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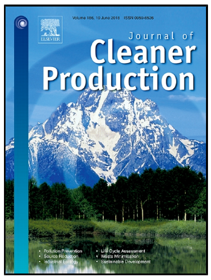

Effect of tourism on environmental pollution: Further evidence from Malaysia, Singapore and Thailand

Muhammad Azam, Md. MahmudulAlam, Muhammad Haroon Hafeez

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Effect of tourism on environmental pollution: Further evidence from Malaysia, Singapore and Thailand

Muhammad Azam (PhD. Economics)
Department of Economics,
Abdul Wali Khan University Mardan, KP- Pakistan
Email ID: drazam75@yahoo.com

Md. MahmudulAlam, PhD
School of Economics, Finance & Banking
College of Business ,Universiti Utara Malaysia
06010 UUM Sintok, Kedah, Malaysia
Email: mahmudul@uum.edu.my

Muhammad HaroonHafeez, PhD
Institute of Management Sciences (Business Administration),
Bahauddin Zakariya University, Multan (Pakistan)
Email ID: haroonhafeez81@gmail.com

Abstract
An increasing number of studies reveal that tourism industry makes a substantial contribution towards socioeconomic growth and development of tourism led economies. However, tourism steered economic growth and development is achieved at the cost of environmental pollution and degradation. The main objective of this study is to examine the effect of tourists' arrivals on environmental pollution caused by Carbon Dioxide emissions in Malaysia, Thailand and Singapore over the period of 1990–2014. Some other regressors namely energy consumption and income are also used in the multivariate model. The Zivot–Andrews test is employed to determine unit-root and presence of structural break in the data. Fully Modified Ordinary Least Squares estimator is used as an analytical technique for unknown parameters estimation. The empirical results reveal that tourism has a significant positive effect on environmental pollution in Malaysia. However, an inverse relationship between tourism and environmental pollution is observed in Thailand and Singapore. Empirical findings suggest that sustainable economic growth and development should be ensured by implementing prudent public policy where host governments must strive to promote socially and environmentally responsible tourism industries in their respective countries.
Keywords: Tourism; environmental pollution; sustainable development
JEL Classification: L83; Q5; Q01

Introduction

Tourism contributes enormously towards the economic development of host countries. Globally, many developing countries rely largely on tourists' spending which accounts for significant contribution to Gross Domestic Product (GDP) of those countries. According to Ashley *et al.* (2007) tourism contributes almost 40% of GDP in developing economies and approximately 70% of GDP in case of very small island economies. However, with reference to developed and more diversified economies, tourism accounts for 2% to 12% share in GDP. Moreover, according to most recent report by World Tourism and Travel Council (WTTC) approximately 1.2 billion tourists travelled internationally in 2015; thus, tourism industry contributed US$ 7.2 trillion i.e. 9.8% of world's GDP and generated 284 million jobs i.e. 9.5% of total employment opportunities globally (WTTC, 2016a). These figures reflect the substantial role of tourism in global economy. Tourism influences the economy of host countries in multiple ways; through employment generation, infrastructure establishment, tourism-related value chain development and through other socio-economic impacts on the lives of domestic population Tang & Abosedra, 2014; Tang & Tan, 2013; Apergis & Tang, 2013; Ashley *et al.*, 2007).

However, the other side of the picture is quite dismal and gloomy. On one hand, tourism industry serves as a catalyst for economic growth of tourism led economies; whereas, the flip side of coin illustrates that there are numerous hazardous effects of rapidly increasing tourism. Some of those hazards are economic (uneven development, income inequality, geopolitical risks, rising costs of materials); whereas, others are environmental (extreme weather conditions and climate change, emission of greenhouse gases, water and other resources scarcity, excess consumption of energy) and social (child labour and forced labour, human trafficking and sex tourism, culture and heritage protection) in nature (Mowforth& Munt, 2016; WTTC, 2015). It is immensely apprehended that positive aspects of tourism would be overshadowed by the aforementioned negative aspects if serious efforts are not made towards promoting socio-economically viable and environmentally sustainable tourism worldwide. Tourism has been attributed as an environmentally damaging industry on account of the greenhouse gas discharges related with tourist mobility (Highamet *et al.,* (2016). Wang et al. (2018) expounds that being one of the key CO_2 emitter, industrial sector has drawn substantial attention of the global community regarding efficient energy usage and CO_2 reduction policies.

Irrespective of tremendous contribution of Travel and Tourism (T&T) industry to the economic progress, it is still an uphill task for the industry to maintain a positive outlook in terms of its expansion and growth. With the promulgation of Islamic and medical tourism as its backbone, Malaysian government has rendered its undoubted devotion to strengthen and support the tourism industry. However, Blanke & Chiesa (2013) observed Malaysia's challenging situation to cope with the growth momentum when the T&T sector declined two points in the global index of T&T competitiveness among 140 countries in 2013, from the 32nd place in 2008, as mentioned in the Travel and Tourism Competitiveness (T&TC) Report 2013. This decline happened quite unexpectedly and without any indications; however, the industry managed to learn some alternative methods to carry out tourism business more successfully. With particular focus on quality and environmental dimensions, several basic initiatives can be taken in this regard. More recently, analytical reports and newspapers identified some factors i.e. travelling, hotels, accommodation, and other facilities and services that cause T&T industry to be a significant contributor in global greenhouse gases emissions (Doyle, 2014; UNEP, 2015). Air travelling and accommodation predominantly rely on huge energy consumption (Gossling, 2002; Tovar & Lockwood, 2008; Gossling et al., 2010), which consequently leads to greenhouse gases emissions, particularly CO_2 (see Becken, Simmons & Frampton, 2003; Becken, 2005; Liu et al., 2011; Katircioglu, 2014a; Solarin, 2014). This becomes more relevant in case of Malaysia where its position in terms of environmental management ranking eventually declined and the environmental sustainability rating deteriorated to 61 from 44 in 2008, as revealed in 2013 in the updated version of the T&TC report (Blanke & Chiesa 2013). This decline was further supported when Malaysia was ranked at 103 in 2013, dropping from 86th position in 2008 with regard to CO_2 emissions (Blanke & Chiesa, 2013). It must be remembered that environmental quality degeneration can't be treated as an insignificant matter any further, as poor air quality would subsequently obstruct travel demand and upcoming progress opportunities (Kelly & Williams 2007; Pang et al. 2013). Finally, the countries in pursuit of their developmental objectives are deemed to have incurred additional costs caused by rapidly emerging environmental consequences and climate change (Shahbaz *et al.,* 2015).

