mu_t \quad (2)$$

Whereby,

A_1, A_2, A_3, A_4 denotes long-run coefficients.

a_{1i}, a_{2i}, a_{3i}, a_{4i} denotes short-run coefficients.

Dependent variable: Human Development Index (HDI).

Independent variables: tourist arrivals (TA), tourism receipts (TR), government expenditure (GOV), and exchange rate (ER).

m, n, o, p denotes optimal lag lengths.

t denotes year; Δ denotes the differenced version of the series; α denotes the trend coefficient; μ_t denotes the residual.

From above equation:

H_0: $A_1 = A_2 = A_3 = A_4 = 0$

H_1: $A_1 \neq A_2 \neq A_3 \neq A_4 \neq 0$

Whereby,

H_0: there exists no long-run relationship

H_1: there exists long-run relationship

If the null hypothesis is rejected, a cointegration relationship exists among the series.

Variables Explanation

To analyze the impact of tourism against the control variables on human development in Vietnam, annual-series data from 1993 to 2020 (28 observations) for 5 variables (Table 1) is summarized in terms of proxies, variables, and the unit of measurements together with corresponding sources of information. Two proxies for tourism growth (TA and TR) are selected to ensure the reliability and robustness of the outcomes.

Human Development Index (HDI): Citing Biagi et al. (2017), Sharma et al. (2020), and Stryzhak et al. (2021), HDI is a more comprehensive indicator of development than income per capita. The data was retrieved from the UNDP report.

Tourism receipts (TR): The study uses tourism receipts (TR), or tourism revenue, as an indicator of tourism development. This is a familiar variable widely used in studies assessing the association between economic growth and tourism development (Belloumi, 2010; Chen & Chiou-Wei, 2009). Annual revenue data were collected from the Vietnam National

Administration of Tourism – VNAT, measuring in billion VND.

Tourist arrivals (TA): Another common proxy for tourism growth is tourist arrivals (Croes & Rivera, 2010; Rivera, 2017; Wang & Godbey, 1994; Kim & Chen, 2006). It is a popular proxy for the magnitude of the tourism sector because of its availability and reliability (Rivera, 2017). The information on international tourist arrivals was also obtained from VNAT.

Government expenditure (GOV): The variable indicates government spending as a percentage of GDP. The role of government is said to be important in some aspects of development such as health and education. Thus, it was chosen as a control variable in many studies' models (Chattopadhyay et al., 2021; Biagi et al., 2017). According to Grier and Tullock (1989), an unfavorable relationship exists between the growth of government consumption of GDP and economic growth. The annual data was collected from World Development Indicators – World Bank.

Variables	**Symbol**	**Proxy**	**Data source**
Human Development Index	lnHDI	Human development level (life, education, GNI/capita)	UNDP
Tourist arrivals	lnTA	Number of international tourist arrivals	VNAT
Tourism receipts	lnTR	Annual tourism earnings (billion VND)	VNAT
Government expenditure	lnGOV	Government spending as percentage of GDP (%)	World Bank
Exchange rate	lnER	Official exchange rate (LCU per US$, period average)	World Bank

Table 1: Data Source and Measurement of Variables

Note: LCU (Local currency unit), VNAT (Vietnam National Administration of Tourism)

Foreign exchange rate (ER): Some research has noted the potential implications of the foreign exchange rate on economic growth and tourism attractiveness. Li, Jin, & Shi, (2018) theorizes that a stable exchange rate will enhance tourism growth. Some other researchers also took exchange rate into account when assessing the linkage between tourism and development (Jani & Magai, 2022; Njoya & Seetaram, 2018; McDonald, 2000). The data was retrieved from World Development Indicators – World Bank. It is measured in VND per USD and estimated as an annual average using monthly averages.

Econometric Methodology

Descriptive Data Analysis

Descriptive statistics give a brief description of the dataset through indicators of this quantitative statistical method such as the number of observations; measures of central tendency include the median, mean, and mode. Measures of variability include variance, standard deviation, minimum and maximum variables, skewness, and kurtosis. Furthermore, the correlation coefficients overall show the strength of relationships among variables.

Unit Root Analysis

Even though the ARDL approach does not need unit roots preliminary testing, identifying the highest order of integration is required since a variable that is stationary at the second difference, I(2), will not fit in the bounds analysis, which later deviates from the final results. The integration level should not be greater than I(1), following the prerequisite of ARDL estimation. For this purpose, the study used the Augmented Dickey-Fuller (ADF) test with constant and trend to check the stationarity of the variables (Dickey & Fuller, 1979). The author also determines the optimal lag length at I(0) and the I(1) stage, adopting values estimated by the Aikaike Information Criterion (AIC). The null hypothesis for this test is that the variables have a unit root, i.e., are not stationary. The alternative hypothesis states that they are stationary. If the outcomes at level, I(0), show that the null cannot be rejected, the test should be estimated again with the series converted into first differences, I(1).

Conditions to reject the null hypothesis are as follows: If ADF statistic < Critical Values at 1%, 5%, or 10% and p-value < 0.01, 0.05, or 0.1 => Reject the null hypothesis (H_0), the absence of a unit root indicates that the time series is stationary. It does not follow a time-dependent structure.

Diagnostic Stability Tests

Before proceeding with additional econometric analysis, proper model diagnostic tests must be conducted to make sure the chosen model is valid and stable. The diagnostic tests in this part should pass four main tests: normality, heteroskedasticity, serial correlation, and recursive residuals.

Residuals Normality

One of the assumptions of the ARDL model is that the residuals must be normally distributed, otherwise, the model does not fit in the data. The Jarque-Bera Normality test is a statistical test that determines whether a dataset has a normal distribution. This method is based on two descriptive statistics, namely the skewness coefficient and the kurtosis coefficient, to evaluate the normality of data distribution with the two following hypotheses:

H_0: The distribution is normal.

H_1: The distribution is not normal.

If p-value > 0.05 => accept the null hypothesis, if p-value < 0.05 => accept the alternative hypothesis.

Serial Correlation

In a time-series study, serial correlation (autocorrelation) arises when residuals connected with a specific period carry over into subsequent periods. The residuals in the ARDL model must be uncorrelated in different periods or have a zero mean, meaning that there should be no pattern or systematic relationship between the residuals over time. The author used the Breusch-Godfrey LM test for the autocorrelation with these hypotheses:

H_0: There is no serial correlation.

H_1: There is serial correlation.

If p-value > 0.05 => accept the null hypothesis, if p-value < 0.05 => accept the alternative hypothesis.

Heteroskedasticity

Another assumption of the ARDL model is that heteroskedasticity should not exist in the data. That is, the variance and mean should be consistent throughout the model. If this assumption is breached, it may lead to inefficient coefficient estimates, leading to less precise estimates of the parameters. One of the most common tests for detecting heteroskedasticity is the Breusch-Pagan-Godfrey test, which is going to be used in this study with the two hypotheses as follows:

H_0: Homoscedasticity is present.

