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Taking the bad with the good: The nexus between tourism and environmental degradation in the lower middle-income Southeast Asian economies

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ABSTRACT

The contribution of tourism to economic development is an open secret but it is a double-edged sword. The opportunity cost for this significant share is environmental degradation without required measures to protect the environment. Using the Fully Modified Ordinary Least Squared approach from 1995 to 2014, this study aims to explore the nexus between tourism and environmental pollution for three lower middle-income Southeast Asian economies: Indonesia, the Philippines and Vietnam. This paper uses carbon emissions as a proxy for environmental pollution against tourist arrivals with a few control variables for analysis. The Zivot-Andrews unit root test is applied to deal with structural breaks in data and the Gregory-Hansen test for robustness. The results confirm a negative impact of tourism on the environment for Indonesia and the Philippines; however, tourism improves the environmental quality of Vietnam. This implies that the relationship varies for different countries in the same region, depending on the country-specific characteristics and corresponding policies to protect the environment. The impact of governmental policies also differs for high and lower middle-income countries as one size cannot fit all. This study provides a comprehensive milieu of the impact of tourism on the environment. The identified dominant factors can guide Southeast Asian and other developing countries' governments at all levels in systematically formulating policies; by using these policies, carbon emissions from tourism can be reduced efficiently, resulting in sustainable development in the region.

1. Introduction

Tourism is a hot topic of research in recent literature and its contribution to the economy is significant (WTO, 1980). This contribution has its direct and indirect impact on the economy (Lee and Chang, 2008). Tourist arrivals can play an important role in the improvement of various sectors such as the economic, social and infrastructural status of a host country. Tourism also accelerates international trade, mobilizes domestic resources and fills the vacuum of unemployment. In fact, the share of tourism in job creation is significant, i.e. one fifth of the total employment worldwide during the last decade. Consumer spending was on the rise in 2017 and the direct growth of this sector in that particular year reached 4.6% (WTTC, 2018a). This recent surge is robust, particularly for Asian economies. By virtue of its promising growth, tourism is capable of creating 100 million jobs in the coming decade.

Recent statistics from the World Travel and Tourism Council (WTTC) show that the total contribution of the Travel and Tourism (T&T) industry to Gross Domestic Product (GDP) is $8272.3 billion in 2017 and is expected to rise from 10.4% to 11.7% of GDP by 2028. This will turn the total economic share of T&T into $12450.1 billion after a decade. The direct share of this sector in GDP is $2570.1 billion in 2017, and by the year 2028 this sum is expected to be

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$3890.0 billion. Furthermore, in 2017, T&T created 313.22 million jobs i.e. 9.9% of total employment. These numbers will be increased to 413.56 million i.e. 11.6% of total employment by 2028. T&T also has a significant impact on exports and investment worldwide. The industry generated a total sum of $1494.2 billion visitors' exports in 2017. This sum is forecasted to grow from 6.5% to 6.9% of total exports in the decade ahead. Likewise, the investment share of T&T industry will rise from 4.5% to 5.1% of total investment in the next decade (WTTC, 2018a).

Southeast Asia is among the fastest growing regions in terms of the T&T sector. The recent figures from WTTC indicate that it is in the top three out of thirteen regions; 12% of aggregate GDP comes from this industry and it is expected to grow to 13% in next ten years. T&T is a substantial contributor of employment, providing 4% of total jobs and is expected to grow by 3% per annum during the next decade. Additionally, the impact of T&T on exports and investment is also significant and in 2018 it was likely to rise by 6% and 5.4% respectively. By the next decade, both figures will grow at 5.4% and 6% per annum. Tourism is a flourishing industry in Southeast Asia and makes a major contribution to the development of high, upper middle and lower middle-income countries in the region (WTTC.Southeast Asia, 2018).

Considering this division, Indonesia is an attractive destination for tourists worldwide and the share of T&T is identical with overall growth. The key facts from the WTTC show that Indonesia stands 23rd in the world in terms of absolute growth in T&T and secures 7th position for long term growth. Moreover, the sector currently contributes 5.8% of total GDP and this share will rise to 6.6% in the next decade. In terms of total employment, 10% of total jobs in Indonesia are related to the T&T industry (WTTC, 2018b). The Philippines is also counted among the lower middle-income countries of this region and is ranked 18th in terms of T&T contribution to GDP. The current contribution of tourism to GDP in the Philippines is 21.1%; with the annual growth of 5.8%, this share will reach 22.4% after ten years. At present, the country stands in 6th place in terms of T&T contribution to employment. Furthermore, the possibility of growth in tourist exports and investment is significant in the coming years (WTTC, 2018c).

The contribution of T&T to Vietnam's economy is worthy of discussion. Vietnam is listed as a lower middle-income country, ranked 47th in terms of tourism's contribution to the economy, and is included in top ten nations for long term growth prospects in tourism. The current share of tourism in GDP is nearly 10% and the industry is expected to grow at a similar rate during the next decade; the total contribution to employment is estimated to rise from 7.6% to 8% for the same time span. Tourism driven investment and exports in Vietnam were 8.5% and 4% respectively in 2017; this share is forecasted to grow with excellent rates in the coming decade (WTTC, 2018d).

The sustainable development goals (SDGs) of the United Nations elaborate that the lines of economic and social expansion are associated with a robust ecological basis. SDGs fourteen and fifteen describe the importance of a strong and clean eco-system for sustainable development. Similarly, the emphasis on controlling climate change and protecting the environment with advanced industrial setup and environmentally friendly processes are the contemporary measures towards cleaner production. Furthermore, the promotion of tourism as an alternative growth sector for green development to decrease carbon (CO_2) emissions is the essential agenda of these goals (UN, 2015). Conversely, there is a dark side of this remarkable economic growth. The concept of tradeoff implies that there always exists a compromise among various available choices. This fast growing industry may also have significant adverse effects on the environment of the host country. The annual tourist arrivals to Southeast Asia are estimated to be around 125.78 million and the numbers are expected to grow to 208.77 million by 2028 (WTTC.Southeast Asia, 2018); therefore, it will be crucial for the Southeast Asian countries to be proactive in handling the adverse effects of tourist arrivals.

