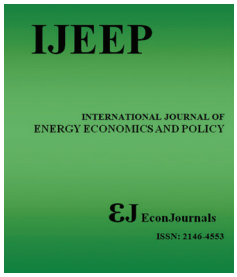

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The Impact of GDP, Government Effectiveness, Globalization, and Carbon Emissions on ASEAN Tourism Receipts: An Empirical Study

Ahmad Rohan, Suyanto Suyanto*

Faculty of Business and Economics, University of Surabaya, Surabaya, Indonesia. *Email: suyanto@staff.ubaya.ac.id

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ABSTRACT

This study examines the impact of GDP, globalization, government effectiveness, and carbon emissions on International Tourism Receipts (ITR) across ten ASEAN countries during the period 2003-2018. Employing Fixed-effect model, Unit Root Tests, and Johansen Fisher Panel Cointegration techniques, the findings reveal that GDP and globalization have a significant positive effect on ITR. By contrast, government effectiveness and carbon emissions have a significant negative impact on tourism revenue. These results suggest that the success of the tourism sector is influenced not only by economic growth, but also by the quality of governance and environmental conditions. This study highlights the importance of efficient public policy, global openness, and environmental management in promoting sustainable tourism growth in the ASEAN region.

Keywords: International Tourism Receipts, GDP, Globalization, Government Effectiveness, Carbon Emissions, ASEAN
JEL Classifications: O11, O47, Q43, Q56

1. INTRODUCTION

The economies of the Association of Southeast Asian Nations (ASEAN) member states have experienced rapid growth, positioning the region as a significant global player (Sugiharti et al., 2025). However, behind this economic progress and improved quality of life lies a serious consequence: substantial degradation of local ecosystems (Ehigiamusoe, 2023). In recent years, Southeast Asia has witnessed remarkable economic expansion. According to Asean Stats (2023) the region recorded an average gross domestic product (GDP) growth rate of approximately 4%. Meanwhile, data from the World Bank (2023) shows that the Philippines had the highest GDP growth among ASEAN countries at around 5.5%, while Singapore had the lowest at approximately 1.1%. One of the largest sources of revenue for ASEAN countries is the tourism sector (Shafrullah et al., 2024). Southeast Asia, comprising the Indochinese Peninsula and the Malay Archipelago, possesses unique geographical characteristics owing to its combination of mainland and island territories (Zhang et al., 2021). Consisting of ten member countries, the region has become a top destination for millions of international tourists each year (Tan and Soon, 2023).

Despite its captivating tourist attractions that are highly admired by travelers, the tourism sector in Southeast Asia faces considerable challenges (Xu et al., 2025). According to World Bank (2018) Thailand recorded the highest tourism revenue among ASEAN countries at approximately USD 61.38 billion, followed by Malaysia at USD 21.78 billion, Singapore at USD 20.42 billion, Indonesia at USD 17.92 billion, and Brunei Darussalam at the lowest revenue at USD 190 million. The region offers a wide range of attractions to international tourists, including traditional culture, cuisine, natural landscapes, and modern destinations, such as Universal Studios in Singapore (Ramadhani et al., 2025). The tourism industry holds immense potential to drive economic growth and development and serves as a significant contributor to national foreign exchange earnings (Brida et al., 2020). As a major

source of foreign exchange, tourism continues to play a vital role in driving economic growth in both developing and developed countries (Kumar et al., 2025). The development of tourism in ASEAN cannot be separated from the regional cooperation among member states (Adeleye et al., 2022). The governments of ASEAN countries have designed various regional policies aimed at collectively integrating and advancing the tourism sector (Annamalah et al., 2023).

Strengthening cooperation among ASEAN member states through regional mechanisms is the key to accelerating the growth of cross-border tourism (Kim et al., 2024). In response to this dynamic, ASEAN governments have introduced numerous national policies and engaged in regional collaboration (Ha Van et al., 2024). As part of the ASEAN Tourism Strategic Plan (ATSP), member countries are committed to promoting sustainable and inclusive tourism while enhancing the region's competitiveness as a leading global destination (Li et al., 2020). Globalization has significantly increased the number of international tourist arrivals in the ASEAN region, but has also contributed to an increase in the tourism sector's carbon footprint (Naseer et al., 2024).