H_1: Heteroskedasticity is present.

If p-value > 0.05 => accept the null hypothesis, if p-value < 0.05 => accept the alternative hypothesis.

Recursive Residuals

The stability of coefficients is essential for meaningful economic interpretation. If the relationships between variables change over time, the instability can lead to unreliable forecasts and misleading inferences. Hence, the economic insights derived from the model may no longer be valid. Cumulative sum (CUSUM) and square of cumulative sum (CUSUMQ) tests proposed by Brown, Durbin, & Evans (1975) are employed in this study to evaluate the model's stability.

- CUSUM:

H_0: The model parameters are stable over time.

H_1: The model parameters are not stable over time.

- CUSUMQ:

H_0: The variance of the residuals is stable over time.

H_1: The variance of the residuals is not stable over time.

For both tests, if the plot stays inside the critical bounds of 5% level of significance, the results indicate consistent parameter stability.

ARDL Cointegration Bounds Test

Next, the author conducted a long-run equilibrium study using the ARDL Bounds testing technique. The test is performed according to two main processes. The first process determines the ARDL equation by using the Ordinary Least Squares (OLS) estimation tool to check if the long-term relationship exists among the variables of both models. Afterward, the Wald test is conducted for the significance level of the elasticity coefficients of variables in their lagged state.

If the results of the cointegration test demonstrate the existence of at least one cointegrating link, then long-term equilibrium prevails among the variables and the effects of postulated relationships may be examined. The study employed the common model selection criterion called the Akaike Information Criterion (AIC) to pick the optimal lag lengths for each variable. The procedure consists of the following hypotheses:

H_0: No cointegration

H_1: Cointegration

According to Pesaran et al. (2001), by comparing a combined F-statistic with two critical bound values (the upper bound suggests all variables are I(1) and the lower bound suggests all variables are I(0)), three feasibilities occur (F_C = calculated F statistic; F_U = upper bound critical value; F_L = lower-bound critical value):

- If the F-statistic is above the upper bound ($F_C > F_U$): Reject the null hypothesis, indicating the presence of a long-run relationship (cointegration).
- If the F-statistic is below the lower bound ($F_C < F_L$): Fail to reject the null hypothesis, indicating no long-run relationship.
- If the F-statistic lies between the bounds ($F_L < F_C < F_U$): The result is inconclusive.

Error Correction Model (ECM)

After determining the cointegration among variables, this stage involves evaluating the long-run and short-run impacts of the selected variables on one another. It is necessary to capture short-term fluctuations taking place during the path. The Error Correction Model (ECM) is great for recognizing those short-term patterns. It also captures an element of speed with which a dependent variable recovers to the equilibrium, through the Error Correction Term (ECT). The right-hand side of equations (1) and (2) contains both short and long-run components. The short-term parts contain every variable in the first difference, whereas the long-term ones include the lagged-level variables.

The short-run unrestricted error correction model (ECM) can be described as follows:

For model (1)

$$\Delta lnHDI_t = \alpha + \sum_{i=1}^{m} S_{1i}\Delta lnHDI_{t-i} + \sum_{i=0}^{n} S_{2i}\Delta lnGOV_{t-i} + \sum_{i=0}^{o} S_{3i}\Delta lnER_{t-i} + \sum_{i=0}^{p} a_{4i}\Delta lnTA_{t-i} + \Phi ECT_{t-1} + \nu_t \qquad (3)$$

For model (2)

$$\Delta lnHDI_t = \alpha + \sum_{i=1}^{m} S_{1i}\Delta lnHDI_{t-i} + \sum_{i=0}^{n} S_{2i}\Delta lnGOV_{t-i} + \sum_{i=0}^{o} S_{3i}\Delta lnER_{t-i} + \sum_{i=0}^{p} a_{4i}\Delta lnTR_{t-i} + \Phi ECT_{t-1} + \nu_t \qquad (4)$$

Whereby,

S_{1i}, S_{2i}, S_{3i}, S_{4i}: short-run coefficients

m, n, o, p: lag lengths

Φ: pace of adjustment

The ECT indicates the rate of convergence to the long-run equilibrium. In simpler terms, it represents the needed time to return to the equilibrium route if any deviation occurs. The ECT coefficient typically falls between 0 and -1.

- Closer to -1: Indicates a fast adjustment back to equilibrium. For example, if the ECT coefficient is -0.8, 80% of the previous period's disequilibrium has been addressed in the current period.

- Closer to 0: Indicates a slower adjustment. For instance, an ECT coefficient of -0.2 means that only 20% of the previous period's disequilibrium has been addressed in the current period.

Toda – Yamamoto Granger Non-causality Test

How long-term associations between variables are causally connected is the final significant puzzle that needs to be addressed in the study. Testing directional causation between variables is required for this. Cointegrating relationship data shows that the explanatory and response variables move in tandem through time. It remains unclear, nevertheless, whether the dependent variable leads the independent variable or the independent variable leads the dependent variable. As a solution, the study applies the Toda – Yamamoto (TY) non-causality test (1995). The TY procedure augments the Vector Autoregressive (VAR) model by adding the maximum order of integration, ensuring that standard asymptotic theory applies. This approach works well regardless of the level of integration of the series. The TY test involves the estimation of the maximum order of integration of the variables (d_{max}), maximum lag lengths of the variables in the VAR, and finally the performance of the TY procedure to test the hypothesis of non-causality.

Maximum Order of Integration (d_{max})

In the TY test, the additional lags (d_{max}) are added to the VAR model to ensure that the model adequately accounts for the maximum integration order of the series. After figuring out the integration order of each variable, the maximum one is chosen as d_{max}. This step must be already fulfilled in the unit root analysis step (3.3.2).

Estimation of Optimal Lag Order k of VAR

To estimate the optimal lag order (k) of VAR(k), some common information criteria like LR, AIC, SBC, FPE, and HQ are employed. The estimation must be implemented based on the levels, I(0), of each variable regardless of their order of integration. To ensure the VAR model is stable and robust, the Inverse Roots of AR Characteristic Polynomial test is employed. The condition is that all roots (plots) should lie inside the unit circle. If one or more of them fall outside or lie right on the circle, the VAR model does not meet the stability criteria. The optimal lag length (k) is then adjusted to fit the condition.