Generally speaking, the tourist overflow increases waste and decreases available natural resources in those places which already face the problem of scarcity. The excessive water use and increasing waste at natural sites may cause soil erosion, increase air, water and land pollution and may eventually destroy the original sources of attraction for tourists. The more alarming fact is that tourism is a significant contributor in global CO_2 emissions, mainly due to transportation, use of electricity and housing facilities for tourists. Therefore, the estimated potential of the T&T industry demands an urgent shift of domestic and global policy measures to protect and improve the environment. The eco-friendly attempts from the government may provide the best alternative to traditional tourism and eventually might lead to a positive environmental impact of tourism on the host nation (Zhong et al., 2011; Ahmad et al., 2018).

Taking into account the remarkable contribution of the T&T industry in Southeast Asia, it is clear that this region is an attractive destination for tourists. As well as the high and upper middle-income countries such as Singapore, Malaysia and Thailand, the lower middle-income countries of this region are also receiving surges of tourists from all over the world. The numbers are growing at a decent rate for Indonesia, the Philippines and Vietnam. If other factors remain constant, the upsurge of tourists will result in high CO_2 emissions and eventually affect the environment. In fact, this relationship is tricky as, on one hand, the positive contribution of this industry towards the economy and environment cannot be overlooked and, on the other hand, the possibility of environmental degradation is also high with tourism and tourist activities (Fernandez et al., 2019). Therefore, to explore the exact impact of tourism on the environment via quantitative analysis and logical reasoning, a detailed study is indispensible for the aforementioned lower middle-income economies. Thus, the primary objective of this paper is to explore the possible link between tourism and environmental pollution for three Southeast Asian countries, namely Indonesia, the Philippines and Vietnam from 1995 to 2014.

In a recent study, Azam et al. (2018) explored this issue by taking high and upper middle-income countries in Southeast Asia i.e. Singapore, Malaysia and Thailand. Following their rationale, this paper takes three lower middle-income countries and uses the longest available data range for analysis. The importance of tourism for the selected countries is justified by the recent economic contributions i.e. 5.8%, 10% and 21.1%, made by tourism in Indonesia, Vietnam and the Philippines respectively. Moreover, the upsurge of tourists in the abovementioned countries demands an analytical review of the connection between tourist arrivals and environmental degradation. Based on this argument, this study is expected to provide deep insights into the link between tourism and environmental pollution through a comparison of the Southeast Asian countries with different income levels. Furthermore, the logical difference of opinion can be helpful for readers and policy makers to better understand the relationship and the possible factors driving it. Thus, this work will provide concrete findings about the welfare and environmental effects of tourism.

A review of recent studies is presented in section 2 and section 3 offers the theoretical background of this study. Section 4 deals with data, variables and methodology and sections 5 and 6 explain the findings and offer some discussion. Finally, the concluding remarks and detailed policy implications are given in section 7.

2. Literature review

2.1. Tourism and environment in developed and less developed economies

Tourism and its economic and social impact is a relatively under-researched area. Although the economic impact of tourism is well established in the existing literature, studies about its environmental effects are rather scarce; specifically, studies about lower-middle and lower-income economies are very limited. To find out the link between tourism and CO_2 emissions, León et al. (2014) use the Stochastic Impacts by Regression on Population, Affluence and Technology (STIRPAT) analysis on panel data from developed and Less Developed Countries (LDCs); the results show a substantial impact of tourism on CO_2 emissions for both panels, however, this relationship is more significant for advanced economies due to high CO_2 emissions during the production and consumption stages of the T&T industry. Similarly, taking the transport sector into consideration, Mulali et al. (2015) use data from 48 top tourist destinations to examine the impact of tourism on environment. The results indicate that tourist arrivals significantly increase CO_2 emissions in all regions except Europe; the authors are of the view that strict environment-friendly policies are essential in non-European countries. Furthermore, Dogan et al. (2017) investigated the relationship between energy, trade, GDP and CO_2 emissions for OECD countries; the authors confirmed through various econometric approaches that energy use and tourism increase CO_2 emissions while trade improves environmental quality; likewise, the causal links among these variables also support the association. Apart from CO_2 emissions, tourism also causes increase in solid waste; Using panel data from EU countries, Arbulú et al. (2015) find a significant relationship between tourism and waste generation. The aforementioned studies reveal that tourism causes more environmental degradation in developed countries compared to the LDCs.

The existing literature also shows that economic development contributes to environmental degradation. For instance, in case of advanced and developing countries of various regions, Zaman et al. (2016) validate the CO_2 emissions and tourism relationship; the authors indicate that energy use and economic development also contribute to CO_2 emissions; furthermore, investment, growth and health sector development promote tourism. Likewise, studying tourism, CO_2 emissions and GDP growth nexus, Paramati et al. (2017) conclude that tourism enhances economic development in the European Union (EU) countries; however, the role of tourism in environmental degradation varies among different EU regions; it may improve the climate or cause pollution depending on measures to encourage sustainable tourism. Using the VECM and causality approaches for the top ten worldwide tourist destinations, Jebli and Hadhri (2018) find that tourism improves environmental conditions, as there is a negative relationship between tourism and CO_2 emissions; however, this link is positive for GDP growth and CO_2 emissions nexus indicating that economic development causes pollution.

Besides developed regions and LDCs, the existing literature also presents some interesting results about individual economies. Examining the long-term equilibrium of tourism development, growth and environment in Turkey, Katircioglu (2014) reveals that the use of energy increases due to tourist arrivals, which not only contributes to economic development but also affects the climate of the country. Ng et al. (2015) examine the tourist-led CO_2 emissions from electricity, heating and transport sectors for Malaysia; the authors apply a bound test and the Vector Error Correction Model (VECM) causality approach confirming a long-term association among the variables studied. Using the Wavelet approach, Raza et al. (2016) confirm that tourism has an adverse impact on environment for the USA; furthermore, tourism is also associated with waste generation that negatively affects the environment. Examining the policy measures for Greece, Michailidou et al. (2016) conclude that rational use of energy and water management is necessary to control the negative effects of tourism on climate.