One of the key challenges faced by all countries in maintaining consistent tourism revenue is climate change and carbon dioxide (CO_2) emissions (Zhang et al., 2021). Climate change and environmental pollution have emerged as critical issues that policymakers must address urgently worldwide (Muhammad et al., 2021). According to data released by the Global Carbon Atlas (2023), Indonesia recorded the highest level of carbon emissions among ASEAN countries at 733 $MtCO_2$, followed by Vietnam with 335 $MtCO_2$, and Malaysia at 289 $MtCO_2$. In contrast, Brunei registered the lowest carbon emissions in the region, at only 12 $MtCO_2$.

A study conducted by Jannat et al. (2025) revealed that GDP and green technology have a positive impact on International Tourism Receipts (ITR), while CO_2 emissions negatively affect ITR. Conversely, government effectiveness and globalization were found to have no significant influence on ITR. This study utilizes data from ten ASEAN member countries covering 2003-2018. It investigates how tourism receipts contribute to national income by examining government policies, pollution levels, and globalization indices. One limitation of the study is that, although it was published in 2025, the dataset used does not align closely with the publication year because of restricted data availability in several countries, where the most recent data only extends to 2018.

This study addresses a gap in the existing literature by shifting the focus from developed nations to ASEAN countries, which present different developmental and environmental dynamics. Furthermore, this study enriches academic discourse by integrating macroeconomic factors (GDP, CO_2 emissions, globalization) with tourist behavior, while also incorporating the role of government policy and regional cooperation within ASEAN topics, which have been largely overlooked in prior research. This journal contributes to examining whether government effectiveness in ASEAN countries significantly influences their respective International Tourism Receipts (ITR). As is widely recognized, ASEAN nations engage in extensive cooperation across the political, trade, and educational sectors. This study also investigates the impact of globalization and carbon dioxide (CO_2) emissions on the ITR within the ASEAN region. Employing an empirical approach, this research compares ASEAN countries with the G-7 nations. The analysis is conducted using EViews software and applies several econometric techniques, including Ordinary Least Squares (OLS) with Fixed Effects, Unit Root Tests, and the Johansen Fisher Panel Cointegration method.

2. LITERATURE REVIEW

2.1. Environmental Kuznets Curve

The theoretical foundation linking environmental issues and economic growth was first introduced by Kuznets (1955) through the Environmental Kuznets Hypothesis. According to this hypothesis, environmental degradation tends to increase in the early stages of economic growth. The Environmental Kuznets Curve (EKC) provides a theoretical framework to explain the relationship between economic development and environmental degradation, including within the context of the tourism sector (Kuznets, 1955). The hypothesis posits that, as an economy grows, environmental damage such as CO_2 emissions, initially rises. However, once a certain income threshold or "turning point" is reached, further economic growth leads to improvements in environmental quality, thereby reducing environmental pressure.

In the context of International Tourism Receipts (ITR), the Environmental Kuznets Curve (EKC) theory suggests that increased income from the tourism sector may initially have a negative impact on the environment due to high energy consumption and carbon emissions. However, over time, such growth can contribute to environmental improvement, if accompanied by sustainable development policies (Basheer et al., 2022). ASEAN countries, which rely heavily on tourism as a source of foreign exchange, face this dilemma. On one hand, tourism drives economic growth, but on the other, it generates environmental challenges that must be managed carefully to ensure long-term sustainability (Khan et al., 2020).

2.2. Economic Growth and Tourism Development

The tourism sector is closely linked to economic growth, as it not only contributes to an increase in GDP, but also plays a vital role in job creation, infrastructure development, and the preservation of cultural heritage (Aniramu et al., 2025). Tourism development remains a dynamic and evolving field, gaining significant attention for its economic, social, and environmental impact across the globe (Polo-Peña et al., 2025). Buckley (2023) highlighted that international tourism revenue makes a substantial contribution to economic development. As a continuously growing sector, tourism plays a pivotal role in both global and regional economies (Cárdenas-García et al., 2024).

