Effect of Tourism on Environmental Pollution: Further Evidence from Malaysia, Singapore and Thailand

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Abstract

The central aim of this study is to contribute to the encroachment of knowledge on impact of tourism on environmental pollution by CO₂ emissions ASEAN-3 namely Malaysia, Thailand and Singapore during 1990-2014. The FMOLS results reveal that the impact of tourism variable on environmental pollution is significantly positive, while for Thailand and Singapore, it is found negative and statistically significant. Empirical findings suggest that sustainable economic development should be ensured by implementing prudent public policy, where tourism industry needs to be expanded further but fulfilment of its responsibility towards maintaining green and sustainable environment must be top most priority.

Keywords: Tourism; environmental pollution/ CO₂ emissions, ASEAN

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 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 the contribution of tourism in term of GDP lies in the range of 2 % to 12%. 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 economies worldwide. Tourism influences the economy of host countries in multiple ways; through employment generation, infrastructure establishment, tourism related value chain development and other dynamic effects on socio-economic dimensions of 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 feared 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.

The focus of this study is on socio-economic significance of tourism and its impact on environmental quality (climate change) in a few tourism-led economies in Southeast Asia namely Malaysia, Thailand and Singapore. The travel and tourism (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 gross domestic product (GDP) in 2013 (Tourism Malaysia, 2014). In 2015, travel and tourism industry contributed MYR 152.8 billion which represents 13.1% share in GDP. In addition, travel and tourism 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).

Irrespective of tremendous contribution of 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, other facilities and services that cause T & T industry to be a significant contributor in global greenhouse 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 result into greenhouse gas emissions, particularly CO₂ (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 mentioned in the updated version of the 2013 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 CO₂ 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 2,795.1 billion which represents 20.8% share in GDP. It is predicted that the contribution of travel and tourism industry would account for THB 5,420.5 billion i.e. 30.5 % share in GDP in 2026. It indicates per annum growth rate of 6.4%. 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. In 2015, the total amount injected in travel and tourism industry of Thailand was approximately THB 227.4 billion which represents 6.8% of total investment in Thailand economy (WTTC, 2016c).

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 amount invested 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 suitable for economic setup of the Singapore where it serves as the locomotive sector. 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 CO₂ 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. However, Karki et al. (2005) have also reinforced that during previous two decades this region has undergone a changing trend with more emphasis on sustainable development concerns with respect to worsening environmental conditions, energy security and financial constraints in energy-oriented ventures. Thus, owing to these developments, tourism expansion in Singapore is likely to have potential influence on environmental quality and standards.

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 for three countries from ASEAN namely Malaysia, Singapore and Thailand during the period ranging from 1990 to 2014. Though, there are some more or less related studies available but to the best of the authors' knowledge, current study is among the pioneer studies on these three ASEAN countries. Moreover, set of regressors, time period and estimation methodology is different compared to the erstwhile studies. Thus, it is expected that the outcomes will guide the management constituting public policies for tourism and environment. 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 Shagzatova (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 CO₂ emissions. Where the outcome results of tourism development appear to exhibit increasing levels of CO₂ 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 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 CO₂ 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). With reference to air, sea or land destinations, everywhere the routes are predominantly reliant on energy as the actual fuel source which resultantly ends up in CO₂ emissions. The international flow of tourists has been employed as key indicator in a recent research that focused on the pollution effects of tourism expansion with respect to its future implications (Mayor & Tol, 2010). Their findings revealed that the demand of transport trips is likely to

increase with the pace of tourism expansion in coming years and specifically in Asian countries, where the fuel consumption in traffic facilities is considered as determining factor of pollution emissions. Keeping in consideration the economic activities, several researchers have considered the 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 CO₂ 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 measure 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 CO₂ emissions.

Zhang and Gao (2016) found that the tourism-induced Environmental Kuznets Curve hypothesis does not exist in China (Central) and is merely weakly support observed in China (Eastern and Western) during 1995–2011.

The aforementioned empirical studies show that both tourism and the environment are playing key role in the development of any economy. However, still there is lack of inclusive study on the tourism and environmental pollution in the context of Malaysia, Thailand and Singapore. Thus, the broad aim of this study is to explore the tourism and environmental pollution relationship for three ASEAN countries and thereby reduce the gap and further advance knowledge on tourism and environmental pollution correlation.