In addition to the abovementioned studies, it is also argued in the recent literature that tourism and pollution have a feedback relationship and that pollution levels may affect tourist arrivals. The findings of Tugcu and Topcu (2018) from a panel ARDL approach show a mixed impact of various emissions on tourist receipts for ten major tourist destinations. Similarly, assessing the link between tourism growth and environmental quality, Sghaier et al. (2018) draw several conclusions for Morocco, Tunisia and Egypt: the long-term association between tourism and GDP proves true at different significance levels; tourism and environmental connection varies, for instance, the impact is negative for Egypt, and positive for Tunisia; additionally, Environmental Kuznets Curves (EKC) hypothesis is also valid for the three economies studied.

2.2. Tourism and environment in Asia-Pacific and South Asian economies

The available literature presents interesting findings regarding the Asian-Pacific and South Asian economies. Investigating the link between tourism, growth and pollution, Zhang and Gao (2016) discover significant differences among various regions of China; contrary to the general perception, the link between CO_2 emissions and tourism is negative in China's eastern region and a causal link among these variables exists in the long run. On the other hand, testing the EKC hypothesis for selected Asia-Pacific countries, Shakouri et al. (2017) find a positive long-term connection between tourist arrivals and CO_2 emissions; moreover, there exists a unidirectional causality among energy consumption, tourist arrivals and CO_2 emissions. Likewise, Sharif et al. (2017) found long-term associations between tourist arrivals and CO_2 emissions for Pakistan and unidirectional causality running from tourist arrivals to CO_2 emissions. However, Gamage et al. (2017) investigate the long run association among income, energy consumption, CO_2 emissions and tourism development for Sri Lanka; their results suggest that these variables are linked in the long run, but the EKC hypothesis does not hold true; furthermore, energy consumption has an adverse effect on environment in both the short run and long run, while tourism development increases environmental pollution in the long run only. Analyzing the sample of 20 Asia-Pacific Economic Cooperation (APEC) countries, Wu et al. (2018) propose that energy use for economic purposes has significant impact on environment.

Inspecting the five western provinces of China, Ahmad et al. (2018) establish that tourism has negative effect on the environment in Gansu, Shanxi, Qinghai and Ningxia, yet tourism development improves the environmental situation in Xinjiang; nevertheless, the negative impacts of economic growth and energy consumption are more significant than tourism on CO_2 emissions in the long run. Likewise, Rauf et al. (2018) find that the increased energy consumption promotes rapid economic growth and urbanization increases environmental pollution in the Belt and Road countries; however, trade openness and focus on alternative growth channels reduce CO_2 emissions. Combining decoupling analysis with EKC, Jiang et al. (2019) cite that CO_2 emissions control is an imperative task for China; the decoupling contribution varies significantly, and the role of the household and service sector is important in influencing overall CO_2 emissions in China.

Apart from CO_2 emissions, the existing literature also focuses on environmental sustainability. For instance, Fernandez et al. (2019) points out that on the one hand, tourism expansion adds to

environmental pollution and on the other hand, some particular factors are related to environmental sustainability; thus, the association between tourism and environment is bidirectional. Similarly, in case of developing countries, Goffi et al. (2019) argue that sustainability improves the competitiveness of a tourist destination; furthermore, tourism is associated with increased environmental and socioeconomic issues, and cleaner production in tourism related industries can help to improve environmental quality.

2.3. Tourism and environment in Southeast Asian economies

The current literature on tourism and environmental degradation present limited findings about the Southeast Asian economies. Using panel data from selected Southeast Asian countries, Jahromi et al. (2017) confirm the existence of EKC and a significant impact of tourism on environmental pollution, whereas energy consumption and economic development are the significant contributors of CO_2 emissions. However, taking three Southeast Asian economies into account, Azam et al. (2018) provide mixed evidence regarding impact of tourism on pollution in Malaysia, Thailand and Singapore; this link is positive for Malaysia and negative for other two economies. Furthermore, Volpi and Paulino (2018) establish that the servicing sector of tourism generally has a negative impact on the environment; the physical facilities including hotel units, bathrooms and laundry rooms have significant adverse impacts on the environment.

The existing literature validates the view that the T&T industry and improved environmental quality play a strong role in the economic progress of a country. The available studies also highlight the threats of increase in environmental degradation due to tourist upsurges and eventual CO_2 emissions. At present, the evidence is mixed, and most studies take into account the advanced economies with great numbers of visitors every year. Likewise, researchers mostly employ panel data to analyze the association between tourism and environmental degradation. Thus, the current literature is lacking in policy implications for the lower-middle income Southeast Asian economies. The aim of this study is to offer a thorough analysis of three lower middle-income countries in Southeast Asia namely: Indonesia, the Philippines and Vietnam. This study will explore the country-specific characteristics that may influence the linkage of tourism with environmental pollution for the lower middle-income level countries under consideration.

3. Theoretical background of the study

Tourism is considered an imperative growth factor because modern economic systems have been concentrating on sustainable development. The main purpose of focusing on sustainability and eco-efficiency is to promote the idea of a green economy. Tourism offers several benefits to a domestic economy including job creation, improvement of living standards and promoting native culture. However, this remarkable contribution is coupled with certain environmental costs because this rapid development significantly adds to energy depletion and deteriorates the environment with increased CO_2 emissions (Xie and Zheng, 2001). Pigram (1980) argues that the association between tourism and environment could be defined as substantially negative, marginally negative and positive. The connection automatically differs after attaining the threshold level. Considering the country-specific factors, the elasticity between these two variables explains the final effect of tourism on environmental pollution. Tourism has both biophysical and socio-cultural environmental effects. For instance, tourism causes atmospheric pollution due to emissions of smoke, sulfur dioxide, nitrogen oxides and other harmful gases. Tourist activities might damage the natural environment and its attractiveness (Jiang, 1996). Waste augmentation can turn a stunning place into a dump. Additionally, tourism significantly increases noise pollution; this includes physical noise and the use of transportation vehicles (Zhong et al., 2011).

