The effects of tourism on economic growth and CO_2 emissions: A comparison between developed and developing economies

Abstract

The objective of this study is to empirically examine the effect of tourism on economic growth and CO_2 emissions across the panels of developed and developing economies around the world. The study also investigates the Environmental Kuznets Curve (EKC) hypothesis between tourism revenue and CO_2 emissions. To achieve these objectives, study employs robust panel econometric techniques on balanced panel data sets of developed and developing economies. The cointegration test results confirm the long-run equilibrium relationship among the variables. Similarly, the long-run elasticities indicate that tourism has a significant positive impact on economic growth and CO_2 emissions of both developed and developing economies. The results also imply the presence of EKC hypothesis between tourism and CO_2 emissions. More specifically, our results indicate that after a threshold point the contribution of tourism to the CO_2 emissions is negligible, and the reduction is much greater in developed economies than those of developing economies. Overall, our findings reveal that tourism plays a significant role in stimulating economic development and prosperity; though it increases CO_2 emissions. However, the effect of tourism on the CO_2 emissions can be minimized by adopting more sustainable tourism policies and efficient management across developed and developing economies.

Keywords: Tourism, CO_2 emissions, economic growth, developed and developing economies

1. Introduction

Tourism has experienced significant growth over the last few decades and become one of the largest industries both in the developed and developing economies.[1] Despite various domestic and international wars, political turbulence, terrorist activities, natural calamities, disease epidemics, energy crises and economic distress in numerous parts of the world, international tourist arrivals worldwide reached a record high from only 166 million in 1970 to 1.33 billion in 2014 (UNWTO, 2015). Moreover, globally, international tourism generated US$1.5 trillion revenue earnings, 277 million employment, and 10% of the worlds gross domestic product (GDP) in 2014 (WTTC, 2015). Along with these direct impacts, tourism also has tremendous indirect positive effects on the national and global economy through its contribution to the balance of payments, improving the living standards of citizens, accumulating foreign exchange reserves, raising production of goods and services, and increasing government revenues in the form of profits and taxes. In addition, the sector also leads convergence from developed countries to developing ones by transferring income. Therefore, expansion of the tourism industry is considered as an engine of economic development across the world (Brida & Risso, 2009; Tang & Tan, 2013).

While tourism yields immense positive economic influences, it may have an adverse effect on the environment in the form of CO_2 emissions at both national and international levels since most of the tourism activities need energy consumption directly from fossil fuels or indirectly from electricity that often generated from coal, natural gas or oil. For example, according to the United Nations World Tourism Organization (UNWTO, 2007), tourism is responsible for 5 percent of global CO_2 emissions, particularly from transportation, accommodation, and other

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[1] According to the International Statistical Institute (ISI, 2015), economies which have a Gross National Income (GNI) per capita of US$ 11,906(specified by the World Bank, 2013) and more are considered as developed economies. On other hand, economies with a GNI per capita of US$ 11,905 and less are defined as developing economies.

tourism-associated activities.[2] Hence, the development of the tourism industry can lead to severe adverse influences on the environment. However, United Nations Environment Programme (UNEP) argues that well-managed tourism can play a positive role on the environment through promoting the usage of environment-friendly technology and transportation, and contribute to the environmental protection and conservation (UNEP, 2008). Hence, it can be a way to raise the consciousness of environmental safeguards and work as a tool to finance against environmental degradation.

While past studies have investigated the impact of tourism on CO_2 emissions and environment (Becken & Simmons, 2002; Gössling, 2002), most of the research is conducted on the basis of qualitative judgment because the environmental impacts of tourism activities are not easy to measure. Even though some studies (e.g. Becken & Patterson, 2006; Kuo & Chen, 2009) attempt to quantify the environmental impact, they are limited to a particular country and a year by using survey data. Therefore, empirical studies based on numerous countries and long-time series data to provide more general and reliable findings are scarce in the prevailing literature due to the lack of reliable panel data. To fill the research gap, this research attempts to examine the effects of tourism on CO_2 emissions and economic growth using a panel framework.

This study contributes to the literature in four ways. First, this study pioneers to examine the dynamic relationship between tourism and CO_2 emissions in a panel framework to reflect the importance of causality between tourism and CO_2 emissions. Second, the sample countries in this study cover major tourism receipts countries not only accounting for 84 percent of total world's tourism income but also being responsible for 85 percent of global CO_2 emissions in

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[2] Jones and Munday (2007) also clearly demonstrated the selected environmental consequences of tourism activities.

2013. Hence, this study provides a robust insight into the relationships among tourism, economic growth and CO_2 emissions. Third, different from previous studies such as Lee and Brahmasrene (2013) and León et al. (2014), this study conducts a comparative analysis between developed and developing economies by using a longer time period data to enhance our understandings of explicit differences in the impacts of tourism on economic growth and CO_2 emissions. Finally, our study advances previous works in tourism literature by adopting recently developed econometric techniques. For instance, the Pesaran (2004) cross-sectional dependence (CD) test is used to identify the cross-sectional dependence among the variables. The Fisher-type Johansen panel cointegration test by Maddala and Wu (1999) is used to investigate the long-run equilibrium relationship. The fully modified OLS (FMOLS) model and the heterogeneous non-causality test (Dumitrescu & Hurlin, 2012) are employed to estimate long-run elasticities and causal relationship among the variables, respectively.

The remainder of this paper is organized as follows. Section 2 provides a review of existing literature. Section 3 describes the empirical methodology, nature of data and measurement. Section 4 presents empirical results and discussion. Finally, Section 5 provides conclusions and future research direction.