Likewise, tourism industry provides tremendous support to socio-economic development of Thailand. In 2015, travel and tourism industry contributed THB 2,795.1billion which represents 20.8% share in GDP. Besides, travel and tourism industry created almost 6 million direct and indirect employment opportunities which account for 15.4% of total employment opportunities in Thailand. Similarly, with reference to Singapore, the role of travel and tourism industry in economic development is quite significant. In 2015, travel and tourism industry contributed SGD 39.5 billion which represents 10% share in GDP. Moreover, travel and tourism industry generated almost 310,500 direct and indirect employment opportunities which account for 8.5% of total employment opportunities in Singapore. In 2015, the total investment in travel and tourism industry of Singapore was SGD 19.8 billion which represents 19.9% of total investment in Singaporean economy (WTTC, 2016d).

According to Wilson (1994) tourism being the most prominent industry of Singapore is also considered as one of the largest industries of Asia Pacific region. Keeping in view the economic context, Katircioglu (2014b) authenticates that hypothetical relationship between tourism and growth is immensely important because locomotive sector serves as a pillar of Singapore economy. In this regard, Chang and Wong (2003) examined the linkage of oil price shocks with the economic scenario of Singapore, which has significant implications for energy sector. The findings revealed that oil price shock has a very minimal impact on Singapore economy, irrespective of Singapore's status as net oil importer. Xuchao et al. (2010) carried out an analytical research regarding energy consumption and CO_2 emissions mainly caused by hotel industry in Singapore. A well-established and feedback relationship between electricity consumption and economic development in Singapore is found to have been established by Yoo (2006) as well. On the contrary, Karki et al. (2005) have advocated that economy of the Association of South East Asian Nations is prospering at surprisingly dynamic rate, in terms of rapidly increasing urbanization, diversified energy resources and technology oriented industrialization.

The focus of this study is on socio-economic significance of tourism and its impact on environmental pollution in tourism-led economies in Southeast Asia namely Malaysia, Thailand and Singapore. The T&T industry of Malaysia has experienced rapidly increasing growth over the previous few decades owing to the focused governmental endeavours and intensive campaigning to declare Malaysia as tourists' favourite destination (Ng, Lye & Lim, 2016). T&T plays a significantly crucial role in the Malaysian economy in terms of economic growth which is clearly represented by constant improvement in the rankings according to the contribution to the national economy in 2013. T&T contributed RM 1.5 billion to the Gross National Income (GNI) that reached up to 16.1% of GDP in 2013 (Tourism Malaysia, 2014). In 2015, T&T industry contributed MYR 152.8 billion which represents 13.1% share in GDP. In addition, T&T industry created almost 1.5 million direct and indirect employment opportunities which account for 11.4% of total employment opportunities in Malaysia. In 2015, the total amount injected in travel and tourism industry of Malaysia was approximately MYR 20.7 billion which represents 6.9% of total investment in Malaysian economy (WTTC, 2016b).

Keeping in view the previous research, the countries under study namely Malaysia, Thailand, and Singapore are emerging economies with constantly increasing number of tourists. Consequently, environmental pollution in the form of CO_2 emission has also maintained an upward trend. The main issue is to identify the actual trigger of this upsurge in CO_2 emission, be it tourism or some other factors. Therefore, a fresh quantitative study is required in order to examine the relationship between tourism and environment.

Indeed, the very constructive role played by the tourism sector can't be overlooked in the process of economic growth and development and thereby promoting social welfare. At the same time, the environment and economic growth has a close relationship, where clean and green environment is necessary for improving social wellbeing. Therefore, the broad objective of this study is to explore the impact of tourism on environmental pollution by CO_2 emissions[1]in Malaysia, Singapore and Thailand during the period ranging from 1990 to 2014. The foremost rationale behind selection of aforementioned countries for the present study is their predominant economic reliance on tourism industry as T&T industry contributes 20.8%, 13.1% and 10% share in GDP of Thailand, Malaysia and Singapore respectively. Moreover, the selection of these specific countries is made owing to their social and geographical similarities as they share mutual neighbourhood in ASEAN region. Though, a few related relevant studies are available; but to the best of the authors' knowledge, current study is among the pioneer studies pertaining to examining the effect of tourism on environmental pollution in these countries. Moreover, set of regressors, time period and estimation methodology is different as compared to the previous studies. Thus, it is expected that the outcomes will guide the management constituting public policies for tourism and environment in the selected countries. Consequently, it will boost economic growth and development and hence social welfare of the people in the region.

The study is structured as follows: Section 2 deals with review of literature. Section 3 presents empirical methodology. Section 4 discusses empirical results. Section 5 presents summary and conclusion. Lastly, policy implications and recommendations for future research are presented in section 6.

2. Literature Review

In recent years, the linkage between tourism and its impacts on socio-economic factors has drawn considerable attention from academicians. However, the relationship between tourism and climate change still remains an under investigated scholastic domain.