Fig. 1 shows the number of arrivals from 1995 to 2016 for three countries under consideration. Indonesia (IDN) is the top recipient entertaining more than 10 million tourists from around the world, Vietnam (VNM) secures second position and the Philippines (PHL) stands at third. Overall, these three countries are attractive destinations for tourists and surges of tourists provide grounds for a significant impact of the T&T industry on these countries and motivate our empirical investigation.

4. Data, variables and methodology

To explore the aforementioned relationship, the major variables are: tourist arrivals (TR) in countries under consideration, and following the literature, CO_2 emissions (per capita in metric tons), denoted by CO_2, are used as a proxy variable for environmental degradation. The CO_2 includes both solid and liquid fuel emissions, and gas flaring. Additionally, GDP per capita and energy use (EU) are employed as control variables. This paper uses annual data for all variables from 1995 to 2014 in United States Dollars (USD). The data source for all variables is the World Development Indicators 2017 for Indonesia, Vietnam and the Philippines.

To test the stationary properties of data, the Zivot and Andrews (2002) test (Z&A test) is applied. This method is capable of dealing with structural breaks in data at various points. Perron (1989) claimed that in the case of structural breaks in data the traditional methods might produce vague conclusions about stationary structures. Alternatively, the break points are treated as unknown in this test which is an advanced form of the Perron test. Therefore, this test generates precise estimations for series with breaks. The mathematical form of this test is described as follows:

$$\Delta X_t = b + bx_{t-1} + ct + bDT_t + \sum_{j=1}^{k} d_j \Delta X_{t-j} + \mu_t \quad (1)$$

$$\Delta X_t = c + cx_{t-1} + ct + dDU_t + dDT_t + \sum_{j=1}^{k} d_j \Delta X_{t-j} + \mu_t \quad (2)$$

DU_t denotes dummy variables used for mean shift with time breaks for a particular point; whereas DT_t is used for time breaks in the series. For unit root break dates, the null hypothesis states that the series has a unit root with an unknown structural break point or $c = 0$. The other case states the series is stationary where $c < 0$. This test reflects all possible break points and evaluates them successively. It does not include the end sample points during break point selection.

To test the co-integration among all variables, this study applies the Gregory-Hansen approach which is an extension of the available conventional tests. This test uses a general hypothesis of no co-integration and is effective in case of possible regime shift. This method can detect the link among variables in the presence of a break in intercept and slope coefficients. For such cases, the conventional Augmented Dickey-Fuller (ADF) test is not a smart choice (Gregory and Hansen, 1996a; 1996b). The three different models with various assuptions are: level shift, level shift with trend and regime shift. The general mathematical forms of three models, respectively, are as follows:

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \varepsilon_t \quad (3)$$

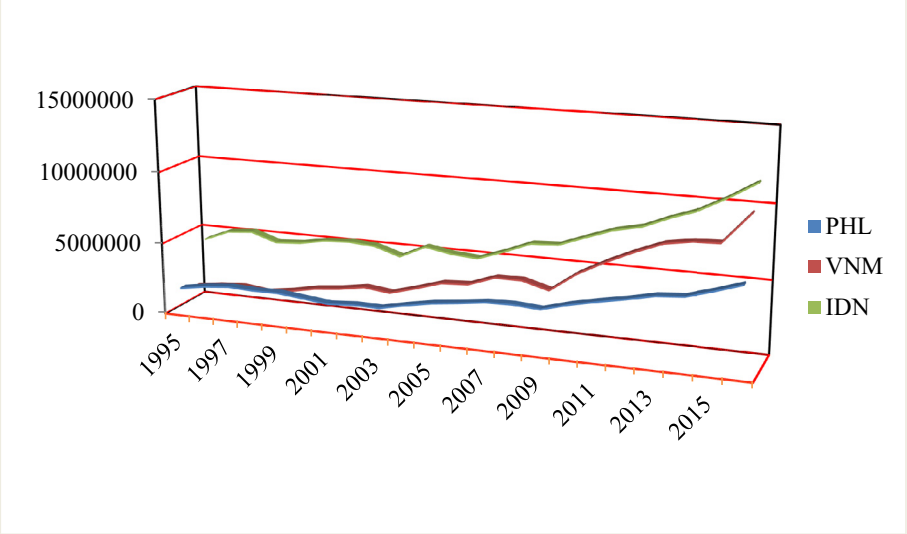

Fig. 1. Tourist arrivals in the Philippines, Vietnam and Indonesia.

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t \quad (4)$$

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \beta_2 t f_{tk} + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t \quad (5)$$

This test framework is used to determine the possible breaks and the break dates in the data. The test uses the highest absolute ADF test value for break selection. The calculated value is compared against the critical value to decide the status of a series. In the econometric model, Y is the dependent and X is an independent variable and k represents the break date in a data series.

This study utilizes the Fully Modified Ordinary Least Squared (FMOLS) method developed by Phillips and Hansen (1990) to investigate the impact of tourism on the three lower middle-income Southeast Asian economies, i.e. Indonesia, the Philippines and Vietnam. The general form of regression after including all variables can be described as follows:

$$CO_{2t} = \beta_0 + \beta_1 TR_t + \beta_2 GDP_t + \beta_3 GDP^2 + \beta_4 EU_t + \varepsilon_t \quad (6)$$

where ε_t indicates an error term and β_0 refers to the intercept. The CO_2 emission is the dependent variable and GDP per capita, energy and tourism are used as independent variables. The GDP^2 indicates the square of the GDP per capita to evaluate the EKC hypothesis. The FMOLS is an advanced version of Ordinary Least Squares OLS to provide more specific results and efficiency in several aspects. The corrections in the original OLS can be used to determine the important empirical effects of this new version. The FMOLS uses the standard Wald test based on an asymptotic Chi-square statistical interpretation. Generally, this method takes endogeneity and serial correlation into consideration. It provides more options for investigators to find the differences between both techniques as it offers impartial estimators of co-integrating regressions in a single equation. Furthermore, this method is asymptotically balanced and suitable in the existence of mixed normal asymptotic. The detailed discussion starts from a simple regression:

$$Y_t = \beta_0 + \beta_t X_t + \mu_t, t = 1, \ldots n \quad (7)$$

In this equation, the independent variables are of order I(1) and not co-integrated. Therefore, the stationary process for independent variables is needed to separate the vector of drift from a stationary variable. This method assumes a strict stationary procedure with zero mean and a fixed positive-definite covariance matrix. The FMOLS estimation can be retrieved in two stages. The dependent variable is reformed for the long-run T interdependence and the residuals of the OLS estimator are also calculated. This will lead us to the following equation:

$$\xi_t = \begin{pmatrix} \widehat{\mu}_t \\ \widehat{\nu}_t \end{pmatrix}, t = 2, 3 \ldots . n \quad (8)$$