Rasoolimanesh et al. (2023) asserts that the tourism sector holds significant economic, social, and cultural importance, offering tangible opportunities to achieve inclusive and sustainable development. After six decades of consistent growth, tourism emerged as an indispensable driver of economic progress

(Esfandiar et al., 2020). In ASEAN countries, the growth of the tourism sector, reflected in rising international tourist arrivals and increased tourism revenue, has substantially contribute to GDP growth. Based on prior research, this study proposes the following hypotheses:

H_1: The higher a country's ITR is, the greater its GDP is.

2.3. Government and Tourism

According to Villaseñor et al. (2023), the development of the tourism sector has been adopted globally as a key strategy in government policies to design and manage national economic growth. As a social, economic, and environmental phenomenon, tourism generates both positive and negative impacts, necessitating an in-depth analysis of its implementation and development (Espinoza-Sánchez et al., 2022). Governments have positioned tourism policy at the core of cross-sectoral economic development initiatives, while also recognizing its critical role in environmental preservation efforts (Cornejo-Ortega et al., 2021). Li et al. (2019) emphasized that government policies play a crucial role in influencing tourist decisions, as they can affect various factors such as satisfaction levels, intentions to revisit, commitment, and destination loyalty.

Collaboration among government entities in the development of the tourism sector highlights the importance of synergy between public authorities, private sector, local communities, and various other stakeholders (Mariani et al., 2021). The growth of the tourism industry has stimulated increased investment in supporting infrastructure, such as hotels, airports, road networks, and other public facilities (Stipanović et al., 2019). Well-developed infrastructure plays a crucial role in facilitating expansion of the tourism sector (Paunović and Jovanović, 2017). According to Taufik et al. (2023), tourism development initiatives that involve collaborative efforts among governments, private actors, communities, and stakeholders generate significant positive impacts. Based on previous studies, this research proposes the following hypotheses:

H_2: The more effective and supportive government's policies, the higher the level of ITR.

2.4. Globalization and Tourism

Vašaničová (2025) explains that globalization has been a major driving force behind the transformation of the global tourism sector, accelerating its growth and expanding the reach of tourist destinations. The unrestricted flow of information, advancements in transportation technology, and market liberalization have enabled travelers to explore various parts of the world with greater ease and speed (Ruan et al., 2025). However, tourism activities driven by globalization have also contributed to significant environmental challenges (Kholil et al., 2025).

A study by Raihan (2024) demonstrates that increased tourist arrivals, economic growth, and energy consumption in Brazil have led to higher CO_2 emissions, both in the short and long term.This underscores the importance of developing sustainable tourism practices that take into account the environmental impacts of globalization (Wang et al., 2024). Globalization has also served as a catalyst for innovation in the tourism sector (Vašaničová, 2025). The adoption of digital technologies, such as virtual reality and online platforms, has created new travel experiences and expanded access to destinations that were previously difficult to reach (Baker et al., 2023). These innovations not only enhance the overall tourist experience but also provide opportunities for destinations to more efficiently access global markets (Işık et al., 2022). Globalization exerts a complex influence on the tourism industry, presenting opportunities for growth and new challenges, thereby requiring adaptive and sustainable policy responses (Raihan, 2024).

H_3: Globalization can increase a country's ITR.

2.5. Carbon Emission and Tourism

Climate change represents one of the greatest challenges facing humanity in the 21st century, with impacts that not only alter climate patterns across different regions of the world but also affect human lifestyles on a global scale (Jiménez-Islas et al., 2024). According to Gómez Martín (2017), among the various economic sectors, agriculture and tourism are the most vulnerable to the effects of global warming due to their high sensitivity to climate variability. In the context of tourism, there is consensus that industry is one of the largest in the world (Alamineh et al., 2023). Huseynli (2022) highlighted the reciprocal relationship between tourism and climate change, emphasizing that each influence and is influenced by the other.