Mirbabayev and Shagazatova (2006) have attributed tourism as environment friendly industry which does not involve chimneys. However it does not necessarily frees local government from all types of responsibilities. There are very few empirical studies, if any, which have examined the tourism and environmental concern linkage in the light of time series analysis. This research takes up the challenging objective to investigate the effects of tourism development on environment with relation to CO_2 emissions. Where the outcome results of tourism development appear to exhibit increasing levels of CO_2 pollutants, remedial policies need to be formulated and implemented as the prime responsibility of tourism department. Beladi et al. (2009) in their study examined a small open economy dealing with tourism

[1] Following the studies of Acharyya (2009), Azam (2016) and Zheng and Sheng (2017), where they also measured environmental pollution/degradation by CO_2 emissions.

related taxes in the form of pollution tax. However, their findings revealed that where taxes can potentially decrease the emission levels, they can simultaneously make tourism more expensive. The relationship between tourism development and CO_2 emissions is spelt out in the context of economic and transportation activities by consumption of domestic energy. Transport sector being the central factor of tourism development provides the tourists with best possible movement facility from the sources to their destinations (Yeoman et al., 2007).. So far as air, sea, or land transportation is concerned, all locomotive vehicles end up in CO_2 emissions because of their heavy reliance on energy as a primary fuel source. The international flow of tourists was employed as a key indicator in a recent study conducted by Mayor and Tol (2010). Their study focused on the long term effects of tourism on environmental pollution. Findings of their study revealed that tourism expansion would lead to increased transportation requiring greater fuel consumption resulting in increased CO2 emissions. Keeping in consideration the economic activities, several researchers have considered tourism expansion to be the consequential outcome of ever-expanding economic activities (Dritsakis, 2004; Durbarry, 2005; Kim *et al.,* 2006). Following the line of research by Zhang and Cheng (2009), Chang (2010) has recently discovered how economic growth ultimately results into higher levels of CO_2 emissions so far as energy consumption is concerned.

Ghobadi and Verdian (2016) performed a study using research sample containing 380 families and 384 tourists from Noushahr, Iran. Findings of the study revealed that there is a substantial correlation between the environment effects and tourism in the country. However, findings of the study suggested some appropriate policy measures for encouraging tourism, and clean environment. Azam and Khan (2016ab) empirically proved that urbanization, investment, energy consumption, and trade are also the main factors determining environmental pollution by CO_2 emissions. Robaina-Alves et al. (2016) assert that tourism played a crucial role in boosting Portugal's economy and thereby provides sustainable economic growth. The study finds that tourism activity has the most significant effect, energy use mix, carbon intensity and energy intensity effects are also shown to be vital. Though, Zhang and Gao (2016) observed that the tourism-induced Environmental Kuznets Curve (EKC) hypothesis did not exist in Central China, however; it was weakly supported in Eastern and Western China during 1995-2011. More recently, Alam and Paramati (2017) examined the role of tourism investment on tourism development and CO_2 emissions in panel of 10 major tourism countries (Barbados, Bahamas, Belize, Cabo Verde, Fiji, Maldives, Malta, Seychelles, St. Lucia and Vanuatu) during 1995-2013. The causality test results indicate that tourism development Granger causes CO_2 emissions and tourism investment in the short-run, implying that investment in tourism enhances environmental quality by reducing CO_2 emissions. The empirical results of robust panel econometric methods of Paramati et al. (2017) study show that the effect of tourism on CO_2 emissions is decreasing substantially in developed countries as compared to the developing economies, thereby indicating the EKC hypothesis on the linkage between tourism growth and CO_2 emissions.

Sherafatian-Jahromi et al. (2017) conducted a study on the data pertinent to five major economies of Southeast Asian region during the period of 1979-2010 and revealed that tourism and CO_2 emissions are co-integrated, indicating that tourism affects CO_2 emissions in the long run. Hence, empirical results of their study validated the existence of an EKC in the Southeast Asian tourism industry as the nonlinear connection between tourism and CO_2 emissions was revealed. Similarly, Shakouri et al. (2017) found that tourist arrivals has significantly positive impact on CO_2 emission levels in long-run in selected Asia-Pacific countries over the period of 1995-2013. Wu et al. (2018) findings suggest that as far as environmental-economic efficiency is concerned, most countries in Asia-Pacific Economic Cooperation revealed higher economic efficiency than environmental efficiency over the period of 2006–2010. Tugc and Topcu (2018) finds that gaseous fuel emissions have a positive effect, whereas total emissions, emissions from liquid fuel and solid fuel have negative effects on tourism receipts (only in the short-run) in ten most visited country destinations during 1995–2010. Croes et al. (2018) explored that the association between tourism specialization, quality of life and economic growth is not well established in Malta. Though, tourism speciality develops the resident's quality of life in the short-term.

The abovementioned pragmatic studies reveal that both 'tourism' and the 'environment' are playing key roles in the development of any economy. However, prior studies found mixed results on the effect of tourism on environmental pollution by CO_2 emissions. The existing studies also show that there is dearth of inclusive studies on the tourism and environmental pollution in the context of ASEAN countries namely Malaysia, Thailand and Singapore. Thus, the broad aim of this study is to explore the effect of tourism on environmental pollution for three ASEAN countries and thereby reduce the contextual and knowledge gap and further advance pedagogic insight on tourism and environmental pollution relationship.

3. Empirical Methodology

3.1 Data &Source

This study has employed World Development Indicators (2016) data set of Malaysia, Singapore and Thailand for the period of 1990 to 2014 to measure the dynamic impact of tourism on environmental pollution. For the environmental pollution proxy, we (the authors) have considered CO_2 emissions per capita in metric tonnes. This includes CO_2 emission produced during consumption of gas flaring, solid, and liquid fuels. Tourism is our concerned variable which is the total number of arrivals in the host country per year. Explanatory variables of the study include GDP per capita (constant 2010). Moreover, we have considered energy use (EU, kg of oil equivalent per capita). Figure 1 shows trend analysis of CO_2 emissions for Malaysia, Singapore and Thailand, whereas, Figure 2 shows trend analysis of tourist arrivals during 1990 to 2014.