In this equation, $\widehat{\nu}_t = \Delta X_t - \widehat{\mu}$ for t = 2, 3 …. n and $\widehat{\mu}_t = (n-1)^{-1} \sum_{t=2}^{n} \Delta X_t$. Whereas, the long-term variance for ξ_t can be derived as follows:

$$\widehat{\Omega} = \widehat{\sum} + \widehat{\Lambda} + \Lambda' = \begin{pmatrix} \widehat{\Omega}_{\underset{1}{11}} x 1^{\widehat{\Omega}_{11}} & \widehat{\Omega}_{\underset{1}{22}} x k^{\widehat{\Omega}_{21}} \\ \widehat{\Omega}_{\underset{1}{11}} x 1^{\widehat{\Omega}_{21}} & \widehat{\Omega}_{\underset{1}{22}} x 1^{\widehat{\Omega}_{22}} \end{pmatrix} \quad (9)$$

In this equation, $\widehat{\sum} = \frac{1}{n-1} \sum_{t=2}^{n} \widehat{\xi}_t \widehat{\xi}_t, \widehat{\Lambda} = \sum_{s=1}^{m} w(s,m) \widehat{\Gamma}_s, \widehat{\Gamma}_s = n^{-1} \sum_{t=1}^{n-s} \widehat{\xi}_t \widehat{\xi}$ whereas, $w(s,m)$ is the lag window with horizon m.

Let us suppose:

$$\widehat{\Delta} = \widehat{\sum} = \widehat{\Lambda} = \begin{pmatrix} \widehat{\Lambda}_{11} & \widehat{\Lambda}_{12} \\ \widehat{\Lambda}_{21} & \widehat{\Lambda}_{22} \end{pmatrix} \quad (10)$$

$$\widehat{Z} = \widehat{\Lambda}_{21} - \widehat{\Lambda}_{22} \tilde{\Omega}_{22}^{-1} \tilde{\Omega}_{21} \quad (11)$$

$$\widehat{Y}_t^* = Y_t - \tilde{\Omega}_{12} \tilde{\Omega}_t^{-1} \widehat{\nu}_t \quad (12)$$

$$(k+1)xk = \begin{bmatrix} {}_{0}xk^{0} \\ {}_{1}xk^{lk} \\ {}_{k}xk^{lk} \end{bmatrix} \quad (13)$$

The second stage of FMOLS for β calculations can be expressed as follows:

$$\widehat{\beta}^{*} = (w'w)^{-1}\left(w'\widehat{y}^{*} - nD\widehat{z}\right) \quad (14)$$

In this equation, $\widehat{y}^{*} = (\widehat{y}^{*}_1, \widehat{y}^{*}_2 \ldots . \widehat{y}^{*}_n)^{'}, w = (\tau_n, X)$ and $\tau_n = (1, 1 \ldots 1)^{'}$.

5. Results and discussion

To test the stationary properties of the data, this paper applies the Z&A test. This method is designed to deal with structural breaks in the data. The concept of stationary is important in regression analyses as a non-stationary series leads to misleading results commonly known as spurious regression. The transformation of data is the remedy to solve this problem (Granger and Newbold, 1974). To solve the non-stationary issue, this study uses the differencing option for the variables with unit root problem at level. The results of the unit root test are presented in Table 1 for the three selected countries.

These test results shown in Table 1 indicate a mixed trend among the variables for all three economies. For instance, CO_2 emissions, energy use and tourism are not stationary at all levels for Indonesia, but GDP per capita is stationary at all levels. For the Philippines, all variables show the unit root at all levels but become stationary at the 1st difference. The response of variables is also mixed for Vietnam, showing all other variables are stationary at all levels except energy use. However, all variables are free from unit root problem after taking the 1st difference with different breakpoints for both levels.

5.1. FMOLS approach

The presence of unit root in the data and its removal provides the basic platform to apply the FMOLS. For this purpose, CO_2 is the dependent variable including few independent variables to confirm the impact of tourism on environmental degradation for the selected lower middle-income Southeast Asian economies. The FMOLS estimations are reported in Table 2. The results show that economic development is a significant contributor of CO_2 emissions as the GDP coefficient is positive and significant for Indonesia. The association between energy use and CO_2 is also positive and significant. The coefficient of tourism indicates a positive association with CO_2 showing that tourist arrivals significantly pollute the environment in Indonesia. Therefore, the results indicate that both GDP and T&T are the substantial consumers of energy which leads to CO_2 emissions and causes environmental degradation in the country.

For example, the famous tourist destinations such as Bali in Indonesia are immensely polluted and even the tourism industry and marine life are both in danger. Indonesia stands second among the marine waste producers after China. The most crowded tourist places, e.g. Kuta in Bali, are regularly covered with solid waste including garbage, plastic bags and other tourist castoffs (Oliphant, 2017; Coyle, 2019). The junk piles foster CO_2 emissions and pollute the atmosphere. Thus, tourism related activities increase the pollution level in Indonesia. Volpi and Paulino (2018) and Goffi et al. (2019) also suggest that tourist services and activities produce CO_2 and contaminate the environment. The GDP^2 indicates the square of the GDP per capita to evaluate the EKC hypothesis. Therefore, destination sustainability and eco-friendly policies are necessary to improve the environment. Furthermore, the coefficient of GDP^2 is negatively linked with CO_2. This connection confirms the validity of EKC hypothesis in Indonesia.