With the selected lag length of VAR(k) and the estimated maximum order of integration (d_{max}), a VAR model is determined with ($k+d_{max}$) lags, which is formulated as follows:

For model (1)

$$lnHDI_t = C_0 + \sum_{i=1}^{k} C_{1i} lnHDI_{t-i} + \sum_{j=k+1}^{d_{max}} C_{2j} lnHDI_{t-j} + \sum_{i=1}^{k} B_{1i} lnTA_{t-i} + \sum_{j=k+1}^{d_{max}} B_{2j} lnTA_{t-j} + \varepsilon_{1t} \quad (5)$$

$$lnTA_t = C_0 + \sum_{i=1}^{k} B_{1i} lnTA_{t-i} + \sum_{j=k+1}^{d_{max}} B_{2j} lnTA_{t-j} + \sum_{i=1}^{k} C_{1i} lnHDI_{t-i} + \sum_{j=k+1}^{d_{max}} C_{2j} lnHDI_{t-j} + \varepsilon_{2t} \quad (6)$$

For model (2)

$$lnHDI_t = C_0 + \sum_{i=1}^{k} C_{1i} lnHDI_{t-i} + \sum_{j=k+1}^{d_{max}} C_{2j} lnHDI_{t-j} + \sum_{i=1}^{k} B_{1i} lnTR_{t-i} + \sum_{j=k+1}^{d_{max}} B_{2j} lnTR_{t-j} + \varepsilon_{1t} \quad (7)$$

$$lnTR_t = C_0 + \sum_{i=1}^{k} B_{1i} lnTR_{t-i} + \sum_{j=k+1}^{d_{max}} B_{2j} lnTR_{t-j} + \sum_{i=1}^{k} C_{1i} lnHDI_{t-i} + \sum_{j=k+1}^{d_{max}} C_{2j} lnHDI_{t-j} + \varepsilon_{2t} \quad (8)$$

If $B_{1i} \neq 0$, TA/TR is considered to have a unidirectional causal relationship with HDI; If both $B_{1i} \neq 0$ and $C_{1i} \neq 0$, TA/TR and HDI are considered to have a bidirectional relationship.

Toda – Yamamoto Granger Non-causality test

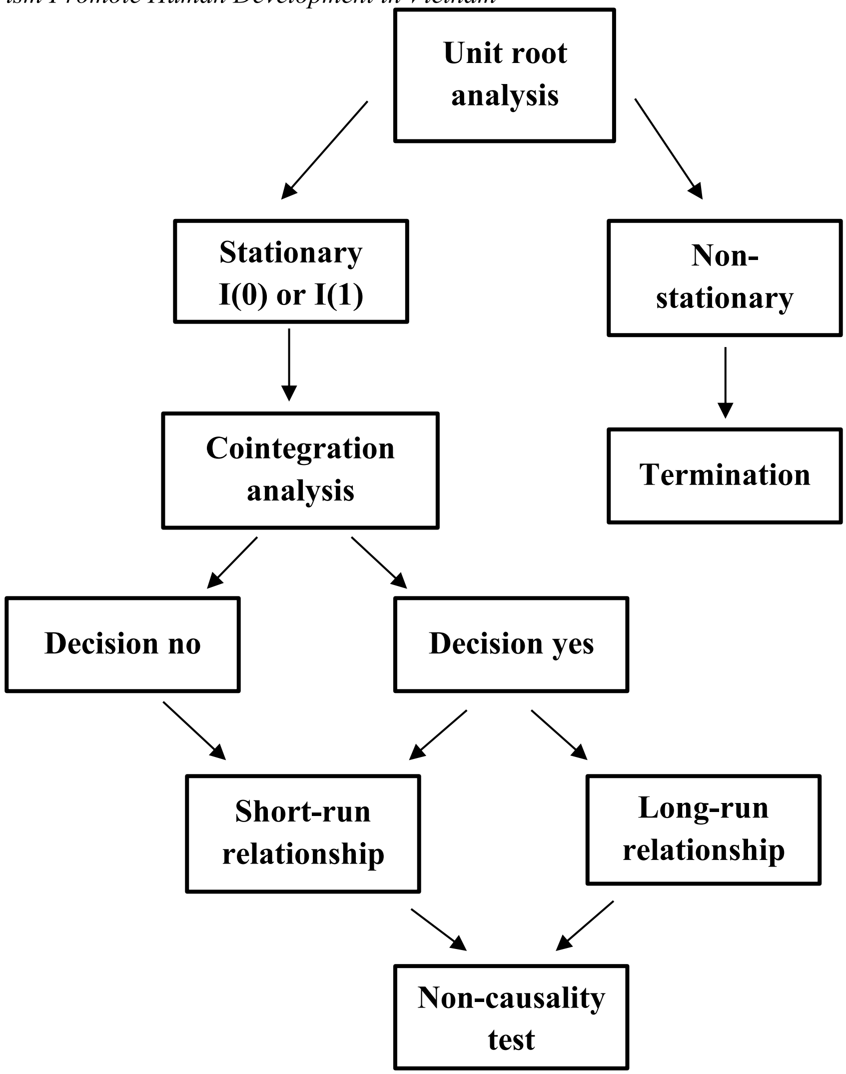
This final step is to examine whether the coefficients of the lagged values of the causal variable(s) (up to lag k) are jointly zero (no causality). These are the two hypotheses:

H_0: The coefficients of the lagged values of the explanatory variable(s) are zero (no Granger causality).

H_1: There is at least one non-zero coefficient. (presence of Granger causality).

If p-value < 0.1 (10% level of significance) => accept H_1; If p-value > 0.1 (10% level of significance)=> accept H_0.

Here is the diagram summarizing all the necessary steps required in the analysis.



Results and Discussion

Descriptive Statistics

Descriptive statistics of the selected dataset of 28 observations during the research period from 1993 to 2020 are summarized in Table 2. Descriptive statistical values include indicators such as number of observations, mean, median, maximum, minimum, standard deviation, skewness, kurtosis, etc.

	lnHDI	lnTA	lnTR	lnGOV	lnER
Mean	-0.466322	15.11986	10.94900	2.065077	9.711181
Median	-0.439295	15.11409	10.88634	2.099145	9.683439
Maximum	-0.342490	16.70638	13.53447	2.390245	10.05227

Minimum	-0.663588	13.41503	8.565983	1.698401	9.272466
Std. Dev.	0.094574	0.830004	1.509202	0.243569	0.253911
Skewness	-0.598767	0.067534	0.216349	-0.166253	-0.257542
Kurtosis	2.165045	2.371561	1.764290	1.500320	1.888136
Jarque-Bera	2.486444	0.482043	1.999908	2.752865	1.751812
Probability	0.288453	0.785825	0.367896	0.252478	0.416484
Sum	-13.05702	423.3562	306.5720	57.82216	271.9131
Sum Sq. Dev.	0.241493	18.60047	61.49763	1.601796	1.740718
Observations	28	28	28	28	28