Figure 1: Trend analysis of CO_2 emission (million KW)

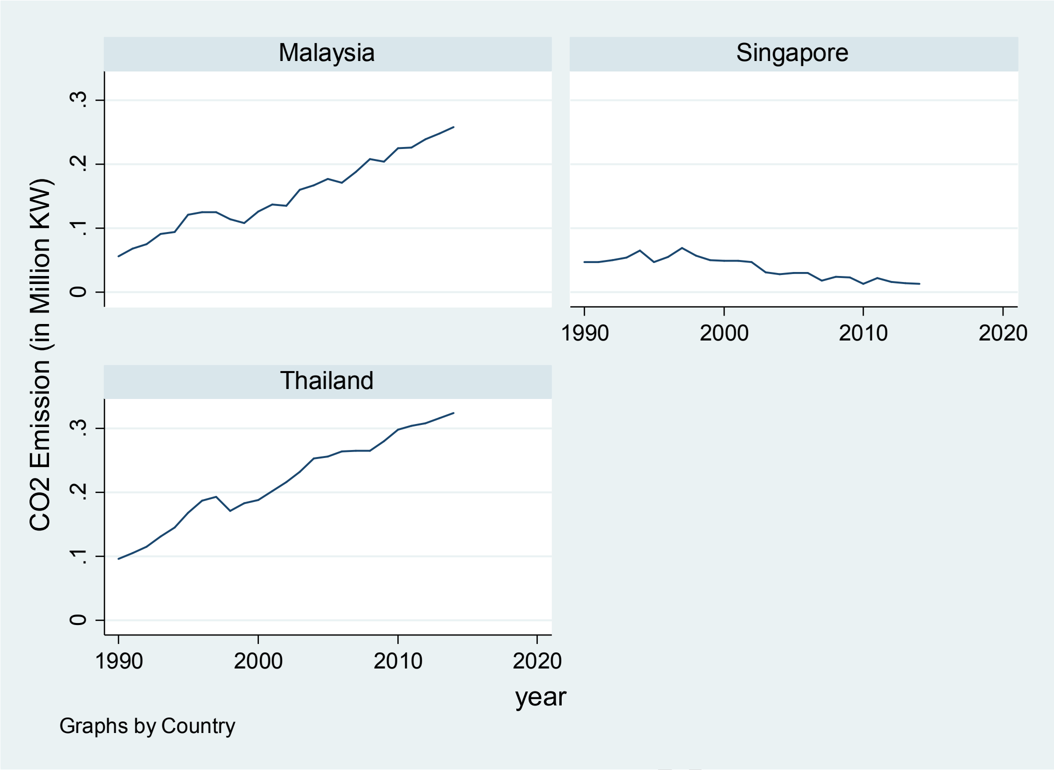
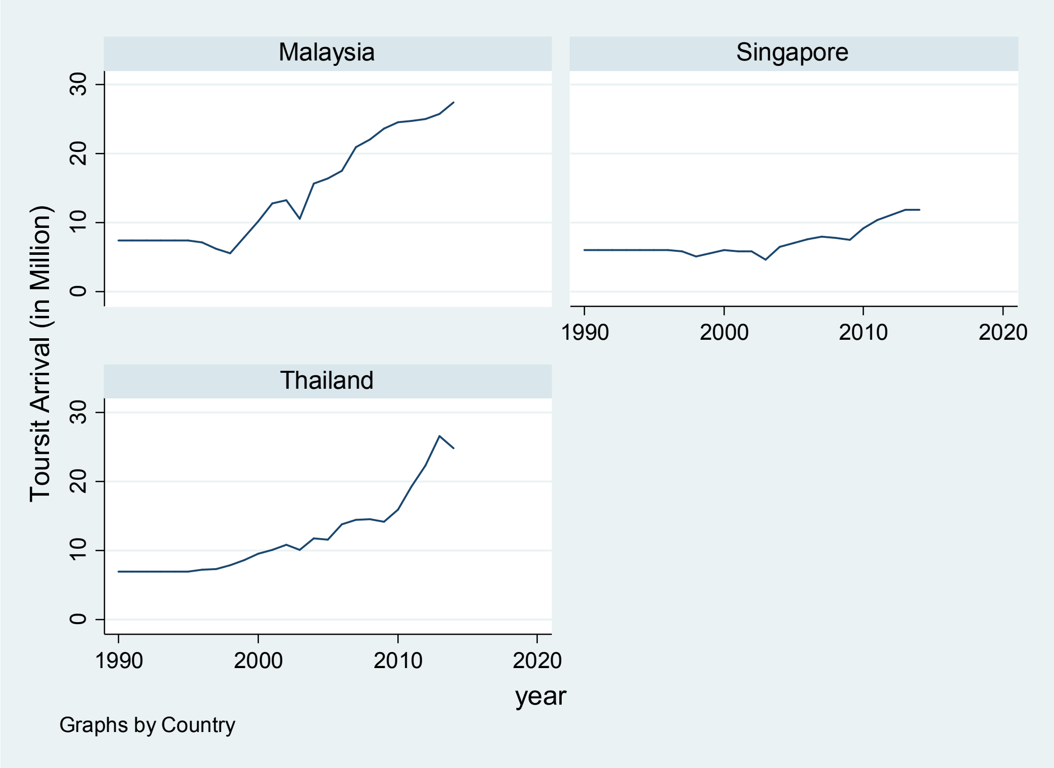


Figure 2: Trend analysis of tourist arrivals (million)



3.2 Model Estimation

3.2.1 FMOLS approach

We have applied the fully modified ordinary least squared regression approach (FMOLS) to measure the dynamic impact of tourism on CO_2 emission along with respective control variables.