2. Literature review

Tourism development inevitably derives various impacts such as economic, environmental and socio-cultural economies on the tourism destination. To sustain the development of tourism, it is crucial to understand these impacts and their inter-relationships. In particular, while tourism growth has a positive impact of economic growth (e.g. income increase, employment etc.) or vice verse, it also likely brings negative environmental impacts during the process of tourism-related service provision. However, it attracts research attention to take a deeper look at whether the negative environment impact associated with tourism development still holds given the adoption of environmental-friendly strategies and technologies. Past studies by and large investigate the causal relationships either between tourism development and economic growth or between tourism development and environmental impact such as CO_2 emissions. In this section, we review the literature using time-series techniques of econometric model by two subsections: i) tourism and economic growth and ii) tourism and CO_2 emissions.

2.1 Tourism and Economic Growth

Tourism economy theory argues that tourism-led growth may take place when tourism exhibits a stimulating impact on economy through spillovers and other externalities (Marin, 1992; Balaguer & Cantavella-Jorda, 2002). There have also been a number of studies that empirically investigates the causal relationship between tourism and economic growth. Based upon the empirical evidences, four different strands of literature regarding the casual reltionship between tourism and economic growth can be found: i) tourism-led economic growth, ii) economic-driven tourism growth, iii) feedback relationship between tourism and economic growth, and iv) no causal relationship

Tourism-led economic growth suggests that a unidirectional causality runs from tourism development to economic growth, i.e. a positive long-run association between the expansion of tourism activities and economic growth. Past empirical studies widely support the perspective of tourism-led economic growth, such as Archer (1984) for Barbados, Durbarry (2002) for Mauritius, Gunduz and Hatemi-J (2005) for Turkey, Lee and Chang (2008) for 55 OECD and non-OECD countries, Narayan et al. (2010) for 4 Pacific Island countries, Castro-Nuño et al. (2013) for 87 countries and Cárdenas García et al. (2015) for 144 countries. Furthermore, some studies argue that positive externalities derived from tourism development also enhance economy indirectly. For example, Archer (1995) suggests that the growth of tourism industry has multiplier effects such as employment generations, gross savings and improving balance of payments. Tang and Jang (2009) and Holzner (2011) argue that tourism has not only direct positive contribution to the development of tourism-related industries but also indirect but significant impact on the development of other industries. Fayissa et al. (2011) provide empirical evidence that apart from contributing to the per capita GDP growth, tourism industry also contributes to the investment in infrastructural and human capital development of the Latin American countries.

The economic-driven tourism growth implies that economic growth increases tourism revenue. The economic rationality to support this argument is that when an economy experience rapid economic expansion, tourism infrastructure, education, and safety improve in that economy, which may attract more international tourists. The empirical evidence of one-way causality from GDP growth to tourism development can be found in studies such as Narayan (2004) for Fiji, Oh (2005) for Korea, and Tang and Jang (2009) for the USA.

The feedback (or bidirectional) relationship between tourism and economic growth suggests that tourism and economic growth cause each other. A good number of studies support the feedback relationship such as Dristikis (2004) for Greece, Kim et al. (2006) for Taiwan, Khalil et al. (2007) for Pakistan, Lee and Chang (2008) for both the OECD and non-OECD countries, Chen and Chiou-Wei (2009) for Korea, and Ridderstaat et al. (2014, 2016) for Aruba. However, the non-causal (or neutral) relationship implying that tourism has no substantial influence on economic growth and vice versa is found in several studies such as Katircioglu (2009) for Turkey and Kasimati (2011) for Greece.

2.2 Tourism and CO_2 emissions

Negative tourism-driven environmental impact is inevitable since most of tourism-related activities involve energy consumption from fossil fuels. Energy consumption for tourism from both transport-related activities and destination-related activities emit a significant amount of

CO_2 emissions. Although tourism is one of the key contributors to the climate change and anthropogenic component of global warming as claimed by Scottet al. (2010), the relationship between tourism activities and CO_2 emissions is relatively underexplored in the literature until from the last decade. Previous studies by and large support the negative effect of tourism growth on CO2 emissions. Becken and Simmons (2002) report tourism as an important source for energy consumption and malefactor of global climate change and find that tourist activities (e.g. scenic flights, jet boating or air traveling) use more energy than tourist attractions (e.g. museums or experience centers) do in New Zealand in 2000. Likely, Gössling (2002) points out that air travel among leisure-related transports has the greatest impact on energy consumption and CO_2 emissions across the world in 2001. Subsequently, Gössling et al. (2005) estimate CO_2 emissions produced from the tourism activities per unit of financial value for Finland, the United States, Canada and Australia/New Zealand in 2002. Becken and Patterson (2006) measure the national CO_2 emissions from tourism industry in New Zealand in 2000 by using two approaches: a bottom-up and a top-down analysis.

Tovar and Lockwood (2008) qualitative study suggests tourism industry is an important contributor to economic development as well as environmental degradation in a rural area of Australia. Employing life cycle assessment (LCA), Kuo and Chen (2009) estimate energy consumption and CO_2 per tourist per trip considering major aspects of tourism-related activities such as transportation, accommodation and recreation in Penghu island of Taiwan in 2006.Using the autoregressive distributed lag model (ARDL) approach, Katircioglu (2014a) finds that tourism development in Turkey not only increases energy consumption but also produces environmental pollution significantly in terms of CO_2 emissions during the 1960-2010 period. Similar evidences are provided by Tang et al. (2014) for China, Tsai et al. (2014) for Taiwan, Katircioglu et al. (2014) for Cyprus, and Durbarry and Seetanah (2015) for Mauritius.