Table 2: Statistical Analysis of Selected Variables

Dependent and Independent Variables

Based on Table 2, the central tendency measurements of lnHDI, lnTA, and lnTR are relatively consistent. The mean and median of each variable show insignificant differences: -0.466 and -0.439 (lnHDI), 15.12 and 15.11 (lnTA), 10.95 and 10.89 (lnTR), meaning the data is quite symmetric. The standard deviation of lnTR is 1.51, the highest among the three variables, with the minimum and maximum values being negative at 8.57 and 13.53, respectively. Next is lnTA with a standard deviation of 0.83 (the minimum and maximum values are 13.42 and 16.71, respectively). Finally, lnHDI has the lowest standard deviation of 0.09 (the minimum and maximum values are -0.66 and -0.34, respectively). While both lnTA and lnTR have positive skewness (0.07 and 0.22) showing that they are right-skewed, lnHDI is negatively skewed, or left-skewed. The three variables' kurtosis observations are less than 3: 2.17 (lnHDI), 2.37 (lnTA), and 1.76 (lnTR). The analysis shows that all of the variables are platykurtic (flat-peaked and short-tailed). The given skewness and kurtosis indicate that the residuals of lnHDI, lnTA, and lnTR are normally distributed according to the Jarque-Bera normality test.

Other Control Variables

LnGOV and lnER share some similar patterns with the other 3 variables. For example, the disparity between the mean and median of each one is not large, showing the data is symmetric and outliers do not have much effect. They share the same low standard deviations (0.24 and 0.25). The minimum and maximum values of lnGOV are 1.7 and 2.39, and those of lnER are 9.27 and 10.05. Both have negative skewness, meaning that they are left-skewed. Their kurtoses are less than 3, meaning that they are platykurtic (short-tailed and flat-peaked). This indicates that the data points are more evenly spread out and that there are fewer extreme values. With a Jarque-Bera test statistic of 2.75 and 1.75 for lnGOV and lnER (with corresponding p-values 0.25 and 0.42), the data of both are normally distributed.

Correlation Coefficients

Furthermore, all of the selected variables have positive correlations with one another as the correlation coefficients indicate the intensity of the links between the variables. Some have weak to moderate correlations, while others have strong correlations. For example, lnHDI is positively and significantly correlated with lnTA, lnTR, and lnER but weakly correlated with lnGOV. LnGOV is also moderately correlated with lnTA, lnTR, and lnER. Table 3 below provides the specifics.

	lnHDI	lnTA	lnTR	lnGOV	lnER
lnHDI	1.000000				
lnTA	0.927353	1.000000			
lnTR	0.942269	0.961596	1.000000		
lnGOV	0.336519	0.464299	0.556731	1.000000	
lnER	0.975376	0.932124	0.969202	0.482666	1.000000

Table 3: Correlation Coefficients

Unit Root Analysis

The Augmented Dickey-Fuller (ADF) testing procedure is used to test the stationarity of the data (Dickey & Fuller, 1979). The lnTA variable, whose null hypothesis of the existence of a unit root at I(0) was rejected, is shown by the data in Table 4, implying that lnTA is stationary at 5% level of significance with lag length 2 chosen by the AIC criterion. The remaining variables become stationary at I(1). Specifically, lnGOV and lnER are stationary at 1% level of significance with lag 0 and 1 respectively; lnHDI is stationary at 5% level of significance with lag 1; and lnTR is stationary at 10% level of significance with lag 0. Based on these outcomes, the ARDL method was the only cointegration strategy that was sustained since it does not need all variables to be integrated in the same order or in any order higher than I(1) (Pesaran, M. H., & Pesaran, B. 1997). Therefore, the ARDL model satisfies the need of this study.

Augmented Dickey-Fuller (ADF) test				
	At levels, I(0)		At first difference, I(1)	
Variables	Intercept (t)	Trend & Intercept (t)	Intercept (t)	Trend & Intercept (t)
lnHDI	-0.612824	-2.265131	-3.438519**	-0.424389
lnTA	-1.071983	-3.935341**	-3.522354**	-3.106860
lnTR	-1.197081	-1.762538	-2.771855*	-2.587370
lnGOV	-1.220003	-1.789514	-4.927938***	-4.872102***
lnER	-1.800803	-2.984970	-4.033553***	-4.368902**

Table 4: Results for Unit Root Tests

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Diagnostic Stability Tests

The four main tests that the diagnostic checks conducted in this investigation were normality, CUSUM, CUSUMSQ, serial correlation, and heteroskedasticity. These tests were recommended by Pesaran, M. H., & Pesaran, B. (1997). This makes it possible to investigate the validity of the regression model's assumptions and helps determine the reliability of the inference conclusions that follow.

Diagnostic Tests Results of Model (1)

A large portion of the data from the test outcomes shown in Table 5 indicates that the model is not misspecificated and does not appear to be heteroskedastic. In particular, at the 5% level of significance, the Breusch-Godfrey LM test demonstrates that the residual terms do not have a serial correlation issue (1) as its corresponding probability (0.4998) is higher than 0.05, thus failing to reject the null hypothesis. The existence of heteroskedasticity is disproved using the Breusch-Pagan-Godfrey test because the corresponding probability (0.3136) is higher than 5%, implying that the residuals had the same variance throughout the period. Similarly, the normal distribution and correct model specification are obvious from the results of Jarque-Bera normality, since its probability (0.99) is higher than 0.05, confirming the normal distribution of the residuals.

	Test statistic	**Probability**	**Remarks**
Breusch-Godfrey serial correlation LM test	0.455382	0.4998	Do not reject H_0
Heteroskedasticity test: Breusch-Pagan-Godfrey	11.58706	0.3136	Do not reject H_0
Normality (Jarque-Bera test)	0.020917	0.9896	Do not reject H_0

Table 5: Results of diagnostic tests of Model (1)

Moreover, as reflected in Figure 3, by adopting CUSUM and CUSUM of squares tests, at the 5% level of significance, the equation variables in model (1) are deemed stable when the total sum of the recursive errors falls between the two crucial lines, confirming the structural stability of the coefficients. This authorizes more analysis of the model (1).