$$lnCO_{2t} = \beta_0 + \beta_1 lnX_t + \varepsilon_t \text{ ....eq. (1)}$$

In Model 1, ε_t refers to the error terms while$lnCO_{2t}$is dependent variable (here it can be CO_2 emissions), β_0 is the intercept, β_1 refers to the vector slope coefficients and $lnX_t$is the vector of independent variable including tourism. This study applies FM-OLS to measure the impact of tourist arrivals on carbon emission for selected countries due to some silent features. Firstly, Phillips and Hansen (1990) developed FM-OLS approach to retrieve the unbiased estimators of co-integrating regressions under single equation based. Primarily, this method modifies ordinary least squares (OLS) to eliminate the potential endogeneity bias problem. In addition, FMOLS addresses potential serial correlation problem. The FM-OLS estimator is asymptotically unbiased and fully efficient in the presence of mixture normal asymptotic. Since the unit-root approach found mixed order of integration, it endorses the validity of FMOLS to analyse the taken series. Lastly, the co-integration estimation of FMOLS is carried out by the standard Wald tests using asymptotic Chi-square statistical inference

Assuming the following linear regression model:

$$Y_t = \beta_0 + \acute{\beta}_t X_t + u_t, t = 1,2,.........n.....\text{eq (2)}$$

Where the vector of regressors are characterized as I(1) and are not co-integrated individually. Thus,X_t has a first-differences stationary process given by

$$\Delta X_t = \vartheta + v_t \; where \; t = 2,3,........n...........\text{eq(3)}$$

WhereasΔX is transformed to be stationary by segregating the vector of drift parameters (ϑ) and v_t a vector of I(0), or stationary variable. This approach assumes $\xi_t = \left(u_t, v'\right)'$ follows a strict stationary process with zero mean and a finite positive-definite covariance matrixΣ. The estimation of FM-OLS approach, mainly the parameter β is retrieved in two folds. Firstly,Y_t is modified for the long-run T interdependence of u_t andv_t. In addition, $\hat{\mu}_t$ presents identically and independently distributed like the residual of OLS estimator.

$$\xi_t = \begin{pmatrix} \hat{u}_t \\ \hat{v}_t \end{pmatrix}, t = 2,3....n.......\text{eq(3)}$$

Whereas $\hat{v}_t = \Delta X_t - \hat{\mu}\, for\ t = 2,3,\ldots,n$ and $\hat{\mu}_t = (n-1)^{-1}\sum_{t=2}^{n} \Delta X_t$. A consistent estimator of the long-run variance of ξ_t is given by

$$\hat{\Omega} = \hat{\Sigma} + \hat{\Lambda} + \Lambda^{'} = \begin{bmatrix} \hat{\Omega}_{11}{}_{1}^{x1^{\hat{\Omega}_{11}}} & \hat{\Omega}_{21}{}_{1}^{xk^{\hat{\Omega}_{21}}} \\ \hat{\Omega}_{21}{}_{k}^{x1^{\hat{\Omega}_{21}}} & \hat{\Omega}_{22}{}_{1}^{x1^{\hat{\Omega}_{22}}} \end{bmatrix} \ldots\ldots\text{eq}(4)$$

Where $\hat{\Sigma} = \frac{1}{n-1}\sum_{t=2}^{n} \hat{\xi}_t \hat{\xi}_t, \hat{\Lambda} = \sum_{s=1}^{m} w(s,m)\hat{\Gamma}_s, \hat{\Gamma}_s = n^{-1}\sum_{t=1}^{n-s} \hat{\xi}_t \hat{\xi}^{'}_{t+s}$ and $w(s,m)$is the lag window with horizon m.

Now let

$$\hat{\Delta} = \hat{\Sigma} = \hat{\Lambda} = \begin{bmatrix} \hat{\Lambda}_{11} & \hat{\Lambda}_{12} \\ \hat{\Lambda}_{21} & \hat{\Lambda}_{22} \end{bmatrix} \ldots\ldots\text{eq}(5)$$

$$\hat{Z} = \hat{\Delta}_{21} - \hat{\Delta}_{22}\widehat{\Omega_{22}}^{-1}\hat{\Omega}_{21} \ldots\ldots\text{eq}(6)$$

$$\hat{Z} = \hat{\Delta}_{21} - \hat{\Delta}_{22}\widehat{\Omega_{22}}^{-1}\hat{\Omega}_{21} \ldots\ldots\text{eq}(7)$$

$$\hat{Y}^{*}_{t} = Y_t - \hat{\Omega}_{12}\hat{\Omega}_t^{-1}\hat{v}_t \ldots\ldots\text{eq}(8)$$

$$(k+1)\ x\ k = \begin{bmatrix} 0 \\ 1^{xk^{0}} \\ lk \\ k^{xk^{lk}} \end{bmatrix} \ldots\ldots\text{eq}(9)$$

In the second stage the FM-OLS estimator of β is given by:

$\hat{\beta}^{*} = (W^{'}W)^{-1}(W^{'}\hat{Y}^{*} - nD\hat{Z})$,

Where $\hat{Y}^{*} = (\hat{Y}^{*}_{1}, \hat{Y}^{*}_{2}, \ldots\ldots \hat{Y}^{*}_{n})^{'}$, $W = (\tau_n, X)$, $and\ \tau_n = (1,1,1\ldots1)^{'}$.

3.2.2 *Gregory- Hansen Co-integration under Structural Break*

We have applied Zivot–Andrews (2002) approach to examine the order of integration of our variables. This approach is efficient in detecting the potential structural break that may occur over the study period.Zivot–Andrews approach has two alternative versions as follows.

$$\Delta X_t = b + bx_{t-1} + ct + bDT_t + \sum_{j=1}^{k} d_j \Delta X_{t-j} + \mu_t \ldots\ldots\ldots\ldots eq(10)$$

$$\Delta X_t = c + cx_{t-1} + ct + dDU_t + dDT_t + \sum_{j=1}^{k} d_j \Delta X_{t-j} + \mu_t \ldots\ldots\ldots eq(11)$$

Where the dummy variables indicated by DU_t refer to a mean shift at each point with time break while $DT_t$is showing the time break for each variable. So, DU_t = 1 ….. if t> TB or 0 ……. if t<TB. Moreover, DU_t = t-TB ….. if t> TB or 0 ……. if t<TB.