The tourism industry continues to rely on energy consumption patterns rooted in the Industrial Revolution, which are characterized by high levels of CO_2 emissions and other greenhouse gases (Guerrero-Moreno and Oliveira-Junior, 2024). According to Jiménez-Islas et al. (2024), climate change alters the climatic conditions that support tourism activities, thereby affecting the functionality of tourism areas and diminishing the attractiveness of natural resources. The three types of tourism most vulnerable to climate change are beach and sun tourism, winter sports tourism, and ecotourism (Kuldasheva et al., 2023). A study by Zhang et al. (2023) focusing on ASEAN countries such as Indonesia, Malaysia, Thailand, the Philippines, and Vietnam found that the growth of tourism particularly coastal tourism, snow tourism (e.g., in northern Thailand), and ecotourism, has led to increased fossil fuel consumption. This, in turn, has contributed to higher CO_2 emissions, thereby reducing the environmental quality and competitiveness of tourism destinations. Based on these findings, the present study proposes the following hypothesis:

H_4: Carbon emissions (CO_2) negatively affect ITR.

3. RESEACRH DATA AND METHODS

This study is classified as explanatory research and aims to explore existing phenomena based on empirical data. The primary objective is to examine the relationship between International Tourism Receipts (ITR), Gross Domestic Product (GDP), Globalization Index (GI), Government Effectiveness (GE), and Carbon Dioxide Emissions (CO_2) across ten Southeast Asian countries: Indonesia, Malaysia, Thailand, the Philippines, Singapore, Vietnam, Cambodia, Brunei Darussalam, Myanmar, and Laos. Given its objective, this study is also categorized as conclusive research, as it seeks to validate and confirm current phenomena through quantitative analysis.

3.1. Data Type and Data Sources

The data utilized in this study are secondary data obtained from the online databases of the World Bank and the Global Carbon Atlas. The sample includes ten Southeast Asian countries: Indonesia, Malaysia, Thailand, the Philippines, Singapore, Vietnam, Cambodia, Brunei Darussalam, Myanmar, and Laos. Timor-Leste is excluded from the analysis, as it is not yet an official permanent member of ASEAN. Additionally, the exclusion was justified by the limited availability and insufficient data for the variables required in this study.

Table 1 shows the definition of variables employed in this study were International Tourism Receipts (ITR), Gross Domestic Product (GDP), Globalization Index (GI), Government Effectiveness (GE), and Carbon Dioxide Emissions (CO_2). The data span from 2003 to 2018, as this range represents the most consistent period for which complete data are available across the ten ASEAN countries included in the analysis.

The data for International Tourism Receipts were obtained from the World Bank online database and were defined as the revenue generated from inbound international tourists for each ASEAN country. GDP data, also sourced from the World Bank, serve as an indicator of economic growth. The third variable, the Globalization Index, was retrieved from the World Bank to assess the degree of globalization in ASEAN countries. Government Effectiveness, the fourth variable, was also derived from the World Bank and reflects the estimated effectiveness of government policies, particularly in the tourism sector. The final variable, Carbon Dioxide Emissions, was sourced from the Global Carbon Atlas and measured in metric tons of CO_2 ($MtCO_2$).

3.2. Analysis Method and Model

In the panel data analysis, several important statistical methods were used to ensure the validity of the econometric model. These include unit root tests, Least Squares (LS) regression, and the Johansen Fisher Panel Cointegration test. By applying these three methods sequentially and complementarily, panel data analysis can yield more valid results and more accurately reflect economic relationships in both short and long terms.

This study employs an empirical model in which four independent variables are used to examine their influence on the pattern of ITR. The independent variables were GDP, GE, GI, and CO_2. The analysis covers ten ASEAN countries - Indonesia, Malaysia, Singapore, Thailand, the Philippines, Vietnam, Cambodia, Brunei, Laos, and Myanmar - from 2003 to 2018.

$$ITR_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 GI_{it} + \beta_3 GE_{it} + \beta_4 CO2_{it} + \mu_i + \varepsilon_{it}$$

The dependent variable used in this study is ITR_{it}, which represents the international tourism revenue for country *i* in year *t*, measured in United States dollars (USD). The independent variables include GDP_{it}, which refers to total GDP; the GI_{it}, which captures a country's level of global integration, such as through the KOF Globalization Index; GE_{it}, which reflects the effectiveness of public governance based on indicators from the World Governance Indicators; and $CO2_{it}$, representing either per capita or total national CO_2 emissions. In the panel data model, μi denotes the fixed or random effects that capture the unique characteristics of each country, while ε_{it} is the error term accounting for unobserved variation over time in country *i* at time *t*.