3. Empirical Methodology

3.1 Data & Source

This study has employed World Development Indicators (WDI) data set of Malaysia, Singapore and Thailand for the period of 1990 to 2014 to measure the dynamic impact of tourism on environment quality. For the environmental quality proxy, we (the authors) have considered CO₂ emissions per capita in metric tonnes. This includes CO₂ 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).

3.2 Model Estimation

3.2.1 FM-OLS approach

We have applied the fully modified ordinary least squared regression approach (FM-OLS) to measure the dynamic impact of tourism on CO₂ emission along with respective control variables.

$$\ln CO_{2t} = \beta_0 + \beta_1 \ln X_t + \varepsilon_t \dots \text{eq. (1)}$$

In Model 1, ε_t refers to the error terms while $\ln CO_{2t}$ is dependent variable (here it can be CO_2 emissions), β_0 is the intercept, β_1 refers to the vector slope coefficients and $\ln X_t$ is the vector of independent variable including tourism. We have analysed our model by applying FM-OLS regression due to few distinct features. This approach was initially applied in a study by Phillips and Hansen (1990) to retrieve the unbiased estimators of co-integrating regressions. Primarily, this method modifies ordinary least squares (OLS) to eliminate the potential endogeneity bias problem, where OLS is unable to address. In addition, FMOLS addresses the serial correlation problem. The FM-OLS estimator is asymptotically unbiased and fully efficient in the presence of mixture normal asymptotic. 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:

$$Y_t = \beta_0 + \beta_t X_t + u_t, t = 1, 2, \dots, n \dots \dots \dots \text{eq(2)}$$

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

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

Whereas ΔX 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 $\xi_t = (u_t, v_t)'$ follow a strict stationary process with zero mean and a finite positive-definite covariance matrix Σ . 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 and v_t . In addition, $\hat{\mu}_t$ presents identically and independently distributed like the residual of OLS estimator.

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

Whereas $\hat{v}_t = \Delta X_t - \hat{\mu}$ for $t = 2, 3, \dots, n$ 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

$$\hat{\Omega} = \hat{\Sigma} + \hat{\Lambda} + \hat{\Lambda}' = \begin{bmatrix} \hat{\Omega}_{11} x_1 \hat{\Omega}_{11} & \hat{\Omega}_{21} x_k \hat{\Omega}_{21} \\ 1 & 1 \\ \hat{\Omega}_{21} x_1 \hat{\Omega}_{21} & \hat{\Omega}_{22} x_1 \hat{\Omega}_{22} \\ k & 1 \end{bmatrix} \dots \dots \dots \text{eq(4)}$$

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

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

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

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

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

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

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 $\hat{Y}^* = (\hat{Y}_1^*, \hat{Y}_2^*, \dots, \hat{Y}_n^*)'$, $W = (\tau_n, X)$, and $\tau_n = (1, 1, 1, \dots, 1)'$.

3.2.2 Gregory- Hansen Co-integration under Structural Break

We apply 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.

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

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

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 not 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.

$$\ln CO_{2t} = \beta_0 + \beta_1 X_t + \varepsilon_t \dots \dots \text{Model 1}$$

Where ε_t refers to the white noise error, $\ln CO_{2t}$ is the dependent variable (here it can be CO₂ 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

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \varepsilon_t \dots \dots \dots \text{eq(12)}$$

Model: Regime shift where intercept and slope coefficients change

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t \dots \dots \dots \text{eq(13)}$$

Model: Regime shift where intercept, slope coefficients and trend change

$$Y_t = \mu_1 + \mu_2 f_{tk} + \beta_1 t + \beta_2 t f_{tk} + \alpha_1 X_t + \alpha_2 X_t f_{tk} + \varepsilon_t \dots \dots \dots \text{eq(14)}$$

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:

$$f_{tk} = 0 \text{ if } t < k \text{ and } f_{tk} = 1 \text{ if } t > k.$$

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. CO₂ emissions per capita are characterized as unit-root for all three countries, indicating that current CO₂ emissions level is significantly influenced by lagged CO₂ emissions. Nevertheless, CO₂ 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 1 st 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 quality

The detection of the stationary status of our variables in Table 1 endorse the appropriateness of using FM-OLS. We have scrutinized the impact of tourism on CO₂ 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 CO₂ emission.