The null hypothesis of unit root break date c=0 indicates that the series is neither stationary with a drift nor having information about structural break point. While c<0 hypothesis implies that the variable is found to be stationary with one unknown time break. Zivot-Andrews (2002) unit root test considers all potential break points and estimates them successively and finally picks the break when $\hat{c}(=c-1)=1$ from the region where the end points of the sample period are excluded. More importantly, we have applied Gregory-Hansen (1996a and 1996b) framework for co-integration that considers the single endogenous structural breaks. Our CO2 emission and tourism model is as follows.

$lnCO_{2t} = \beta_0 + \beta_1 X_t + \varepsilon_t$ ….Model 1

Where ε_t refers to the white noise error, $lnCO_{2t}$ is the dependent variable (here it can be CO_2 emissions), β_0 is the intercept, β_1 is the vector slope coefficients of the model 1 and $X_t$is the vector of independent variable. Gregory and Hansen (1996a and 1996b) proposed three different models with variant assumptions.

Model: level shift with trend
$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \varepsilon_t$ …………………...eq(12)

Model: Regime shift where intercept and slope coefficients change
$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t$……….eq(13)

Model: Regime shift where intercept, slope coefficients and trend change
$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \beta_2 t f_{tk} + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t$………eq(14)

In the above equations, Y is the dependent variable while X are independent variables. Moreover, k is break date while φ is dummy variable such as:
$f_{tk} = 0\ if\ t < k\ and\ f_{tk} = 1\ if\ t > k.$

The above frameworks endogenously determine a single break and provide the predicted time of break within the sample. The frameworks select break date where the test statistic is the least vis-à-vis the absolute ADF test statistic is the highest. Finally, we have compared the calculated value of this approach with MacKinnon (1996) critical value to ensure breaks.

4 Result and Discussion

4.1 Unit root and structural break test

We have applied Zivot–Andrews (2002) to examine the status of unit-root and presence of structural break of our series. Table 1 reports the results. CO_2 emissions per capita are characterized as unit-root for all three countries, indicating that current CO_2 emissions level is significantly influenced by lagged CO_2 emissions. Nevertheless, CO_2 emission is stationary after taking first difference. LGDP is non-stationary at level but it is stationary after taking first difference case of all three countries.

Table 1: Order of the integration and structural

Variable	Z&A test for level						Z&A test for 1st difference					
	Malaysia		Singapore		Thailand		Malaysia		Singapore		Thailand	
	T-Stat.	TB	T-Stat.	TB	T-Stat.	TB	T-Stat.	TB	T-Stat.	TB	T-Stat.	TB
LCO_2	-3.537	1994	-3.853	1999	4.030	1996	-6.028[a]	1999	-8.109[a]	2005	-4.149[c]	1999
LGDP	-3.707	1994	-3.228	2004	-2.670	2003	-6.243[a]	1999	-6.084[a]	2000	-4.873	1998
LEU	-5.462[a]	2008	-3.771	1994	-2.969	1995	-5.103[b]	2010	-5.988[a]	1996	-4.621[b]	1999
LTOU	-2.653	1997	-4.851[b]	2004	-3.091	2010	-4.882[b]	2001	-4.151[c]	1999	-4.424[b]	2000

Note: a, b, & c indicate 1 %, 5%, & 10% significance level respectively, L denote log.

Likewise, LTOU is non-stationary at level but stationary after first difference for all three countries. Nevertheless, Table 1 reports that LEU is stationary at level in the case of Malaysia while LEU is stationary after first difference in the case of Singapore and Thailand. Table 1 also reports all these four variables have break point.

4.2 Tourism and environmental pollution

The detection of the stationary status of our variables in Table 1endorsees the appropriateness of using FMOLS. We have scrutinized the impact of tourism on CO_2 emission in the context of three ASEAN countries where tourism sector play a vital role in promoting economic development. Besides, we have exhaustively discussed in the review section about the linkage between tourism and CO_2 emission.

Table 2 presents the results obtained from FMOLS estimator. It shows that LGDP is positively and significantly associated with CO_2 emissions while $LGDP^2$ is negatively and significantly associated with CO_2 emissions in the case of Malaysia. This implies that environmental Kuznets Curve hypothesis is valid for Malaysian context. Our finding coincides with the study of Saboori et al. (2012).The Table 2 also reports that energy use positively and significantly fosters carbon emission in Malaysia. Positive and significant coefficient of tourism indicates that tourism degrades environment by augmenting CO_2 emissions in Malaysia. This finding indicates that inward flow of tourists in Malaysia significantly augments energy use, hence CO_2 emissions. Few recent studies argue that energy-led service sector is responsible in increasing carbon intensity (Al-Mamun*et al.,* 2014).

Table2: FMOLS estimates

Variables	Malaysia	Singapore	Thailand
LGDP	61.652***	1.454	-0.837***
	(21.190)	(0.0162)	(0.0975)
$LGDP^2$	-1.185***	-3.827***	0.0753***

	(0.469)	(1.841)	(0.0039)
LEUC	0.404*	0.738***	0.7572***
	(0.234)	(0.398)	(0.0975)
LTOURA	0.098**	-0.671***	-0.1047***
	(0.0465)	(0.398)	(0.0260)
Constant	-804.627***	17.390	-3.9980
	(271.206)	(11.245)	(0.5228)
R^2	0.963	0.845	0.988
adj. R^2	0.950	0.812	0.986

***, ** and * indicate 1 %, 5%, & 10% significance level respectively. Standard errors are presented in the parenthesis

In the context of Singapore, LGDP is positively and insignificantly associated with CO_2 emission while LGDP square is negatively and significantly associated with CO_2 emission. This implies that environmental Kuznets Curve hypothesis is not valid for Singapore context. Table 2 also shows that energy use positively and significantly fosters carbon emission. Regards to the tourism, it negatively and significantly improves environmental pollution by reducing CO_2 emission in Singapore. Our finding is in line with the anecdotal fact of Singapore. The country adopted massive initiatives to decorate country with gardening and planting more flora and fauna in the landscape of Singapore. Singapore has been recognized as the Garden City after decades of planning and cultivation (Centre for Liveable Cities, 2015). Therefore, the earning from tourism industry is utilized for the betterment of the health of environment in Singapore.