3.3. Unit Root Test

First, the unit root test is used to determine whether the panel data are stationary or nonstationary (Skrobotov, 2024). Stationarity is crucial because nonstationary data can lead to spurious regression results within the model (Ghouse et al., 2024). This test ensures that the statistical properties of the variables analyzed remain constant over time, thereby enhancing the reliability of the estimation results (Yang et al., 2022). Common approaches to panel unit root testing include the Levin, Lin and Chu (LLC) test, the Im, Pesaran and Shin (IPS) test, and the Fisher-ADF test.

3.4. Least Squares

Second, the Least Squares (LS) regression method, specifically Ordinary Least Squares (OLS), is a fundamental estimation technique used in regression analyses, including panel data models. The LS regression estimates the relationship between independent and dependent variables by minimizing the sum of squared differences between the observed and predicted values (Beyaztas and Bandyopadhyay, 2020). When applied to panel data, the LS approach can be adapted through either a Fixed-Effects (FE) model or a Random-Effects (RE) model, depending on the nature of heterogeneity across entities and over time (Lee and Pustejovsky, 2023).

3.5. Johansen Fisher Panel Cointegration Test

Third, the Johansen Fisher Panel Cointegration test is used to examine the existence of long-term relationships among variables in panel data that are non-stationary but integrated of the same order. This test combines the Johansen cointegration approach for time-series data with the Fisher methodology for panel data, allowing for simultaneous testing of cointegration across multiple cross-sectional units (Ahmed et al., 2022). When cointegration is detected, it indicates that despite individual variables being nonstationary, a stable long-run equilibrium relationship exists among them (Warsame et al., 2025).

4. EMPIRICAL RESULTS AND ANALYSYIS

4.1. Descriptive Statistics

The initial section of the research findings presents descriptive statistics for each variable used in the analysis. Table 2 provides a concise, systematic, and easily interpretable summary of the data and illustrates the distribution patterns and key characteristics of the variables examined. Descriptive statistics include the mean, median, minimum, maximum, and standard deviation, which collectively describe the central tendency and degree of variability within the dataset.

The descriptive statistics in Table 2 reveal that the ITR contributes approximately 4.44% to the GDP of ASEAN countries. However, the high standard deviation of USD 10.9 billion indicates substantial disparities in tourism revenue among countries, with nations such as Singapore, Vietnam, and Thailand contributing significantly

Table 1: Definition of variables

Variabel	Symbol	Definition	Data Source
International Tourism Receipts	ITR	International Tourism Receipts, Current US ($)	(The World Bank, 2018)
Gross Domestic Product	GDP	Current US ($)	(The World Bank, 2023a)
Government Effectivenes	GE	Estimate of Public Service Quality	(The World Bank, 2024)
Globalization Index	GI	Index of Globalization	(The World Bank, 2023b)
Carbon Dioxide Emission	CO2	Territorial Emission in MtCO2	(Global Carbon Atlas, 2023)

Table 2: Descriptive statistic

Variable	Mean	Median	Min	Max	Std. Dev.
ITR	8.71E+09	4.65E+09	59000000	6.14E+10	1.09E+10
GDP	1.96E+11	1.36E+11	2.02E+09	1.04E+12	2.25E+11
GE	0.091812	−0.025000	−1.630000	2.470000	1.017134
GI	58.05369	58.21000	32.37000	84.360000	15.00762
CO_2	112.6426	58.28960	1.221000	594.1014	137.6438

higher figures than others. GE accounts for approximately 9% of ITR across ASEAN countries, with Singapore exhibiting the highest GE score at 2.47%, while Myanmar records the lowest at −1.63%.