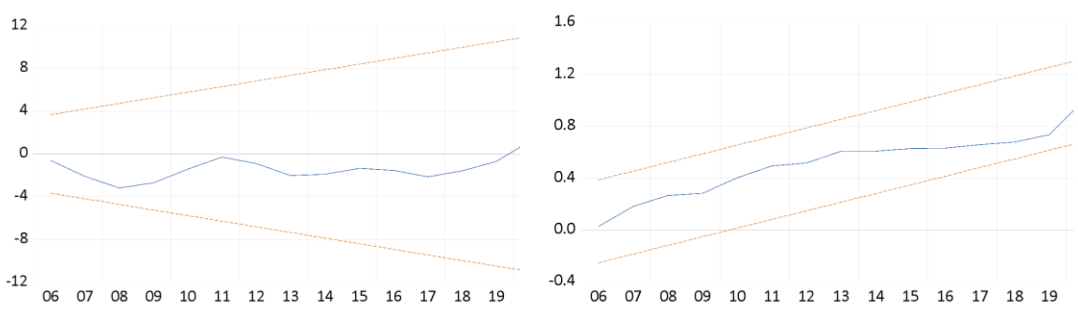


Figure 3: Plot of CUSUM and CUSUMQ of model (1)

Diagnostic Tests Results of Model (2)

As exhibited in Table 6 and Figure 4, model (2) shares the same outcomes with model (1). Particularly, the model is absent from heteroskedasticity and autocorrelation problems in the residuals, as confirmed by the Breusch-Pagan-Godfrey test and Breusch-Godfrey serial correlation LM test with their respective probabilities (0.5752 and 0.2853) higher than 5% level of significance. In addition, the probability of the Jarque-Bera normality test (0.73) is higher than 5%, which means the residuals follow a normal distribution, revealing a bell-shaped curve. Similarly to model (1), model (2) presents a great stability of coefficients by examining the CUSUM and squares of recursive residuals. The plots of both stay within the acceptable 5% significance boundaries of parameter stability, suggesting that the process mean and variance are barely changed through time.

	Test statistic	Probability	Remarks
Breusch-Godfrey serial correlation LM test	1.141746	0.2853	Do not reject H_0
Heteroskedasticity test: Breusch-Pagan-Godfrey	12.38828	0.5752	Do not reject H_0
Normality (Jarque-Bera test)	0.632325	0.7289	Do not reject H_0

Table 6: Results of Diagnostic Tests of Model (2)

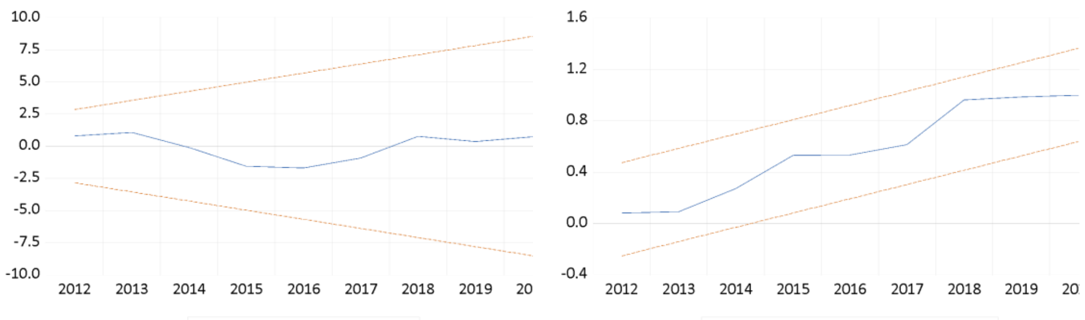


Figure 4: Plot of CUSUM and CUSUMQ of model (2)

ARDL Cointegration Bounds Test

The author then used the ARDL bounds testing approach to conduct a long-run equilibrium study. There are three possibilities for the outcome. In the event that the lower bound value, I(0), is exceeded by the calculated F-statistics, there is no cointegration between the variables; in other words, the null hypothesis of no levels relationship is accepted. In the second case, the cointegration findings are inconclusive if the computed value falls between the two crucial bound values I(0) and I(1), and another technique of cointegration should be applied (Ghildiyal et al., 2015). In order to acknowledge the long-term cointegration of variables, the F-statistics computed value needs to exceed the upper bound value, I(1).

According to the AIC's calculation, the ideal lag lengths for each variable in the two models were selected. In model (1), lags of [2, 1, 2, 2] were applied to [lnHDI, lnTA, lnGOV, lnER], respectively. In model (2), lags of [4, 4, 0, 3] were applied to [lnHDI, lnTR, lnGOV, lnER], respectively. In this research, two models have been used to explore the impact of tourism on human development (HDI). Thus, to represent the tourism sector, model (1) employs tourism receipts, whereas model (2) employs the number of tourist arrivals. The ramifications of the two measures differ. One evaluates the tourism industry's financial component (TR) while the other weighs its physical component (TA). As shown in Table 7, long-run cointegration is obvious for both models. To be clear, the estimated F-statistic of the model (1) is 9.286, which is greater than the F-value at 1% significance level of the upper bound value I(1) (4.66). Likewise, for model (2), the calculated F-value is 12.633 higher than the F-value at I(1), signifying the presence of cointegration, thus rejecting the null hypothesis. What this indicates is that all of the parameters of each model travel together in the long run.

F-Bounds Test	Null hypothesis: No levels relationship			
Test statistic	**Value**	**Significance level**	**I(0)**	**I(1)**
F-statistic (1)	9.286413***	10%	2.37	3.2
AIC lags	*[2, 1, 2, 2]*	5%	2.79	3.67
F-statistic (2)	12.63280***	2.5%	3.15	4.08
AIC lags	*[4, 4, 0, 3]*	1%	3.65	4.66

Table 7: ARDL Bounds test results

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Estimating Long-run and Short-run Relationships

After concluding that there is an equilibrium relationship among the human development index (HDI), tourism growth (TA, TR), government expenditure (GOV), and exchange rate (ER) in the long run, it is crucial to investigate the strengths of the coefficients in each model in long-run and short-run dynamics. Given that the short-term shifts are seen as divergences from the long-term courses, they can move in the same direction (positive or negative) but could also go against each other.

Long-run and Short-run Results of Model (1)

The outcomes of the long-run impacts of model (1) are clearly described in Table 8. The findings indicate a positive and significant nexus between tourist arrivals and human development at 1% level of significance. Namely, a 1% increase in TA results in a 0.03% growth in HDI, substantiating the positive effect of tourism on human development, which supports previous findings (Croes, 2012; Biagi et al., 2017; Sharma et al., 2020; Meng et al., 2010). Furthermore, the outcomes reveal a negative and significant linkage between government consumption expenditure and human development. To be specific, at 1% level of significance, a 1 unit increase in government expenditure could result in a reduction of human development level by 0.05%. These results contradict several prior studies (Wahyuningrum & Juliprijanto, 2022; Nugroho, 2016; Manullang, Amran, Syofya, & Harsono, 2024) claiming that government expenditures positively affect HDI. But it should be noted that these results are not without precedent (Biagi et al., 2017; Sharma et al., 2020). Upon examining the exchange rate data, it is evident that a 1% increase in exchange rates will have a favorable impact on the 0.19% increase in human development level at the 1% significance level. These conclusions roughly align with those of McDonald (2000) and Jani & Magai (2022), who both came to the conclusion that human development is likely to increase as a function of exchange rates.