In case of Thailand, LGDP is negatively and significantly associated while $LGDP^2$ is positively and significantly associated with CO_2 emission. This implies that a further increase of GDP foster CO_2 emission at a larger rate in Thailand. Table 2 also shows that energy use positively and significantly fosters carbon emission. Regarding tourism, negative and significant coefficient of tourism indicates that tourism improves environment by reducing CO_2 emission in Thailand. Our findings clearly indicate that while other factors remain constant, an augmentation of tourism sector reduces CO_2 emission while an increase of GDP (perhaps industrial sector) fosters CO_2 emission in Thailand. The results obtained are consistent with finding of Azam and Khan (2016ab), Alam and Paramati (2017) and Sherafatian-Jahromi et al. (2017).

These empirical results reveal that Malaysia requires an urgent shift towards low-carbon economy as compared to Singapore and Thailand. Malaysia may consider Singapore as a benchmark as it needs to emulate environmental sustainability measures implemented by T&T industry in Singapore. Although, findings reveal negative relationship between tourist arrivals and CO_2 emissions in case of Singapore and Thailand; yet, developing more balanced tourism models in these countries may secure the preservation of natural resources, environment and ecosystems through the growth paths that would help to condense the environmental pollutions.

4.3 Robustness Check: Assumption of structural break

We have applied Gregory–Hansen co-integration approach to detect the potential structural break over our study period. Table 3 presents the result. The result is consistent with long-run relation under *Change in Level and Change in Regime and Trend*. For instance, ADF and $Z_t$tests consistently confirm the existence of co-integration between CO_2 emission and tourism under the two assumptions. Table 3 also detects the year of breaks, which mainly occurred in 1997 in the context of Malaysia.

Table 3:Results from Gregory-Hansen Test for Co-integration: Malaysia

	Test Statistic	Breakpoint	Date	Asymptotic Critical Values 1%	5%	10%
Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
ADF	-6.67	8	1997	-6.05	-5.56	-5.31
Zt	-6.82	8	1997	-6.05	-5.56	-5.31
Za	-32.75	8	1997	-70.18	-59.40	-54.38
Gregory-Hansen Test for Cointegration with Regime Shifts: Change in Regime						
ADF	-4.41	8	1997	-6.92	-6.41	-6.17
Zt	-5.86	9	1998	-6.92	-6.41	-6.17
Za	-29.45	9	1998	-90.35	-78.52	-75.56
Gregory-Hansen Test for Cointegration with Regime Shifts: Change in Regime and Trend						
ADF	-8.12	11	2000	-7.31	-6.84	-6.58
Zt	-7.96	8	1997	-7.31	-6.84	-6.58
Za	-35.84	8	1997	-100.69	-88.47	-82.30

In the context of Singapore, ADF, Z_t and Z_a tests consistently confirm the existence of co-integration between CO_2 emission and tourism under Change in Regime and Trend assumption. Table 3 also detects the year of breaks, which mainly occurred in 2007 and 2004.

Table 4:Results from Gregory-Hansen Test for Co-integration: Singapore

	Test Statistic	Breakpoint	Date	Asymptotic Critical Values 1%	5%	10%
Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
ADF	-5.37	18	2007	-6.05	-5.56	-5.31
Zt	-5.48	18	2007	-6.05	-5.56	-5.31
Za	-28.50	18	2007	-70.18	-59.40	-54.38
Gregory-Hansen Test for Cointegration with Regime Shifts: Change in Regime						
ADF	-5.15	11	2000	-6.92	-6.41	-6.17
Zt	-7.09	15	2004	-6.92	-6.41	-6.17
Za	-33.48	15	2004	-90.35	-78.52	-75.56
Gregory-Hansen Test for Cointegration with Regime Shifts:Change in Regime and Trend						
ADF	-7.44	15	2004	-7.31	-6.84	-6.58
Zt	-7.35	15	2004	-7.31	-6.84	-6.58
Za	-33.96	15	2004	-100.69	-88.47	-82.30

In the context of Thailand, ADF, Z_t and Z_a tests consistently confirm the existence of co-integration between CO_2 emission and tourism under Change in Level assumption. Table 5 also detects the year of breaks, which mainly occurred in 2009.

Table 5:Results from Gregory-Hansen Test for Co-integration: Thailand

	Test Statistic	Breakpoint	Date	Asymptotic Critical Values 1%	5%	10%
Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
ADF	-6.28	20	2009	-6.05	-5.56	-5.31
Zt	-6.42	20	2009	-6.05	-5.56	-5.31
Za	-30.43	20	2009	-70.18	-59.40	-54.38
Gregory-Hansen Test for Cointegration with Regime Shifts: Change in Regime						
ADF	-4.66	11	2000	-6.92	-6.41	-6.17
Zt	-6.30	13	2002	-6.92	-6.41	-6.17
Za	-30.14	13	2002	-90.35	-78.52	-75.56
Gregory-Hansen Test for Cointegration with Regime Shifts: Change in Regime and Trend						
ADF	-5.82	19	2008	-7.31	-6.84	-6.58
Zt	-6.10	20	2009	-7.31	-6.84	-6.58
Za	-28.91	20	2009	-100.69	-88.47	-82.30

5. Concluding remarks

Usually, tourism industry is considered as a supportive industry and plays a substantial role in the improvement of the society at different stages and is perceived as an imperative step to accomplish sustainable development. This study aimed to empirically explore the effect of tourism by the total number of arrivals in the host country per year for three ASEAN countries namely Malaysia, Singapore and Thailand over the period of 1990–2014. The Zivot–Andrews test has been employed for the unit-root and presence of structural break in the data. Results showed that CO_2 emission per capita is characterized as unit-root for all three countries, indicating that current CO_2 emission level is significantly influenced by lagged CO_2 emission. Nevertheless, CO_2 emission is stationary after taking first difference.