Table 2 presents the results obtained from FM-OLS estimator. It shows that LGDP is positively and significantly associated with CO₂ emissions while LGDP² is negatively and significantly associated with CO₂ 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 CO₂ emissions in Malaysia. This finding indicates that inward flow of tourists in Malaysia significantly augments energy use, hence CO₂ emissions. Few recent studies argue that energy-led service sector is responsible in increasing carbon intensity (Al-Mamun *et al.*, 2014).

Table2: FMOLS estimates

Variable	Malaysia	Singapore	Thailand
LGDP	61.652*** (21.190)	1.454 (0.0162)	-0.837*** (0.0975)
LGDP ²	-1.185*** (0.469)	-3.827*** (1.841)	0.0753*** (0.0039)
LEUC	0.404* (0.234)	0.738*** (0.398)	0.7572*** (0.0975)
LTOURA	0.098** (0.0465)	-0.671*** (0.398)	-0.1047*** (0.0260)
C	-804.627*** (271.206)	17.390 (11.245)	-3.9980 (0.5228)
R Square	0.963	0.845	0.988
Adjusted R Square	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 CO₂ emission while LGDP square is negatively and significantly associated with CO₂ 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 quality by reducing CO₂ 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.

Regards to Thailand, LGDP is negatively and significantly associated while LGDP² is positively and significantly associated with CO₂ emission. This implies that a further increase of GDP foster CO₂ 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 CO₂ emission in Thailand. Our findings clearly indicates that while other factors remain constant, an augmentation of tourism sector reduces CO₂ emission while an increase of GDP (perhaps industrial sector) fosters CO₂ emission in Thailand.

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 CO₂ 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:Result from Gregory-Hansen Test for Co-integration: Malaysia

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test	Breakpoint	Date	Asymptotic Critical Values		
	Statistic			1%	5%	10%
ADF	-6.67	8	1997	-6.05	-5.56	-5.31
Z _t	-6.82	8	1997	-6.05	-5.56	-5.31
Z _a	-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
Z _t	-5.86	9	1998	-6.92	-6.41	-6.17
Z _a	-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
Z _t	-7.96	8	1997	-7.31	-6.84	-6.58
Z _a	-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 CO₂ 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:Result from Gregory-Hansen Test for Co-integration: Singapore

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test	Breakpoint	Date	Asymptotic Critical Values		
	Statistic			1%	5%	10%
ADF	-5.37	18	2007	-6.05	-5.56	-5.31
Z _t	-5.48	18	2007	-6.05	-5.56	-5.31
Z _a	-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 CO₂ emission and tourism under Change in Level assumption. Table 5 also detects the year of breaks, which mainly occurred in 2009.

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

Gregory-Hansen Test for Co-integration with Regime Shifts: Change in Level						
	Test Statistic	Breakpoint	Date	Asymptotic Critical Values		
				1%	5%	10%
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. Summary and Conclusion

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 CO₂ emission per capita is characterized as unit-root for all three countries, indicating that current CO₂ emission level is significantly influenced by lagged CO₂ emission. Nevertheless, CO₂ emission is stationary after taking first difference.

The fully modified OLS results reveal that regressor GDP has significantly positive relationship with environmental pollution (CO₂ 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, meaning that it improves environmental quality by reducing CO₂ 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. Energy use 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. Energy use positively and significantly expands environmental pollution. 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.

6. Policy Implications and Future Research

Empirical findings of the study suggest some policy recommendations for further expansion of tourism industry and maintaining clear and green environment as both play crucial role in promoting economic growth and development. It is possible to formulate an adequate and appropriate economic policy that encourages tourism activity with respect to economic development and energy protection as well the environment. 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. It is suggested that Malaysia, Singapore and Thailand require changeover to a low-carbon economy. Developing 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. All these economies need to make efforts and develop low-carbon tourism model, where well panned coordinated tourism development strategy needs to be prudently executed to promise that the fundamental policy and planning are conducive to sustainable growth¹.

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 CO₂ 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

¹ Zhang and Gao (2016).

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 CO₂ 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 CO₂ 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) and policy makers and law enforcing agencies (ministries of tourism and environment supported by interior ministry and legal system).

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 ongoing 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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