Variable	Coefficient	Std. Error	t-Statistic	Probability
lnTA	0.031703***	0.006735	4.707291	0.0003
lnGOV	-0.059812***	0.005487	-10.90109	0.0000
lnER	0.186392***	0.026941	6.918487	0.0000

Table 8: Long-run results for model (1): ARDL (2, 1, 2, 2)

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Table 9 shows the short-run dynamics from the Error Correction Model (ECM) and the rate of modification toward the equilibrium of the model (1). The findings indicate a negative connection between tourist arrivals and HDI in the short run, but it is not statistically significant due to the large p-value (0.26). There were similar findings for the remaining variables GOV and ER. However, current changes in HDI have a slightly positive linkage with the one-period lag of changes in government consumption. In particular, an increase of 10% in a 1-year lagged change of GOV will proportionately increase the level of HDI by 0.07%. The coefficient of the Error Correction Term (ECT) is -0.1974, appearing statistically significant and negative at 1% level of significance. Following a short-term shock, the rate of modification per period back to long-run equilibrium is represented by the value of this coefficient. This coefficient suggests that approximately 19.74% of the deviation is adjusted each year. Therefore, any short-run deviation will take around 5.06 years for model (1) to correct to the long-run equilibrium.

Other statistical metrics shown in Table 9 also prove that the selected model presents a strong performance and good fit. For example, the adjusted R^2 is 0.975 which is close to 1 rather than 0, so 97.5% of the variance in the response variable (ΔHDI_t) can be explained by model (1). The Standard Error of the Regression (S.E. of Regression) is considerably small (0.0008). In other words, the residuals' standard deviation is small, thus the model can predict the dependent variable very well.

Variable	Coefficient	Std. Error	t-Statistic	Probability
$\Delta lnHDI_{t-1}$	0.064962	0.115376	0.563044	0.5817
$\Delta lnTA_t$	-0.000578	0.000493	-1.172694	0.2592
$\Delta lnGOV_t$	0.001027	0.001421	0.722651	0.4810
$\Delta lnGOV_{t-1}$	0.007418***	0.001961	3.783319	0.0018
$\Delta lnER_t$	0.002417	0.006772	0.356832	0.7262
$\Delta lnER_{t-1}$	-0.011386	0.006514	-1.747909	0.1009
ECT_{t-1}	-0.197487***	0.025751	-7.669025	0.0000
Adjusted R^2	0.975232			
S.E. of regression	0.000835			
Sum squared resid	1.32E-05			
Log likelihood	151.4740			

Table 9: Short-run results for model (1): ARDL (2, 1, 2, 2)

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Long-run and Short-run Results of Model (2)

The long-run and short-run results for the model (2) are displayed in Tables 10 and 11. The empirical findings for tourism receipts show a positive and significant relation with human development at 5% level of significance, particularly a 1% gain in tourism revenues proportionately raises the level of human development by 0.048%. The outcome ended up quite similar to model (1)'s, thereby validating the model (1) findings wherein the tourist arrivals (TA) variable is utilized as an indicator for the tourism industry. The similarity also comes down to government consumption expenditure, which reveals a negative and significant linkage with HDI at 1% significance level. Specifically, a 1% increase in government consumption will induce a reduction of 0.076% in HDI. This has so far confirmed the reliability of the model (1)'s results in terms of the HDI – tourism and HDI – government expenditure relationships.

Nonetheless, the relation with the exchange rate in model (2) conflicts with that in model (1), where it was favorable and significant. In model (2), the exchange rate negatively influences HDI by 0.125%, yet the nexus is statistically insignificant as the p-value is larger than 1%, 5%, or 10% significance level. So, there is no consistency in both results.

Variable	Coefficient	Std. Error	t-Statistic	Probability
lnTR	0.048096**	0.015807	3.042787	0.0140
lnGOV	-0.075682***	0.016149	-4.686440	0.0011
lnER	-0.125158	0.118514	-1.056064	0.3185

Table 10: Long-run results for model (2): ARDL (4, 4, 0, 3)

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Table 11 presents short-run dynamics results among the variables utilizing the Error Correction Model. Just like the outcomes of model (1), changes in tourism growth create an immediate negative effect on HDI, yet the effect is weak (-0.0003) and insignificant (p-value = 0.43). However, this negative influence becomes more significant through lagged change results. Specifically, 1-year lagged change of tourism receipts negatively impacts the change of HDI, namely decreasing by 0.004% for each 1% increase in tourism receipts; 0.008% and 0.004% for 2-year and 3-year lagged change, respectively. These coefficients show that the past changes in tourism growth negatively influence the current change of HDI for only a short period (3 years in this case). This inverse effect was also found by Ridderstaat et al. (2016) and Croes et al. (2021), who stated that the improvement in the tourism sector does not comprehensively cover all aspects of human development, especially the health and education which could be poorly managed by the government.

The results also show how HDI can interact with and adjust itself in the past. In detail, a one-unit increase in the change of HDI from the previous period ($\Delta lnHDI_{t-1}$) leads to a 0.74 unit increase in the present period change; a 1% gain in the change of HDI from the two periods ago ($\Delta lnHDI_{t-2}$) leads to a 0.2 unit decrease in the present period change; and a 1% increase in the change of HDI from the three periods ago ($\Delta lnHDI_{t-3}$) leads to a 0.32 unit decrease in the current period change, all are significant at 1%, 10%, and 5% levels respectively. The largest influence is from the immediate past period with a strong positive effect (0.74), suggesting that the immediate past changes tend to persist and carry on to the present's changes. In contrast, changes from two and three periods ago have negative coefficients, indicating that the model corrects or adjusts for earlier changes, potentially preventing runaway trends or oscillations. This balance helps to stabilize the series and provides insights into how HDI evolves based on its past behavior.

The ECT in this model is also negative, which is a good sign that the variable is adjusting back toward the equilibrium, but the magnitude of 0.057 is much smaller than the ECT of the model (1) (0.19). The value is closer to 0 rather than 1, indicating a slower adjustment process. This means that it would take many periods, around 17.5 years, for the variables to fully recover to the equilibrium path after a shock.

The ECM of model (2) is as highly effective and reliable in explaining the dependent variable as that of model (1) with many good metrics. For instance, the adjusted R^2 (0.992) is close to 1, suggesting a very high level of the predictive capability of the independent variables. Thus, the model fits the data very well with very little unexplained variance; a standard error of 0.000391 is very small, suggesting that the model's predictions are very close to the actual data points, indicating a high precision.