The results show that energy use is the most significant contributor of CO_2 emissions in the Philippines, whereas, the share of GDP and tourism is relatively low but still positive. The coefficient of GDP^2 is also positive and does not provide evidence for EKC hypothesis in the Philippines. The Philippines is a holiday paradise and attracts thousands of domestic and international tourists on a daily basis due to its beautiful natural beaches. One of the major reasons for environmental degradation is the less effective waste management policies (McKinsey & Company and Ocean Conservancy, 2015; Palafox Jr., 2018). Despite the abundance of forests, plants and other natural factors to reduce the CO_2 augmentation, corruption and a 'do nothing' approach are common features in the LDCs, resulting in a polluted environment. All these elements lead to an adverse impact of tourism on the environment. Overall, the results suggest that both industrial and service sectors, including tourism, foster CO_2 emissions and adversely affect the environment. If other factors remain constant, the share of industrial sector emissions outweighs those of the service sectors. Mulali et al. (2015) also suggest that strict environment-friendly policies are essential to reduce CO_2 emissions from tourism in non-European countries. Similarly, Arbulú et al. (2015) confirm a significant relationship between tourism and waste generation.

Keeping other factors constant, the scenario is different for Vietnam, where the coefficient of energy use is positive and significant, illustrating a direct significant link between environment and energy use. The significant positive coefficient of GDP turns negative and remains significant for GDP^2. This association validates the existence of the EKC hypothesis in Vietnam. Conversely, the tourism coefficient is negatively associated with CO_2. The significant link implies that tourism improves the environmental conditions in Vietnam. Thus, the FMOLS estimations clearly indicate that energy use, mainly in the industrial sector, has adverse

Table 1
Unit root test with structural breaks.

Countries	Variables	Z&A test for level		Z&A test for 1st difference	
		T-Stat	Break	T-Stat	Break
Indonesia	CO_2	−3.66	2007	−7.71	2011
	TR	−4.04	2008	−5.33	2003
	GDP	−6.63*	2010	−6.30	2004
	EU	−3.71	2005	−5.88	2002
Philippines	CO_2	−3.88	2008	−5.92	2010
	TR	−3.58	2002	−5.39	2000
	GDP	−2.95	2003	−4.96	1998
	EU	−3.55	2011	−6.30	2011
Vietnam	CO_2	−4.96*	2000	−5.58	1999
	TR	−4.32**	2010	−7.22	2010
	GDP	−4.82*	2002	−6.63	1998
	EU	−2.51	2000	−5.99	2007

Notes.
1. "*" and "**" indicate that variables are stationary at 5% and 10% respectively.
2. The level of significance is 5%.

Table 2
FMOLS estimations.

Variables	Indonesia		Philippines		Vietnam	
EU	0.012**	(0.23)	0.002*	(11.12)	0.002*	(5.75)
GDP	0.002**	(1.51)	0.003**	(1.52)	0.004*	(7.83)
GDP^2	−0.005**	(-0.88)	0.97**	(0.073)	−0.005*	(-5.89)
TR	2.61**	(0.19)	8.69**	(0.32)	−3.28*	(-2.53)
Const.	−0.66**	(-0.36)	−0.54*	(-2.89)	−0.54*	(-13.31)
$R2$	0.74		0.85		0.98	
Adjusted R^2	0.67		0.80		0.97	

Notes.
1. The "*" and "**" represent the level of significance at 5% and 1% respectively.
2. The values in parentheses are the t-statistics of coefficients.
3. CO_2 is the dependent variable.

impacts on the environment; as both energy use and GDP are significantly associated with CO_2 emissions. Furthermore, tourism improves environmental quality through its role in reducing CO_2 emissions. The major reason for this negative impact is the coal-backed energy production in Vietnam. The consumption of coal is rapidly deteriorating the air quality in Vietnam and industrialization is adding fuel to the fire. But the government is launching various policies to improve environmental quality (Baker, 2018).

Vietnam follows a more proactive approach than other lower middle-income Southeast Asian countries to protect the environment. For example, the Vietnamese government passed a separate bill introducing environmental regulations and penalties for violating the rules (Hoang et al., 2017). Similarly, the government is working in collaboration with Japan to learn the recent developments in waste management; both countries have signed several memoranda to increase cooperation. Likewise, Vietnam is one of the first countries to introduce an action plan for the Paris agreement for environmental quality. However, the country needs constant efforts to reduce the negative impact of energy consumption and must use its T&T industry to protect the environment in the long run.

These findings are similar with Sghaier et al. (2018) for Morocco, Tunisia and Egypt validating a long-term association between tourism and GDP at different significance levels. Moreover, tourism and environmental connection varies; such as the impact is negative for Egypt, and positive for Tunisia. Also, the findings support the EKC hypothesis. Similarly, Azam et al. (2018) provide mixed evidence regarding tourism's impact on pollution in Malaysia, Thailand and Singapore. This link is positive for Malaysia and negative for the other two economies. In the light of these results, Indonesia and the Philippines need to pay more attention to the environmental issues. Improvements are required in both service and industrial sectors to reduce the levels of CO_2 emissions.

5.2. Cross check: the Co-integration approach

To deal with the potential structural breaks, this study uses the Gregory-Hansen co-integration test for three countries. This method tests the long-term relationships using three cases i.e. change in levels, change in trend and change in regime. The results for Indonesia are presented in Table 3 indicating a long-term co-integration relationship among variables; the test values are significant at the given level of significance for Indonesia, illustrating the long-term association between CO_2 and tourism. The major break date is 2009 in three cases for Indonesia.

The results for the Philippines are reported in Table 4. The values of ADF and Zt are consistent confirming the long run co-integration among variables. The years of break for the Philippines are 2008 and 2009. The link proves true in all scenarios as the test statistics are higher than the critical values.

The estimated results of Vietnam are shown in Table 5. Like the other two economies, the connection between CO_2 emissions and tourism is consistent in the long run. The calculated t-statistics are higher than critical values in absolute terms. This postulates that variables share a co-integration relation in the long run. The breaks occur mainly in 2006 in the case of Vietnam.