However, the relationship between tourism growth and CO2 emissions is not unequivocal. According to the environmental Kuznets curve (EKC) hypothesis analogous to Kuznets curve explaining the dynamic relationship between income inequality and per capita income (Kuznet, 1955), the relationship between various environmental pollutants and per capita income varies alongside with the different economic development. While environmental negative impact significantly increases at the early stage of economic development, emissions subsequently decline implying improvement in environmental quality once over the threshold of income per capita (Dinda, 2004). In other words, the EKC hypothesis suggests an inverted U-shaped relationship exists between economic growth and environmental pollutants (Stern, 2004). The EKC hypothesis is tied with sustainable policy options with requirement of environmental perseveration strategies (Lekakis, 2000) such as sustainable tourism and ecotourism in the context of tourism. Some studies such as Scott (2011) and Weaver (2011) claim that the implementation of sustainable tourism or ecotourism does not necessarily lead to increase but even mitigate CO_2 emissions. According to World Tourism Organization and United Nations Environment Programme (UNWTO & UNEP, 2008), implementation of sustainable tourism development plans by means of utilizing more clean energy and lower emissions technology can greatly reduce CO_2 emissions. Evidence from empirical recent studies such as Lee and Brahmasrene (2013) for the EU countries and Katircioglu (2014b) for Singapore support that tourism sector appears to have a considerable negative effect on CO_2 emissions. In particular, Zaman, Shahbaz, Loganathan, Raza (2016) investigate the relationships between tourism development, energy consumption and environmental Kuznets curve in the panel of developed and developing countries. Their study validates the EKC between carbon emissions and per capita income in the region. Although providing causal evidences of tourism-induced CO_2 emissions and economic growth led tourism, their study analyse the panel data consisting of both developed and developing as a whole instead separately. Whether casual relationships in interest differ between developed and developing countries remains further exploration.

To conclude the above literature review, it is apparent that the relationships among tourism, economic growth and CO_2 emissions are not uniform across countries, periods or estimation methods. Most of the existing literature focuses on causal linkages among variables but ignores their dynamic relationships. In particular, studies examining the relationships among tourism, economic growth and CO_2 emissions simultaneously by the levels of economic development (e.g. developed v.s. developing countries) still remain scarce. Hence, the current study is designed to narrow the research gap, and as a result contributes to the advancement of the literature as well as insight for policy makers.

3. Model, data and methodology

3.1 Model specification

This study aims to estimate the effect of tourism on economic growth and CO_2 emissions in developed and developing economies. To achieve the study objectives, we develop the following models using the existing theoretical approaches such as, neo-classical growth model and IPAT environmental model (Ehrlich and Holdren, 1971) to determine the impact of tourism on economic growth and CO_2 emissions, respectively. We discuss these models in the following:

$$EO_{it} = f(GFCF_{it}, LF_{it}, EE_{it}, ITR_{it}, v_i) \quad (1)$$

where EO, GFCF, LF, EE and ITR represent for per capita economic growth, per capita gross fixed capital formation, total labor force, energy efficiency and international tourism receipts. v_i represents for individual fixed country effects and, countries and time period are indicated by the subscripts i $(i = 1, \ldots\ldots, N)$ and t $(t = 1, \ldots\ldots\ldots, T)$, respectively. Eq. (1) implies the neo-classical production function to study the relationship between economic output, capital, labor, energy and tourism. The aim of this model is to identify the impact of tourism on economic output by accounting other potential determinants of growth such as capital, labor and energy.

In the next step, we aim to examine the impact of tourism on CO_2 emissions. To identify the potential determinants of CO_2 emissions, the previous studies base their empirical analyzes on the *IPAT* model (Raskin, 1995 ; York et al., 2002). This approach is framed on the baseline relationship among population, income, technology and environmental impact as presented in the following equation:

$$I = P \times A \times T \qquad (2)$$

where, I is the pollution or environmental impact which is sourced from population (P), the level of economic activities or per capita consumption - (A) and the technological level or efficiency defined by the amount of pollution per unit of economic activity or consumption (T). This basic model is further extended, by Dietz and Rosa (1994, 1997), to a stochastic version which is popularly known as the *STIRPAT* (STochastic Impacts by Regression on Population, Affluence and Technology) model. This model is no longer an accounting equation, this can be used to test the hypotheses empirically. Thus, following the common specification of *STIRPAT* model, we frame the following equation for our empirical analysis:

$$CO_{2it} = f(POP_{it}, EO_{it}, EE_{it}, IND_{it}, SER_{it}, ITR_{it}, v_i) \qquad (3)$$

where, CO_2 emission is a function of population (POP), economic output (EO), energy efficiency (EE), industrialization (IND), service sector (SER) and international tourism receipts (ITR). The model in Eq. (3) aims to address the impact of tourism on CO_2 emissions by accounting other potential determinants including industry and service sectors. The empirical models of this study are discussed below.

3.2 Estimation techniques

We investigate the long-run association among the variables using a panel cointegration methodology. Similarly, we explore the long-run impact of tourism on economic growth and CO_2 emissions by employing FMOLS approach. Finally, we apply heterogeneous panel non-causality test to identify the short-run causalities among these variables.

3.2.1 CD and CIPS tests

We first aim to identify whether the given series is cross-sectional dependence or independence. For this purpose, we employ Pesaran (2004) CD test. This is a significant issue to be addressed before the use of panel unit root tests. The conventional unit root tests are ineffective, due to lower power, when they are applied on the series that has a cross-sectional dependence.[3] Therefore, in this study, based on the evidence produced by Pesaran (2004) CD test, we apply Pesaran (2007) CIPS unit root which is established on the assumption of cross-sectional dependence. This unit root test is employed to investigate the order of integration of the variables. This is a prerequisite for applying panel cointegration models. If all of the variables are integrated of same order that is, I (1), then this evidences that all of the variables have a unit root at levels and stationary at their first order differentials. Hence, this suggests that these variables, as a group, may have a long-run equilibrium relationship.