Variable	Coefficient	Std. Error	t-Statistic	Probability
$\Delta lnHDI_{t-1}$	0.746536***	0.106184	7.030571	0.0001
$\Delta lnHDI_{t-2}$	-0.205586*	0.103803	-1.980528	0.0790
$\Delta lnHDI_{t-3}$	-0.320929**	0.079156	-4.054389	0.0029
$\Delta lnTR_{t}$	-0.000328	0.000397	-0.826199	0.4300
$\Delta lnTR_{t-1}$	-0.004399***	0.000880	-4.995598	0.0007
$\Delta lnTR_{t-2}$	-0.008960***	0.000904	-9.910637	0.0000
$\Delta lnTR_{t-3}$	-0.004266***	0.001004	-4.247318	0.0022
$\Delta lnER_{t}$	-0.001121	0.004012	-0.279377	0.7863
$\Delta lnER_{t-1}$	-0.008655	0.004813	-1.798328	0.1057
$\Delta lnER_{t-2}$	0.023946***	0.003891	6.154561	0.0002
ECT_{t-1}	-0.056581***	0.005924	-9.551801	0.0000
Adjusted R^2	0.992058			
S.E. of regression	0.000391			
Sum squared resid	1.99E-06			
Log likelihood	161.6045			

Table 11: Short-run results for model (2): ARDL (4, 4, 0, 3)

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Toda – Yamamoto, Granger Non-causality test

The study investigates the causal relation between tourism and human development after determining the coefficient size and direction of human development. Furthermore, the negative ECT confirms causation and cointegration. From ECT, the causal direction is unclear, though. Therefore, to determine the causal direction, the Granger causality test is performed. The Toda – Yamamoto augmented VAR specification is utilized to draw conclusions about the variables' causal relationships.

Maximum Order of Integration (d_{max})

The maximum order of integration (d_{max}) is required for the purpose of augmenting VAR(k) to derive the augmented VAR(k+d_{max}). The orders of integration of lnHDI, lnTA, lnTR, lnGOV, lnER were already estimated by conducting the ADF unit root test in section 4.2 (Unit root analysis). Because none of the variables are stationary other than I(1), except for lnTA (stationary at level), only one additional lag (d_{max} = 1) will be added by VAR models in order to execute the causality test.

Estimation of Optimal Lag Order k of VAR (k)

To estimate the optimal lag order (k) of VAR (k), 5 information criteria are employed, including Likelihood Ratio (LR), Final Prediction Error (FPE), Aikaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ). The lag length selection for both models is presented in Table 12. For model (1), though AIC suggests the highest lag length of 6 out of 5 criteria, 2 lag order (k=2) is selected for the estimation of VAR (k) not only because the majority wins but also because the size of the time series available for the research is small (28 observations) and it is necessary to spare an optimal degree of freedom (df) for the estimation. It is easily spotted out the ideal lag length of 3 for the VAR (k)'s estimation of the model (2).

Lag	LR	FPE	AIC	SC	HQ
Model (1)					
0	NA	0.000418	-2.103663	-2.004478	-2.080298
1	147.7413	2.53e-07	-9.515884	-9.218327	-9.445789
2	19.49001*	1.17e-07*	-10.29872	-9.802791*	-10.18189*
3	3.231265	1.40e-07	-10.15050	-9.456201	-9.986944
4	2.032688	1.82e-07	-9.943225	-9.050554	-9.732938
5	8.259221	1.36e-07	-10.33043*	-9.239384	-10.07341
6	1.678702	1.90e-07	-10.15331	-8.863899	-9.849566
Model (2)					
0	NA	0.000659	-1.649674	-1.550488	-1.626309
1	160.8754	2.00e-07	-9.753166	-9.455609	-9.683070
2	24.76767	6.78e-08	-10.84645	-10.35052	-10.72963
3	11.20883*	4.76e-08*	-11.23007*	-10.53577*	-11.06651*
4	1.603268	6.40e-08	-10.98976	-10.09709	-10.77948
5	0.857514	9.38e-08	-10.70408	-9.613039	-10.44706
6	7.874841	6.57e-08	-11.21543	-9.926014	-10.91168

Table 12: Lag Length Selection for VAR Models

*Note: * indicates lag order selected by the criterion; NA indicates not available.*

The study employs the inverse roots of the characteristic AR polynomial for checking the stability of both VAR models. This step is crucial as the stability ensures accurate impulse response analysis, reliable forecasting, and overall model validity. In order to pass the test, all the inverse roots must lie within the unit circle; put differently, the magnitudes of all roots must be less than 1. Figure 5 affirms both models are ineligible as there are two roots staying right on the unit circle in the first VAR model and two roots staying outside the circle in the second VAR model, indicating that both are unstable. As a result, the optimal lag lengths assigned for the VAR (k) should be adjusted. In model (1), k=1 is chosen instead of k=2. In model (2), k=2 is chosen instead of k=3 initially. The outcomes displayed in Figure 6 turn out acceptable as none of the roots stay outside the circle anymore. Hence, VAR models satisfy the stability condition.

With the selected lag orders of the VAR (k) (k=1 in model (1) and k=2 in model (2)) and the estimated maximum integration order (d_{max}=1), the augmented VAR (k+d_{max}) is specified as VAR (2) (model (1)) and VAR (3) (model (2)). The specifications for both are presented as follows:

Model (1)

$$lnHDI_t = C_0 + C_1 lnHDI_{t-1} + C_2 lnHDI_{t-2} + B_1 lnTA_{t-1} + B_2 lnTA_{t-2} + \varepsilon_{1t} \quad (9)$$

$$lnTA_t = C_0 + B_1 lnTA_{t-1} + B_2 lnTA_{t-2} + C_1 lnHDI_{t-1} + C_2 lnHDI_{t-2} + \varepsilon_{2t} \quad (10)$$

Model (2)

$$lnHDI_t = C_0 + C_1 lnHDI_{t-1} + C_2 lnHDI_{t-2} + C_3 lnHDI_{t-3} + B_1 lnTR_{t-1} + B_2 lnTR_{t-2} + B_3 lnTR_{t-3} + \varepsilon_{1t} \quad (11)$$

$$lnTR_t = C_0 + B_1 lnTR_{t-1} + B_2 lnTR_{t-2} + B_3 lnTR_{t-3} + C_1 lnHDI_{t-1} + C_2 lnHDI_{t-2} + C_3 lnHDI_{t-3} + \varepsilon_{2t} \quad (12)$$