Meanwhile, GI contributed an average of 58%, with Singapore recording the highest value at 84.36% and Myanmar the lowest at 32.37%. The average carbon emissions are recorded at 112.64 million metric tons, with a standard deviation of 137.64 million metric tons, indicating a substantial disparity in carbon pollution levels. This reflects the significant differences in industrial structures and energy consumption patterns across the countries in the sample.

4.2. Result Unit Root Test (Individual Intercept)

The initial stage of the panel data analysis involves testing the stationarity properties of the variables employed, namely ITR, GDP, GE, GI, and CO_2. Conducting stationarity tests is essential to ensure that the data do not exhibit time trends, which could lead to spurious regression results within the panel regression model. To ensure the validity of the results, three unit root testing methods were employed: Im, Pesaran and Shin (IPS), ADF Fisher Chi-square, and Levin, Lin, and Chu (LLC), under the assumption of individual intercepts meaning that each country may have a distinct initial value. These methods are used to determine whether each variable in the panel is stationary or non-stationary. The results of the unit root tests are listed in Table 3.

The test results indicate that all examined variables have P-values below 0.05 across the three unit root testing methods. Statistically, this leads to the rejection of the null hypothesis (H_0), which posits that the variables contain a unit root or are non-stationary. Conversely, the alternative hypothesis is accepted, indicating that all variables are stationary at the first-differencing level.

4.3. Result of Panel Data Test

This regression model analyzes the influence of the independent variables on ITR using a Fixed-Effect (FE) approach, where the variables examined include GE, GI, GDP, and CO_2. The estimation results in Table 4 indicate that all the variables are statistically significant at the 1% level ($P < 0.01$), suggesting that each of the four variables has a meaningful impact on ITR.

Table 3: Result unit root test 1st differencing (Individual intercept)

Variable	Im, Pesaran and Shin unit root	ADF Fisher unit root (ADF - Fisher Chi-square)	Levin, Lin, Chu unit root
ITR	−3.19785*** (0.0007)	42.6145*** (0.0023)	−3.04834*** (0.0012)
GDP	−2.10923*** (0.0175)	33.3719*** (0.0085)	−3.81356*** (0.0001)
GE	−5.40508*** (0.0000)	66.8476*** (0.0000)	−3.83004*** (0.0001)
GI	−3.19407*** (0.0007)	43.5379*** (0.0017)	−4.23151*** (0.0000)
CO_2	−3.59102*** (0.0002)	49.1198*** (0.0003)	−492190*** (0.0000)

Numbers in parentheses are the probability values. ***Indicates significance at 1% level

Table 4: Result of fixed effect model

Var	Coefficient	Standard error	t-statistic	Prob
ITR	−3.88E+10	1.24E+09	−5.989693	0.0000
GDP	0.040851	10812412	−5.298509	0.0000
GE	−7.44E+09	87760903	9.150257	0.0000
GI	8.03E+08	0.006341	6.442312	0.0000
CO_2	−57289667	4.73+E09	−8.189899	0.0000

The findings of the positive and significant impact of GDP on ITR align with those of Indriana (2022), showing that International Tourism Receipts have a positive and significant impact on Gross Domestic Product (GDP) in both the short and long term, indicating that an increase in the number of international tourists can directly stimulate economic growth in ASEAN countries through increased revenue.

Moreover, the study finds that GE has a negative impact on ITR, which is consistent with Ağazade (2021), who observed Mediterranean countries and found that Morocco and Albania have a negative effect of GE on tourism receipts. These outcomes highlight that improved governance does not always translate into tourism sector growth, particularly in developing countries, where excessive bureaucracy may hinder tourism ecosystem efficiency. By contrast, Ghalia et al. (2019) found that GE positively affects tourism revenue in Eastern European countries. However, their results also emphasized that this effect is not homogeneous countries with stricter regulations may experience opposite outcomes, similar to the negative GE effect observed in this research.

This study also reveals that GI positively influences GDP, supporting the findings of Maulana et al. (2025), who argue that globalization plays a significant role in enhancing tourism receipts, thereby contributing to economic growth. These findings

strengthen the hypothesis that globalization, reflected in increased openness and international mobility, can promote higher ITR. Thus, global economic integration and cross-border connectivity are crucial for expanding the contribution of tourism to regional economic development.