6. Discussion

The present literature on the tourism and environmental pollution nexus presents mixed evidence. It may differ from country to country depending on the domestic characteristics of a specific economy. One of the recent studies on this relationship for Southeast Asian countries, including Malaysia, Thailand and Singapore, by Azam et al. (2018) argues that flora and fauna is the main driving force for the positive impact of tourism on Singapore's environment; since their study also finds mixed responses from three countries, a few aspects of this complex relationship are still uncovered. Thus, a detailed discussion to elaborate the findings can motivate further studies on this issue for different regions.

Firstly, the Philippines and Indonesia secured 18th and 23rd position in the world in terms of the absolute growth of the T&T industry. This industry is contributing a significant share of GDP for the both economies (WTTC, 2018b; WTTC, 2018c). The statistics indicate that both countries have sufficient natural resources in the form of forests and plantations. For instance, the World Bank forest data states that the physical planting and forest areas for the Philippines and Indonesia are 24% and 46% respectively. This outweighs Singapore in terms of greenery, as the forest area in Singapore is only 3% of its total land (World Bank, 2018). This implies that flora and fauna are not the only factors that cause reductions in CO_2 emissions.

Secondly, the number of tourists visiting every year is an important factor to consider. It is a great challenge for the LDCs to entertain a large number of tourists and provide them environment-friendly services. Therefore, it is likely that tourist arrivals will negatively affect the environment unless governments introduce effective measures to control it (Ng et al., 2015; Shakouri et al., 2017). According to the World Bank tourist arrivals data, Indonesia, Vietnam and the Philippines received 11.51 million, 10.01 million and 5.96 million tourists respectively in 2016. The surges of tourist arrivals in remote places increase energy use. Transportation fosters CO_2 emissions through fuel consumption and low quality transport carriers further add to the environmental

Table 3
Co-integration test for Indonesia.

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test Statistic	Breakpoint	Date	Asymptotic Critical Values		
				1%	5%	10%
ADF	−6.19	14	2008	−5.77	−5.28	−5.02
Zt	−5.79	15	2009	−5.77	−5.28	−5.02
Za	−18.86	15	2009	−63.64	−53.58	−48.65
Change in Level and Trend						
ADF	−6.67	8	2002	−6.05	−5.57	−5.33
Zt	−5.83	15	2009	−6.05	−5.57	−5.33
Za	−19.08	15	2009	−70.27	−59.76	−54.94
Change in Regime						
ADF	−7.42	10	2004	−6.51	−6.00	−5.75
Zt	−6.18	15	2009	−6.51	−6.00	−5.75
Za	−28.09	15	2009	−80.15	−68.94	−63.42

Table 4
Co-integration test for the Philippines.

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test Statistic	Breakpoint	Date	Asymptotic Critical Values		
				1%	5%	10%
ADF	−6.05	15	2009	−5.77	−5.28	−5.02
Zt	−5.81	14	2008	−5.77	−5.28	−5.02
Za	−22.76	14	2008	−63.64	−53.58	−48.65
Change in Level and Trend						
ADF	−6.40	14	2008	−6.05	−5.57	−5.33
Zt	−5.62	14	2008	−6.05	−5.57	−5.33
Za	−22.66	14	2008	−70.27	−59.76	−54.94
Change in Regime						
ADF	−6.54	12	2007	−6.51	−6.00	−5.75
Zt	−6.32	14	2008	−6.51	−6.00	−5.75
Za	−23.45	14	2008	−80.15	−68.94	−63.42

Table 5
Co-integration test for Vietnam.

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test Statistic	Breakpoint	Date	Asymptotic Critical Values		
				1%	5%	10%
ADF	−6.99	12	2006	−5.77	−5.28	−5.02
Zt	−5.97	12	2006	−5.77	−5.28	−5.02
Za	−23.54	12	2006	−63.64	−53.58	−48.65
Change in Level and Trend						
ADF	−7.18	12	2006	−6.05	−5.57	−5.33
Zt	−6.02	12	2006	−6.05	−5.57	−5.33
Za	−23.52	12	2006	−70.27	−59.76	−54.94
Change in Regime						
ADF	−7.24	10	2002	−6.51	−6.00	−5.75
Zt	−6.11	12	2006	−6.51	−6.00	−5.75
Za	−25.16	12	2006	−80.15	−68.94	−63.42

degradation process. Similarly, the construction industry in the LDCs does not follow international construction standards. The residential and infrastructural facilities for tourists significantly contribute towards CO_2 emissions (Dogan et al. 2017). On the same note, the tourist activities generate different kinds of waste including littering, water waste, depletion of natural resources and damage to the natural sites, causing environmental degradation especially in the LDCs (Michailidou et al., 2016).

On the contrary, tourist arrivals can play an essential role in CO_2 reduction. For instance, natural, beautiful and clean destinations are the first priority of tourists. This motivates domestic governments and the masses to maintain the beauty and eco-friendly environment of not only the tourist resorts but the overall improvement of their city atmosphere. For example, plantations in cities, environmental awareness campaigns, usage of environmentally friendly transport and construction of green buildings for tourists can improve the overall environmental quality (Ahmad et al., 2018). However, the industrial and household sectors of developing countries cause serious threats to their environment. A substantial portion of energy is utilized in industries to keep the momentum of rapid economic growth of the developing nations. This, in turn, significantly increases smoke, dust and various industrial wastes, which are the main sources of CO_2 augmentation.

Likewise, underprivileged households use kerosene and wood as the main energy source, resulting in high CO_2 emissions and environmental pollution (Wu et al., 2019). As the major planting areas are generally located in the remote places rather than cities, all these factors can pollute the environment in the countries with huge forests, including the Philippines and Indonesia. Therefore, the above given discussion confirms that tourism and the environment are a double-edged sword and their nexus does not merely depend upon the flora and fauna of a country. There are certain factors that can influence this association and it can go either way depending upon a region, country or a specific destination.

7. Conclusions

At present, tourism is among the key sectors of economy for sustainable development. Besides economic benefits, tourism can promote cultural heritage and brings the masses together. This may help to improve the image of a country and bring harmony among people from different parts of the world. Besides its remarkable contribution to economy and society, this industry has a significant impact on the environmental quality of the host country. Therefore, this paper aimed to investigate the link between tourism and environmental degradation taking the annual tourist arrivals and CO_2 emissions as main variables for three lower middle-income countries of Southeast Asia namely Indonesia, the Philippines and Vietnam. This paper used the annual data from 1995 to 2014.