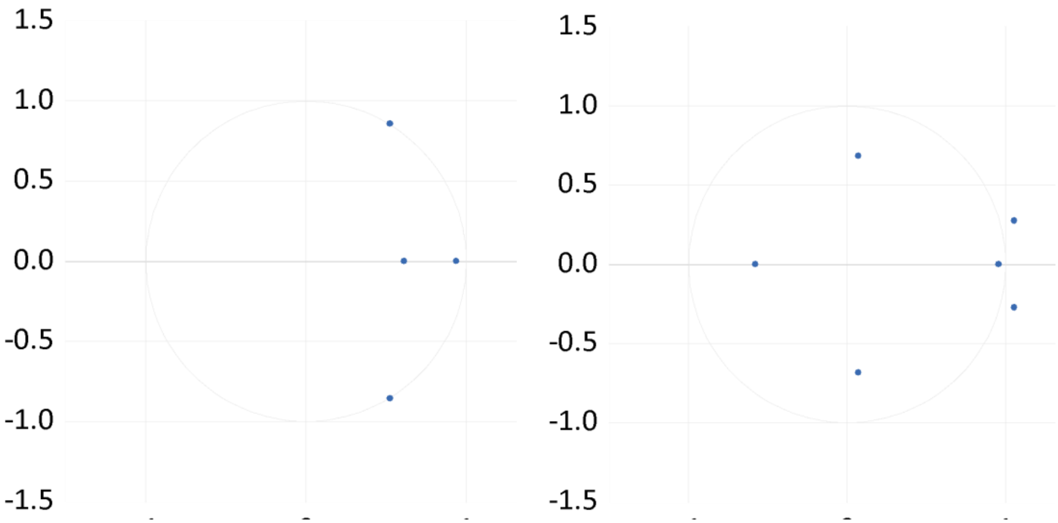


Figure 5: AR Roots Graph (model (1) – left, model (2) – right)

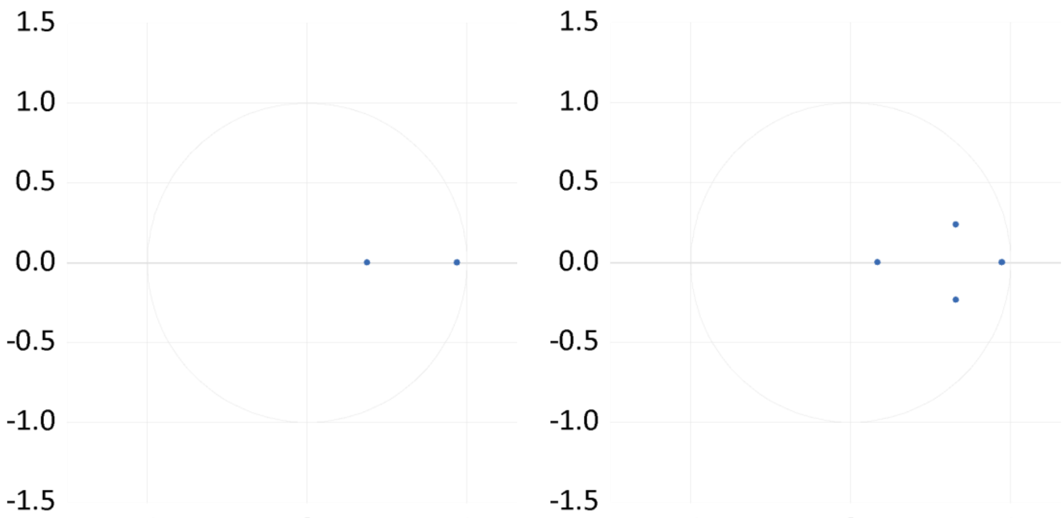


Figure 6: Adjusted AR Roots Graph (model (1) – left, model (2) – right)

Granger Non-causality Test

As already explained, VAR (k+dmax) is assessed to use the Toda and Yamamoto extra lag approach to test for Granger non-causality. The inclusion of the additional lags is a technical adjustment to achieve asymptotic validity and does not pertain directly to the hypothesis about causality. Therefore, when conducting the Wald test in the Toda – Yamamoto framework, the coefficients of the original lags (up to k) are focused because these are the ones directly relevant to the causality hypothesis (Hatemi-J, 2022).

This procedure was carried out for the Equations 9 and 10 for model (1) and Equations 11 and 12 for model (2). Table 13 demonstrates the summary of the findings of the Toda – Yamamoto Granger non-causality test. Remarkably, the research discovers a bidirectional causal relation deriving from the tourism index to the human development index and vice versa. On one hand, in model (1), the null hypothesis of "lnTA does not Granger cause lnHDI" is rejected at 5% level of significance (p-value < 0.05), and the null hypothesis of no causal relationship from lnTR to lnHDI in model (2) is rejected at 10% significance level (p-value < 0.1), confirming the unidirectional causality of tourism – HDI. On the other hand, the null hypotheses of no causal relation from lnHDI to lnTA and to TR are rejected at 10% and 1%, respectively. Thus, the two models that state an inverse relationship exists between the HDI and the tourism sector. Many papers agreed with the forward relationship (tourism – HDI): Croes et al. (2021), Biagi et al. (2017), Uysal, Sirgy, Woo, & Kim (2015), Cárdenas-García, Sánchez-Rivero, & Pulido-Fernández (2015), Tan, Gan, Hussin, & Ramli (2019). However, very few acknowledged the inverse-way relationship (HDI – tourism): Kubickova et al. (2017), Sharma et al. (2020), Rivera (2017). Overall, the findings assert that a rising tourism industry can support human development, and in turn, growing human development will support the advancement of the Vietnamese tourism industry.

Null hypotheses (H_0)	**F-Statistic**	**Probability**
Model (1)		
lnTA does not Granger cause lnHDI	5.90927**	0.0229
lnHDI does not Granger cause lnTA	3.28552*	0.0824
Model (2)		
lnTR does not Granger cause lnHDI	2.58407*	0.0992
lnHDI does not Granger cause lnTR	5.77551***	0.0100

Table 13: Toda – Yamamoto Granger Non-causality test results

*Note: The levels of significance denoted by ***, **, and * are 1%, 5%, and 10%, respectively.*

Conclusion

The outcomes of the ARDL Bounds test demonstrate that the variables for models (1) and (2) have a long-run equilibrium connection. The empirical results proved that in the long run, a positive bilateral causality relationship exists between the tourism sector and human development.

Both models reveal that increasing human development and government consumption are negatively and significantly correlated in Vietnam, which is quite contradictory with a majority of relevant papers' results. One plausible explanation for this is that growing government spending is having a detrimental effect on the economy's GDP growth. Lower economic growth is likely to cause lower standards of living and job creation, which in turn have an adverse consequence on human development (Sharma et al., 2020).

The findings also identified a negative temporary dynamic between tourism receipts and human development, but it is a weak link only. As previously mentioned, advancement in tourism does not fully improve all dimensions of human development; thus, misallocation of resources could occur when the government does not effectively distribute a portion of tourism earnings to invest in education, healthcare, or generally Vietnamese people's own good. Instead, the income is likely to be wasted because of corruption, inefficient projects, and bureaucratic inefficiencies. Corruption can lead to funds being diverted from their intended purposes; investment in projects that do not yield the expected benefits or that are not aligned with the actual needs of the population can lead to wasted resources; complex bureaucratic processes can delay project implementation and increase costs, reducing the overall effectiveness of government spending. All of these flaws could cause short-term stagnation in the long-run, and it also takes a considerable amount of time to recover (low ECT).

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