3.2.2 Panel cointegration technique

We employ a panel cointegration technique to investigate the long-run equilibrium association among the variables across full sample, developed and developing economies. The panel cointegration technique is more useful if a time series element of each cross-section is shorter. Due to these advantages, researchers started using panel cointegration approach to examine the

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[3] A number of previous studies (e.g. Alam et al., 2016; Bhattacharya et al., 2016; Paramati et al., 2016) argued the significance of cross-sectional dependence in the analysis.

relationship among these variables (e.g., Lee and Brahmasrene, 2013). In this study, we apply Fisher-type Johansen cointegration methodology which is proposed and developed by Maddala and Wu (1999).[4]

The Fisher-type panel cointegration methodology uses Johansen (1991) approach. Maddala and Wu (1999) argue that this panel cointegration test is more robust than the conventional cointegration tests which are based on the Engle-Granger two-step approach. This method uses two ratio tests such as, trace test and maximum eigenvalue test to identify the number of cointegrating vectors. The findings of both trace and max-eigen tests can be utilized to determine the presence of cointegrating vectors, however these two tests may not always provide equal number of cointegrating vectors. If both tests do not provide same number of cointegrating vectors, then we can draw the conclusions based on the max-eigen test as it carries the independent analysis on each eigenvalue.

3.2.3 Long-run elasticities

We also estimate a single cointegrating vector, based on the Equation (1) and (3) to investigate the long-run economic output and CO_2 emission elasticities, respectively. In regard to the panel dataset, the application of ordinary least squares (OLS) on Equation (1) and (3) is asymptotically biased and its distribution relies upon nuisance parameter. Pedroni (2001a, 2001b) argues that in the course of regression estimation the nuisance parameters can result due to the presence of serial correlation and endogeneity among the regressors. Therefore, to address these issues, we employ FMOLS model. This model utilizes a non-parametric approach to address the issue of endogeneity and serial correlation. Therefore, we apply FMOLS model to estimate the long-run elasticities.

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[4] Alam and Paramati (2015) also suggest the significance of Fisher-Johansen panel cointegration test in examining the long-run relationship.

3.2.4 Heterogeneous panel causality test

We explore the short-run dynamic bivariate panel causality among the variables by using a model that supports for heterogeneity of the models across the cross-sections. A simple approach is proposed by Dumitrescu and Hurlin (2012) for testing the null hypothesis of homogeneous non-causality against the alternative hypothesis of heterogeneous non-causality. This test has to be applied on a stationary data series using the fixed coefficients in a vector autoregressive (VAR) framework. The significance of this test is that it allows for having dissimilar log structure and also heterogeneous unrestricted coefficients across the cross-sections under both the hypothesis. Under the null hypothesis, no causality in any cross-section is tested against the alternative hypothesis of causality at least for few cross-sections. The Wald statistics for testing Granger non-causality are computed for each of the cross-section separately. Then, the panel test value is acquired by taking the cross-sectional average of individual Wald statistics. Dumitrescu and Hurlin (2012) argue that this panel test value converges to a normal distribution under the homogeneous non-causality hypothesis when T tends to infinity first and then N tends to infinity.

3.3 Nature of data and measurement

The selection of sample period and countries are based on the availability of annual data from 1995 to 2012 (i.e. 18 observations for each cross-section or country) and major tourists receipts' countries, respectively. The selected 26 developed economies are Australia, Austria, Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, Spain, Sweden, Switzerland, the UK and the US, and 18 developing economies are Argentina, Brazil, Bulgaria, China, Dominican Republic, Egypt, India, Indonesia, Jordan, Malaysia, Mexico, Morocco, the Philippines, South Africa, Thailand, Tunisia, Turkey and Ukraine.

The variables of the study are measured as follows: CO_2 emissions per capita is measured in metric tons; EE indicates how much of energy is used to produce one unit of economic output at purchasing power parity; EO indicates per capita gross domestic product (GDP) in current US$; the gross fixed capital formation (GFCF) per capita in current US$; IND is the Industry value added as percentage of the GDP; ITR is the international tourism receipts per capita in current US$; LF is the labour force in millions, POP is the total population in million and finally SER is the services, etc., value added as percentage of the GDP. The time series data on CO_2, EE, EO, GFCF, IND, ITR, LF, POP and SER are obtained from the World Development Indicators (WDI, 2015) online database published by the World Bank while CO_2 emissions data are gathered from the US Energy Information Administration (EIA, 2015).

To normalize the data series into a uniform measurement, we transform all of the data series into natural logarithms to avoid the problems associated with distributional properties of the data series. The log conversion is a preferred approach as each of the estimated coefficients can be interpreted as elasticities.

4. Results and discussions

4.1 Preliminary statistics

Summary statistics on full sample, developed and developing economies are provided in Table 1. This table indicates that the average per capita CO_2 emissions is 7.56, 10.43 and 3.43 metric tons across full sample, developed and developing economies, respectively. This suggests that the per capita CO_2 emissions are much higher in developed economies than those of developing economies. Similarly, the average per capita GDP in developed economies is 30.42 thousand US dollars while in developing economies is only 3.70 thousand US dollars and as an average of entire sample is 19.49 thousand US dollars. Finally, the per capita tourism receipts (ITR) also significantly vary across the countries. For instance, the tourism receipts in full sample, developed and developing economies are 646.21, 979.69 and 164.52 US dollars, respectively. This again suggests that the developed economies have higher per capita tourism receipts as against the developing economies. Overall, the summary statistics imply that the developed economies have higher per capita CO_2 emissions, GDP and tourism receipts.