Finally, the study confirms that CO_2 emissions negatively affect ITR, in line with the findings of Aspy et al. (2024), who demonstrated that globalization and tourism increase ecological footprints, including CO_2 emissions. This supports the hypothesis that carbon emissions have a detrimental effect on ITR, because environmental concerns influence tourists' perceptions of destination quality. Higher CO_2 levels signal environmental degradation, which may reduce destination appeal and ultimately suppress tourism revenue.

Furthermore, Table 5 shows that the Cross-section F Test yields a test statistic of 29.178 with a P-value approaching zero, indicating significant differences across cross-sectional units (e.g., countries). This result suggests that the Fixed Effect (FE) model was more appropriate than the standard pooled regression model. Similarly, the cross-sectional Chi-square Test produced a highly significant result (Chi-square = 164.66; P = 0.0000), further reinforcing the conclusion that the FE model effectively captures the heterogeneity across countries in the dataset.

4.4. Result Johansen Fisher Panel Cointegration

Subsequently, the results of the cointegration test show that a cointegrating relationship exists (Table 6). The result of cointegrating "At most 1" revealed highly significant statistics (with a probability value approaching zero). Therefore, the null hypothesis is rejected, indicating that more than one cointegrating relationship exists in the data. Similar results are observed under the "At most 2" hypothesis, suggesting the existence of more than two cointegrating vectors, with significance levels also approaching zero. Under the "At most 3" hypothesis, the test statistics remained strongly significant. However, for the "At most 4" hypothesis, the probability value increases to 0.5261, which exceeds the commonly accepted significance threshold of 0.05. Consequently, the null hypothesis cannot be rejected, indicating that the maximum number of significant cointegrating relationships in this model is four.

Overall, these findings suggest the presence of a stable long-run relationship among the tested variables, with a maximum of four cointegrating vectors being supported within the model. Additionally, the Johansen Fisher Panel Cointegration test for the "At most 1 cointegration relationship" hypothesis across ASEAN countries provides strong evidence of cointegration among the variables. This test incorporates two primary statistics; the Trace test and the Max-Eigenvalue test, both of which are employed to determine the number of cointegrating relationships within the panel data.

In order to gain insight into the cointegration relationship in each country, Table 7 presents the cross-sectional cointegration results. The Trace test and Max-Eigen test revealed very low probability values (below 0.05) for the majority of countries, indicating that

Table 5: Fixed effect

Effects test	Statistic	d.f.	Prob.
Cross-section F	29.178398	(9,146)	0.0000
Cross-section Chi-square	164.662994	9	0.0000

Table 6: Johansen Fisher panel cointegration

Hypothesized No. of CE (S)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	345.3	0.0000	234.8	0.0000
At most 1	294.0	0.0000	241.4	0.0000
At most 2	125.3	0.0000	86.51	0.0000
At most 3	65.41	0.0000	65.39	0.0000
At most 4	18.93	0.5261	18.93	05261

Table 7: Hypothesis at most 1 cointegration relationship

Cross section	Trace test statistics	Prob.**	Max-Eign test statistics	Prob.**
Indonesia	84.9287	0.0000	55.6625	0.0000
Singapore	68.6842	0.0000	49.6607	0.0000
Vietnam	61.9066	0.0001	29.8439	0.0076
Thailand	99.8379	0.0000	53.9663	0.0000
Malaysia	57.2876	0.0004	24.0170	0.0523
Philippines	99.5511	0.0000	69.5686	0.0000
Brunei	66.5673	0.0000	38.9740	0.0003
Myanmar	75.0035	0.0000	36.6382	0.0006
Cambodia	137.4727	0.0000	83.6692	0.0000
Laos	102.5722	0.0000	71.7435	0.0000

the null hypothesis can be rejected. This finding suggests the existence of at least one cointegrating relationship in each country. For instance, Indonesia recorded a trace statistic of 84.9287 with a probability value approaching 0.0000, indicating a significant cointegrating relationship. Similarly, Singapore showed a trace statistic of 68.6842 with a probability near 0.0000, also confirming the presence of a significant cointegration relationship.