The Zivot-Andrews unit root test was applied to deal with the stationary properties and structural breaks in the data. The test results indicate a mixed trend among variables for all three countries. CO_2 emissions, energy use and tourism are not stationary at all levels for Indonesia but GDP per capita is stationary at all levels. All variables show the unit root at all levels but become stationary at the 1st difference for the Philippines. The response of variables is also mixed for Vietnam showing all other variables as stationary at all levels except energy use. Nevertheless, all variables become stationary after taking the 1st difference with different breakpoints

for both levels.

The aforementioned unit root test result fulfills the preliminary condition for the FMOLS used for further analysis. The FMOLS results for Indonesia show that economic development significantly contributes to CO_2 emissions. The relationship between energy use and CO_2 emissions is also positive and significant. The coefficient of tourism shows that tourist arrivals significantly pollute the environment. Additionally, the EKC hypothesis is valid in the case of Indonesia. The estimations for the Philippines suggest that both industrial and service sectors, including tourism, foster CO_2 emissions and adversely affect the environment. Holding other factors constant, tourism adds to environmental pollution and the share of the industrial sector outweighs that of the service sector. The present study finds no proof for the validity of EKC hypothesis for the Philippines.

The main findings for Vietnam indicate a negative association between tourism and CO_2 emissions, implying that tourism improves environmental conditions. The coefficient of energy use is positive and significant, illustrating the direct significant link between environment and energy use. The results also validate the existence of the EKC hypothesis. Therefore, as both energy use and GDP are significantly associated with CO_2 emissions, it concludes that energy use mainly in the industrial sector has an adverse impact on environment. Besides, tourism improves environmental quality in Vietnam through its role in reducing CO_2 emissions. The Gregory-Hansen test is used to check the robustness of the estimations. The test statistics confirm a long-term co-integration among all variables. Thus, the relationship between tourism and environmental degradation varies for Indonesia, the Philippines and Vietnam. Also, these findings are robust using different estimation tests.

The findings of present study reveal several important aspects of tourism and pollution relationships for lower middle-income countries. The relationship is complex and needs to be handled with immense caution. The natural environment and scenic spots are attractions for tourists but strict regulations are required to create a positive impact for planting and natural greenery in the forests in Southeast Asian economies. At present, the negative impact from tourism and energy use in several sectors outweighs the positive contribution of natural plantation in Indonesia and the Philippines, confirming the crucial role of government policies to promote green and environment-friendly tourism in the LDCs.

Therefore, governments in Southeast Asia should take necessary action urgently to protect their environment. For instance, the tourism industry produces tons of waste and this waste is dangerous for humans and marine life. The junk piles foster CO_2 emissions and pollute the atmosphere. The plastic consumed by marine life affects humans as the seafood is a major content of native cuisines in Southeast Asia. Moreover, this huge waste in itself is a negative omen for the T&T industry. It is likely that tourists from all over the world will lose their interest gradually and select clean and healthy destinations instead. Therefore, active intervention from government to reduce the waste and control the corresponding CO_2 emissions is vital and urgent in Indonesia. On the same note, effective waste management policies are crucial for the Philippines to reduce the CO_2 emissions from tourism.

The industrial sector of Vietnam is the leading contributor of environmental degradation, but the country owns substantial energy alternatives. The central and southern areas are enriched with solar energy production to minimize the pollution. Furthermore, wind energy and biomass plants are the best options to reduce CO_2 emissions from the industrial sector. Additionally, improvements in the tourist sector will help to reduce the adverse effects and help the economy in general. Taking the similar nature of environmental degradation into consideration, the Philippines and Indonesian governments specifically and other lower income countries in general should introduce strict regulations for waste management. The governments should encourage waste segregation and provide funds and technical assistance to individuals and companies promoting this culture. Likewise, governments should relocate beverage manufacturing near clean water sources. This will automatically help to reduce pollution as the water is a major source of their business.

Likewise, the government should encourage the farm to market concept to discourage water waste, the use of packed food, plastic bags and to promote the use of eco-friendly bags and recycling water to reduce pollution at tourist destinations. Similarly, the government should engage the local community to promote tourism and environmental protection; this includes the environmental protection workshops to train and motivate locals. The job opportunities for natives as guides will work both ways: firstly, the reduction of poverty through job creation; secondly, the provision of manpower to encourage environmentally friendly tourism. Similarly, taking Singapore as an example, the government of lower middle-income countries should offer tax incentives to encourage plantation in cities. As the physical forest areas are far from cities, it will help to enhance environmental quality in cities. Furthermore, incentives should be offered for reporting any violations.

In addition, the governments of Southeast Asian countries and other developing regions should act proactively to design policies for their industrial sectors. The economic development of a country cannot be compromised but the implementation of eco-friendly methods should be encouraged. For this, the governments should promote the use of low-carbon technology. Monetary incentives via tax reductions should be offered to those industries which are promoting low-carbon energy production, building of infrastructure and eco-friendly transport systems to enhance sustainable growth with the help of tourism. Finally, the Southeast Asian governments should work in collaboration with their Asian counterparts and countries in other regions. This includes policy and technical assistance from the developed countries to promote the T&T industry without degrading the environment. Last but not least, the selected countries of this study and other lower middle-income countries should focus on eco-friendly energy sources to make their industrial sectors environment-friendly without cutting down its share in economic development.

Finally, the findings and abovementioned discussions confirm that the impact of tourism on the environment depends on several factors and varies among different countries in the same region. Taking this point into account, future studies can, for instance, explore the link for lower middle-income countries of Asia and Africa. The contribution of natural and industrial factors and their impact on this link in various regions and particular countries will enrich the knowledge of academics and policy makers. Furthermore, various factors influencing this association in lower middle-income countries will help to design a combined policy to promote social, economic and environmental sustainability. This will ultimately help in promoting socioeconomic development in the T&T oriented economies.

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