[Insert Table 1 here]

4.2 The cross-sectional dependence and unit root tests

Table 2 presents results on CD test and CIPS unit root test. The CD test results on three groups of sample countries show that the null hypothesis of cross-sectional independence is strongly rejected at 1 percent significance level for all variables, suggesting the evidence of cross-sectional dependence. Instead of using the conventional unit root tests, we hence apply recently developed CIPS unit root test which accounts for cross-sectional dependence in data series. The CIPS unit root test results show that the unit root of null hypothesis cannot be statistically rejected for all of the variables but for those after taking first order difference. The CIPS unit root test results suggest that all of the variables are non-stationary at levels and stationary at their first order differences. In other words, all of the variables are integrated of order I (1), and there may be a cointegration association among these variables in the long-run.

[Insert Table 2 here]

4.3 Findings from panel cointegration test

Table 3 presents the Fisher-type Johansen panel cointegration test results on full sample, developed and developing economies. We applied Fisher-Johansen cointegration test on Eq. (1) and Eq. (3) to find out the long-run equilibrium relationship among the variables. More specifically, first we aim to examine the long-run relationship, using Eq. (1), between economic output and tourism by accounting for other important variables in the model such as; capital, labor and energy. Similarly, we also investigate the long-run equilibrium relationship, using Eq. (3), between CO_2 emissions and tourism by including population, GDP, energy, industrialization and service sector in the model. The appropriate lag length is chosen based on the Schwarz information criterion (SIC) for the empirical analysis. This cointegration test allows for individual effects into vector autoregressive models but not the individual linear trends. The test results on *trace statistic* and *maximum eigen statistic* indicate that the null hypothesis of no cointegration is strongly denied for three groups of sample countries at 1 percent significance level, suggesting the evidence of long-run equilibrium association among GDP, capital, labor, energy and tourism and also among CO_2 emissions, population, GDP, energy, industry, services and tourism.

[Insert Table 3 here]

4.4 Analysis of long-run elasticities

We employ the FMOLS model to estimate long-run elasticities of GDP and CO_2 emissions. This is a robust model to account for serial correlation and endogeneity that present in the model. Empirical results for the Eq. (1), where GDP is served as a dependent variable while capital, labor, energy and tourism are treated as independent variables, are reported in Table 4. The results reveal that tourism has a significant positive impact on GDP for all three groups of sample countries, consistent with previous studies (e.g., Lee and Chang, 2008; Cárdenas García et al., 2013). More specifically, the long-run elasticities of tourism in regards to GDP of full sample, developed and developing economies are 0.134, 0.109 and 0.166, respectively. In other words, a 1 percent rise in tourism receipts will increase economic growth in full sample, developed and developing countries by 0.134, 0.109 and 0.166 percent, respectively. Note that the magnitude of tourism impact on economic growth is higher for the developing economies than that for the developed economies, suggesting the importance of tourism activities in developing economies for the promotion of economic growth through additional employment and revenue opportunities for the local communities and also helps economy as a whole by accumulating foreign currency reserves.

Regarding the CO_2 emissions results, based on Eq. (3), show that tourism has a significant positive impact on CO_2 emissions of full sample, developed and developing economies. The elasticity estimates indicate a 1 percent increase in tourism will raise the CO_2 emissions of full sample, developed and developing economies by 0.051, 0.091 and 0.050 percent, respectively. These findings indicate that tourism increases CO_2 emissions across the developed and developing economies. These results further suggest that the impact of tourism on CO_2 emissions is higher for developed economies than those of developing economies. Our results are consistent with the previous studies (e.g. León et al., 2014) who argue that tourism has more positive impact on CO_2 emissions of developed economies than less developed economies. Despite of similarity in the results, our findings are more reliable than those of León et al. (2014) due to a number of things which include longer period of data, countries are classified into developed, developing and full sample and also applied a robust econometric (FMOLS) model which accounts for endogeneity and serial correlation in the model.

We further examine whether Environmental Kuznets Curve (EKC) exists using Eq. (3). Particularly, we are interested to see whether doubling tourism revenue increases or decreases CO_2 emissions of full sample, developed and developing economies. For this purpose, we squared the tourism receipts (ITR^2) and included this newly generated variable in Eq. (3). The results of this model also displayed in Table 4. For instance, a 1 percent increase in tourism raises CO_2 emissions of full sample, developed and developing economies by 0.005, 0.028 and 0.038 percent, respectively. These results show that the impact of tourism is still positive but significantly reduced in terms of magnitude across full sample, developed and developing economies. More importantly, the impact of tourism on CO_2 emissions is reducing much faster in developed economies than those of developing economies. Based on these findings, we argue that EKC exists across developed and developing economies, meaning that after reaching a threshold point the impact of tourism on CO_2 emissions will significantly reduce and the reduction is much greater in developed economies than the developing economies.

[Insert Table 4 here]

Overall, our results on developed economies imply that the tourism has a considerable role in stimulating economic growth, although it increases CO_2 emissions. The growth of tourism in developed economies might have contributed by several factors, for instance; the policies that are designed for attracting international tourists using print and electronic media. Our findings further suggest that, though developed economies have implemented several eco-friendly tourism policies to control the effect of tourism activities on CO_2 emissions but these policies are not enough to completely eliminate the positive impact of tourism on CO_2 emissions. We therefore emphasize the use of green technology and sustainable tourism policies more effectively to enjoy the positive outcomes of tourism sector. In addition, we urge the policy makers to focus on providing desirable infrastructure facilities such as, transports, telecommunications, hotels, restaurants, shops and various other utilities to the tourists.