Other countries have exhibited consistent findings. Vietnam posted a trace statistic of 61.9066 with a probability of 0.0001, while Thailand registered a notably high trace statistic of 99.8379 with a probability close to 0.0000, both suggesting strong cointegration. In the case of Malaysia, although the Trace statistic of 57.2876 remained statistically significant (P = 0.0004), the Max-Eigen test yielded a probability near the critical threshold (0.0523), indicating that the strength of cointegration may be relatively weaker compared to other countries. By contrast, countries such as the Philippines, Brunei, Myanmar, Cambodia, and Laos demonstrated highly significant cointegration relationships in both statistical tests, with probability values well below 0.05. These results suggest robust and consistent cointegration among the variables in these nations.

5. CONCLUSION AND IMPLICATIONS

5.1. Conclusion

This study investigates the impact of four key factors - GDP, GI, GE, and CO_2 - on ITR. Four principal conclusions can be drawn from the findings. First, GDP exerts a significantly positive

influence on ITR across ten Southeast Asian countries observed in the study: Indonesia, the Philippines, Singapore, Thailand, Vietnam, Cambodia, Malaysia, Laos, Brunei, and Myanmar. Second, government effectiveness demonstrates a negative and significant impact on ITR. Third, the globalization index has a positive effect on ITR. Lastly, carbon emissions were found to negatively and significantly affect ITR. Government policies play a crucial role in shaping the country's ITR. Well-designed and effective tourism-related policies and regulations tend to enhance tourism revenue. This is evident in Singapore, Malaysia, Thailand, and Brunei, where sound governance in the tourism sector corresponds to relatively high ITR levels.

Conversely, high levels of air pollution and carbon emissions significantly deter international tourists, ultimately reducing tourism revenues. Managing carbon emissions remains a pressing challenge for ASEAN nations aiming to boost their tourism performance. In summary, the findings support the proposition that GDP, globalization, government effectiveness, and carbon emissions are all significant determinants of ITR in the ten Southeast Asian countries studied. The growth trends in ITR are consistent with the theoretical framework of the Environmental Kuznets, highlighting the importance of addressing environmental issues and implementing sound governmental policies in the tourism sector to support sustainable economic development.

5.2. Implication

Based on these findings, four key implications were identified. First, the positive impact of ITR on GDP suggests that in addition to international trade and cooperation in various sectors, ASEAN member states can further boost their GDP through enhanced tourism revenues. This underscores the need for continued initiatives aimed at attracting more international tourists to the region, thereby contributing to sustained economic growth in the tourism sector.

Second, it is essential to improve the effectiveness of tourism-related government policies. The findings indicate that many ASEAN countries exhibit weak tourism governance, which adversely affects ITR performance. Thus, better-designed and more efficient policies are required to attract foreign tourists and strengthen the tourism sector.

Third, the role of globalization should be leveraged to increase the ITR. The results demonstrate that ASEAN countries have effectively utilized globalization to expand their tourism reach and market access, and this trend should be further supported through digital innovation and international connectivity. Fourth, ASEAN countries must address the environmental implications of tourism, particularly in terms of carbon emission. Increasing public awareness of health and environmental sustainability means that cleaner, low-emission tourist destinations are becoming more attractive. Therefore, reducing carbon emissions can significantly enhance a country's tourism appeal and, subsequently, improve its ITR.

Furthermore, the effectiveness of the government administration should be reassessed in the context of tourism development. Excessive bureaucracy and centralized policymaking can hinder innovation and limit accessibility, especially in developing countries. In this regard, global openness and appropriate environmental policies play vital roles in achieving sustainability and supporting long-term growth in the tourism sector. Therefore, ASEAN countries must balance institutional reforms with the pragmatic needs of the tourism industry to avoid regulatory constraints that could undermine creativity, competitiveness, and destination attractiveness in the region.

5.3. Limitations

This study has at least two limitations. First, the data only covers the period from 2003 to 2018 because of the limited availability of panel data. Future research could extend the time coverage and include more countries from Southeast Asia or other parts of Asia to provide a broader perspective. In addition, future studies should incorporate more recent data.

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