The FMOLS results reveal that regressor GDP has significantly positive relationship with environmental pollution (CO_2 emissions), while the square of GDP found is negatively and significantly associated with environmental pollution in the case of Malaysia. These results imply that Environmental Kuznets Curve hypothesis is valid for Malaysian context during the period under the study. Positive and statistically significant coefficient of tourism indicates that tourism degrades environment by augmenting environmental pollution in Malaysia. This finding indicates that inward flow of tourists in Malaysia significantly augment energy use, hence environmental pollution. In case of Singapore, the estimated coefficient of tourism variable is negative and statistically significant, implying that tourism improves environmental pollution by reducing CO_2 emission in Singapore. The impact of GDP on environmental pollution is positive but statistically insignificant, while GDP square is negatively and significantly associated with environmental pollution. This implies that Environmental Kuznets Curve hypothesis is not valid for Singapore where energy usage positively and significantly fosters environmental pollution. In case of Thailand, tourism and environmental pollution has significantly inverse relationship. This implies that tourism improves environment by reducing environmental pollution in Thailand. GDP has significantly negative, while GDP square has significantly positive impact on environmental pollution in case of Thailand, thereby corroborates the environmental Kuznets Curve hypothesis. These results indicate that a further increase of GDP would foster environmental pollution at a larger rate in the country. These empirical findings evidently demonstrate that ceteris paribus, an augmentation of tourism sector reduces environmental pollution, while an increase in GDP (perhaps industrial sector) fosters environmental pollution in Thailand.

Empirical findings of the study suggest some policy recommendations for further expansion of tourism industry as well as maintaining green and sustainable environment. It is possible to formulate an adequate and appropriate economic policy that encourages tourism activity with respect to economic development and energy protection. Several strategies can be applied to achieve this goal. Policy about sustainable low-carbon economy needs to be implemented where output of greenhouse emissions is smallest. All these economies need to make efforts and develop low-carbon tourism model, where well panned and coordinated tourism development strategy needs to be prudently executed to promise that the fundamental policy and planning are conducive to sustainable growth[2]. In order to promote sustainable tourism growth, the governments must engage proactively in creating awareness and spreading positive word of mouth pertaining to merits of green tourism among tourists. Besides, detailed policies and action plans must be devised and communicated to reveal how CO_2 emission reduction mechanisms can be materialized. Such efforts would serve as a guideline regarding how future expansion and growth in tourism should be managed in the ASEAN region in particular and other worldwide tourist destinations in general.

Moreover, the governments should introduce and enforce environmental taxes in order to preserve the environment in frequently visited tourist destinations. Trade permits must be issued to those who urge to engage in any commercial activities requiring them to pay appropriate price for exploitation of environmental resources. Those who fail to comply with guidelines of environmental friendly commercial activities must be heavily penalized and their trade permits must be cancelled. Pricing environmental problems would result in multiple benefits which include financial gains for tourism sector, minimizing environmental pollution and controlling depletion of natural resources. Furthermore, governments should facilitate and provide incentives to those businesses that may employ green and low carbon technologies and utilize alternative sources of energy for transportation, logistics, accommodation and other tourism related activities in order to reduce CO_2 emissions and avoid overexploitation of natural resources. Governments in the ASEAN region must also shake hands and collaborate with each other to take active measures for sustainable tourism which should apply to all kinds of tourism i.e. eco-tourism, educational tourism, recreational and adventure tourism and cultural tourism. The crux of aforementioned discussion is that achieving the goal of green tourism requires comprehensive efforts from all parties directly or indirectly involved in tourism activities. Those who share the responsibility of controlling CO_2 emissions and other hazardous pollutants as well as using environmental resources economically comprise of individuals (tourists), businesses (transportation, accommodation, and other travel and tourism related service providers), policy makers and law enforcing agencies (ministries of tourism and environment supported by interior ministry and legal system).

[2] Zhang and Gao (2016).

Future researchers can conduct further studies in ASEAN region to validate the findings of the current study in Malaysia, Thailand and Singapore in particular and other tourist countries in the region in general. Future research can be particularly useful in keeping track of the varying impact of changes in economic and environmental policies of any given country. As governmental policies change with the passage of time, it is essential to continually monitor the utility and effectiveness of those policies. Moreover, an active and on-going research is crucial not only for furthering green tourism but also for striking the right balance among three pillars of sustainability which refer to social sustainability, environmental sustainability and economic sustainability. Hence, future academicians can engage in research that examines the interconnected variables through which all the pillars of sustainability can be further strengthened and may result in holistic socioeconomic development of countries largely reliant on growth of tourism sector.

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Effect of tourism on environmental pollution: Further evidence from Malaysia, Singapore and Thailand

HIGHLIGHTS

- Examines the effect of tourism on environmental pollution in selected ASEAN countries (Malaysia, Thailand, Singapore)
- The method of FMOLS estimator is used as an analytical technique
- The FMOLS results reveal that the effect of tourism on environmental pollution is significantly positive in Malaysia, while negative for Thailand and Singapore.
- Empirical findings suggest that sustainable economic growth should be ensured by implementing prudent public policies.