Similarly, the tourist statistics show that the growth of tourism in developing economies has also significantly increased since last two decades. The tourism growth is mainly attributed to the tourism promotion policies which are adopted by these economies. The increase of inbound tourists may have a positive impact on employment creation, income and foreign exchange reserves and therefore eventually promoting economic development. However, there is a growing concern among the individuals and stakeholders on the environmental degradation due to the tourism activities. This opens the debate on whether these developed and developing economies have taken sufficient policies to promote sustainable tourism activities. We therefore advocate the policy makers of these economies to give attention and bring up more efficient policies to promote eco-friendly tourism and ensure all sorts of infrastructure facilities to the tourists. This study emphasizes the need of urgency to initiate sustainable tourism policies; otherwise these tourist spots can be vulnerable in no time across developed and developing economies.

4.5 Results of heterogeneous panel non-causality test

The dynamic short-run causality results, by employing Dumitrescu and Hurlin (2012) panel causality test, are displayed in Table 5. These results indicate a feedback (bidirectional) relationship between CO_2 emissions and tourism across full sample and developed economies while there is no evidence of causal relationship between these variables in the case of developing economies. These finding therefore suggest that tourism and CO_2 emissions drives each other in the short-run. Similarly, we found a unidirectional causality that runs from GDP to tourism in developed economies and no evidence of causality found among these variables in full sample and developing economies. This implies that the GDP growth rates are significantly affecting tourism in developed economies. Overall, our short-run causality test results indicate significant causal linkage between tourism and CO_2 emissions and GDP in developed economies while there is no relationship among these variables in developing economies.

[Insert Table 5 here]

5. Conclusion

This study aims to empirically examine the role of tourism on economic growth and CO_2 emissions using multivariate framework on panel data sets of major tourist recipients' countries. The empirical analysis was carried out separately on 26 developed and 18 developing economies with annual data from 1995 to 2012. The findings of this study are unique in understanding the linkages among economic growth, CO_2 emissions, and tourism in both developed and developing economies. Our findings on both developed and developing economies support prevailing literature that inbound tourism induces overall economic growth of countries. This might be mainly because tourism has a significant impact on creating employment opportunities, rising income levels, tax revenues and also increases foreign exchange reserves. In general, the tourism is expected to increase the CO_2 emissions across the countries. Our findings are consistent with this expectation, meaning that tourism activities increase CO_2 emissions across the developed and developing economies.

The increase in CO_2 emissions caused by tourism related activities both in developed and developing economies suggests that these economies have not taken sufficient policies to mitigate the adverse effect of tourism on CO_2 emissions. Therefore, important policy implications are made for both developed and developing economies. Since our results, based on EKC, suggest that after reaching a threshold point the impact of tourism on CO_2 emissions will significantly reduce and the reduction is much greater in developed economies than those of developing economies. Based on this evidence, we argue that if developed economies implement more effective tourism-related policies then these policies will significantly assist to control the CO_2 emissions that come from tourism activities. Therefore, we advise the policy makers of developing economies to follow up and learn from the developed economies to promote more efficient environment-friendly tourism policies to reduce the CO_2 emissions caused by the tourism activities. Thanks to the contribution of tourism industry to the economic prosperity, both developed and developing economies should promote sustainable tourism awareness programs among the stakeholders such as tourists, tourism industries, local residents and authorities to carry out environmental friendly tourism activities.

Our empirical findings demonstrate that the magnitude of tourism impact on economic growth and CO_2 emissions significantly vary across the developed and developing economies. Hence, we argue that the classification of the countries into developed and developing is very important in order to understand the level of tourism impact on economic growth and CO_2 emissions. If the empirical analysis was only carried out on the full sample (developed and developing together) then the inferences drawn from the analysis might be misinterpreted. The main limitation of this study is that, due to the lack of disaggregated data at the regional level, it investigates the impact of tourism on economic growth and CO_2 emissions by using aggregate data at country level. Despite this limitation, this research provides valuable policy implications on tourism-economic growth-CO_2 emissions' relationships across developed and developing economies.

Given that we suggest for future studies to focus at a regional level if data becomes available. This regional level analysis may provide more specific guidelines in order to develop sustainable tourism policies for those regions. Further, future research may also consider other important variables in the analysis, for instance sustainable tourism investments. By increasing the share of sustainable tourism investments not only boost the tourism activities but also reduce the tourism related CO_2 emissions effectively. Therefore, future research may incorporate sustainable tourism investment indicator into the environmental impact model to see to what extent it reduces CO_2 emissions at a regional and country level. These findings may offer more specific policy guidelines which will be crucial for the promotion of sustainable tourism development across the countries and regions.

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Table 1: Summary statistics on a panel data set

Variable	Full sample				Developed economies				Developing economies			
	Mean	Maximum	Minimum	Std. Dev.	Mean	Maximum	Minimum	Std. Dev.	Mean	Maximum	Minimum	Std. Dev.
CO_2	7.56	45.03	0.75	5.67	10.43	45.03	3.88	5.56	3.43	9.89	0.75	2.26
EE	5.60	26.66	1.70	3.15	5.10	15.35	1.70	2.06	6.32	26.66	2.77	4.16
EO	19.49	99.64	0.38	18.43	30.42	99.64	1.33	16.65	3.70	14.68	0.38	2.82
GFCF	4.43	22.60	0.07	4.24	6.93	22.60	0.19	3.85	0.82	2.84	0.07	0.61
IND	30.19	48.53	6.97	7.18	27.69	44.80	6.97	6.46	33.80	48.53	21.35	6.63
ITR	646.21	5314.20	2.70	709.25	979.69	5314.20	23.39	748.92	164.52	726.10	2.70	164.57
LF	49.26	796.00	0.36	127.00	20.70	159.00	0.36	32.28	90.52	796.00	1.05	187.00
POP	102.00	1350.00	0.86	249.00	41.44	314.00	0.86	62.74	190.00	1350.00	4.20	365.00
SER	63.91	92.98	33.57	10.55	69.68	92.98	53.94	7.07	55.58	72.11	33.57	9.08

CO_2: CO_2 emissions per capita in metric tons;
EE: Energy use per unit of GDP at PPP;
EO: GDP per capita in 1000 US$ in current prices;
GFCF: Gross fixed capital formation per capita in 1000 US$ in current prices;
IND: Industry, value added as % of GDP;
ITR: International tourism receipts per capita in US$ current prices;
LF: Total labor force in million;
POP: Total population in million;
SER: Services, etc., value added as % of GDP.

Table 2: Tests for cross-sectional dependence and unit root

	Full sample		Developed economies		Developing economies	
Cross-sectional dependence (CD) test						
Variable	CD test	p-values	CD test	p-values	CD test	p-values
CO_2	16.620***	0.000	15.390***	0.000	19.320***	0.000
EE	73.900***	0.000	61.330***	0.000	15.250***	0.000
EO	112.580***	0.000	68.750***	0.000	44.030***	0.000
GFCF	90.540***	0.000	51.220***	0.000	40.110***	0.000
IND	20.790***	0.000	37.410***	0.000	2.100**	0.035
ITR	104.540***	0.000	62.120***	0.000	41.520***	0.000
LF	84.750***	0.000	51.590***	0.000	31.330***	0.000
POP	69.580***	0.000	37.270***	0.000	30.400***	0.000
SER	48.090***	0.000	50.540***	0.000	4.190***	0.000

CIPS unit root test (under cross-sectional dependence)												
	Level		First difference		Level		First difference		Level		First difference	
	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value
CO_2	0.855	0.804	-3.239***	0.001	0.270	0.606	-3.999***	0.000	0.637	0.738	-5.246***	0.000
EE	2.233	0.987	-4.467***	0.000	2.334	0.990	-3.369***	0.000	0.333	0.630	-2.532***	0.006
EO	0.691	0.755	-6.057***	0.000	1.362	0.913	-6.030***	0.000	-1.057	0.145	-2.434***	0.007
GFCF	1.377	0.916	-6.834***	0.000	3.684	1.000	-4.565***	0.000	-1.249	0.106	-2.985***	0.001
IND	1.561	0.941	-4.629***	0.000	2.112	0.983	-4.122***	0.000	0.954	0.830	-3.257***	0.001
ITR	0.727	0.766	-7.351***	0.000	0.881	0.811	-5.318***	0.000	0.130	0.552	-8.614***	0.000
LF	1.890	0.971	-3.281***	0.001	0.206	0.582	-2.404***	0.008	2.433	0.993	-4.696***	0.000
POP	1.696	0.955	-1.818**	0.035	4.850	1.000	-9.479***	0.000	2.671	0.996	-7.092***	0.000
SER	2.323	0.990	-3.592***	0.000	2.947	0.998	-3.708***	0.000	-0.170	0.433	-2.128**	0.017

Note: '***' '**' indicate the rejection of the null hypothesis of cross-sectional independence (CD test) and the null hypothesis of a unit root (CIPS) at the 1 % and 5% significance levels. The CIPS test is estimated using constant and trend variables in the model.

Table 3: Fisher-type Johansen panel cointegration test

	Full sample				Developed economies				Developing economies			
No. of Ces	trace test	Prob.	max-eigen test	Prob.	trace test	Prob.	max-eigen test	Prob.	trace test	Prob.	max-eigen test	Prob.
EO = f(GFCF, LF, EE, ITR)												
None	1794.000***	0.000	1254.000***	0.000	989.100***	0.000	693.500***	0.000	805.200***	0.000	560.200***	0.000
At most 1	1229.000***	0.000	840.900***	0.000	720.500***	0.000	494.900***	0.000	508.900***	0.000	346.100***	0.000
At most 2	553.600***	0.000	371.500***	0.000	313.100***	0.000	204.700***	0.000	240.500***	0.000	166.800***	0.000
At most 3	291.500***	0.000	220.400***	0.000	172.900***	0.000	130.800***	0.000	118.600***	0.000	89.640***	0.000
At most 4	228.500***	0.000	228.500***	0.000	138.000***	0.000	138.000***	0.000	90.540***	0.000	90.540***	0.000
$CO_2 = f(POP, EO, EE, IND, SER, ITR)$												
None	2629.000***	0.000	1410.000***	0.000	1441.000***	0.000	812.100***	0.000	1188.000***	0.000	597.800***	0.000
At most 1	1422.000***	0.000	1064.000***	0.000	777.000***	0.000	439.000***	0.000	644.700***	0.000	624.900***	0.000
At most 2	647.600***	0.000	394.700***	0.000	378.900***	0.000	233.800***	0.000	268.700***	0.000	160.800***	0.000
At most 3	323.100***	0.000	217.800***	0.000	186.600***	0.000	134.100***	0.000	136.500***	0.000	83.740***	0.000
At most 4	162.800***	0.000	98.180	0.215	89.910***	0.001	57.070	0.292	72.870***	0.000	41.110	0.257
At most 5	110.100*	0.056	76.400	0.807	59.250	0.228	40.920	0.866	50.850*	0.051	35.480	0.493
At most 6	91.860	0.368	91.860	0.368	51.500	0.494	51.500	0.494	40.360	0.284	40.360	0.284

Notes: [a] Probabilities are computed using asymptotic Chi-square distribution;
'***' '**' '*' denote rejection of the null hypothesis of no cointegration at 1%, 5% and 10% significance levels, respectively.

Table 4: Panel data analysis of long-run elasticities

	Full sample		Developed economies		Developing economies	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
$EO = f(GFCF, LF, EE, ITR)$						
GFCF	0.646***	0.000	0.722***	0.000	0.617***	0.000
LF	0.582***	0.000	0.432***	0.000	0.567***	0.000
EE	-0.229***	0.000	-0.338***	0.000	-0.061***	0.001
ITR	0.134***	0.000	0.109***	0.000	0.166***	0.000
$CO_2 = f(POP, EO, EE, IND, SER, ITR)$						
POP	0.479***	0.000	0.479***	0.000	0.275***	0.000
GDP	0.106***	0.000	-0.063***	0.000	0.400***	0.000
EE	0.356***	0.000	0.125***	0.000	0.337***	0.000
IND	0.196***	0.000	-0.234***	0.000	0.560***	0.000
SER	0.230***	0.000	-1.313***	0.000	0.716***	0.000
ITR	0.051***	0.000	0.091***	0.000	0.050***	0.000
$CO_2 = f(POP, EO, EE, IND, SER, ITR^2)$						
POP	0.490***	0.000	0.575***	0.000	0.297***	0.000
GDP	0.139***	0.000	-0.150***	0.000	0.427***	0.000
EE	0.342***	0.000	0.302***	0.000	0.335***	0.000
IND	0.214***	0.000	-0.076***	0.000	0.579***	0.000
SER	0.297***	0.000	-1.508***	0.000	0.726***	0.000
ITR^2	0.005***	0.000	0.028***	0.001	0.038***	0.000

Notes: Estimated using fully modified ordinary least squares (FMOLS) method;
TR^2 indicates squared tourism receipts;
'***' denotes the significance at 1% level.

Table 5: Heterogeneous panel causality test

	Full sample		Developed economies		Developing economies	
Null Hypothesis:	Zbar-Stat.	Prob.	Zbar-Stat.	Prob.	Zbar-Stat.	Prob.
EE does not homogeneously cause CO_2	-0.195	0.845	0.490	0.624	-0.894	0.371
CO_2 does not homogeneously cause EE	3.594***	0.000	3.432***	0.001	1.495	0.135
EO does not homogeneously cause CO_2	0.115	0.909	-0.781	0.435	-0.127	0.899
CO_2 does not homogeneously cause EO	1.893*	0.058	2.452**	0.014	1.096	0.273
GFCF does not homogeneously cause CO_2	0.174	0.862	0.693	0.488	-0.561	0.575
CO_2 does not homogeneously cause GFCF	0.886	0.376	0.934	0.350	0.263	0.793
IND does not homogeneously cause CO_2	-0.307	0.759	-0.260	0.795	-0.499	0.618
CO_2 does not homogeneously cause IND	0.884	0.377	0.394	0.693	2.653***	0.008
ITR does not homogeneously cause CO_2	2.140**	0.032	2.193**	0.028	-0.800	0.424
CO_2 does not homogeneously cause ITR	1.696*	0.090	2.741***	0.006	-1.296	0.195
LF does not homogeneously cause CO_2	-0.529	0.597	-0.344	0.731	-0.914	0.361
CO_2 does not homogeneously cause LF	0.611	0.541	1.041	0.298	0.164	0.870
POP does not homogeneously cause CO_2	1.210	0.226	2.248**	0.025	0.544	0.586
CO_2 does not homogeneously cause POP	0.061	0.951	0.376	0.707	-1.333	0.183
SER does not homogeneously cause CO_2	0.965	0.335	0.482	0.630	0.677	0.499
CO_2 does not homogeneously cause SER	2.879***	0.004	0.262	0.793	4.554***	0.000
EO does not homogeneously cause EE	0.005	0.996	-0.809	0.419	0.980	0.327
EE does not homogeneously cause EO	0.125	0.900	-0.634	0.526	0.958	0.338
GFCF does not homogeneously cause EO	-0.182	0.855	0.756	0.450	-1.193	0.233
EO does not homogeneously cause GFCF	0.080	0.936	0.320	0.749	-0.258	0.796
IND does not homogeneously cause EO	-1.502	0.133	-0.877	0.381	-1.295	0.195
EO does not homogeneously cause IND	1.494	0.135	0.544	0.587	1.683*	0.092
ITR does not homogeneously cause EO	0.357	0.721	1.271	0.204	-0.435	0.664
EO does not homogeneously cause ITR	0.491	0.624	2.207**	0.027	1.072	0.284
LF does not homogeneously cause EO	1.741*	0.082	1.117	0.264	1.380	0.168
EO does not homogeneously cause LF	5.337***	0.000	4.899***	0.000	2.456**	0.014
POP does not homogeneously cause EO	2.890***	0.004	2.629***	0.009	3.431***	0.001
EO does not homogeneously cause POP	5.870***	0.000	2.031**	0.042	1.881*	0.060
SER does not homogeneously cause EO	-1.468	0.142	-0.371	0.711	-0.891	0.373
EO does not homogeneously cause SER	1.142	0.253	-1.291	0.197	1.605	0.109

Note: ‘***’ ‘**’ ‘*’ denote rejection of the null hypothesis at 1%, 5% and 10% significance levels, respectively.