Iran. Econ. Rev. Vol. 24, No. 1, 2020. pp. 159-180

Tourism Impact on Air Pollution in Developed and Developing Countries

Mohammad Alizadeh*[1]

Received: 2018, August 23 Accepted: 2018, October 15

Abstract

The main purpose of this paper is to investigate and compare the impact of tourism on air pollution in selected developed and developing countries during the period of 1995-2014. To this end, at first, the model was designed based on the Environmental Kuznets Curve (EKC) assumptions and with the presence of the major influencing factors on air pollution along with the international tourism variable. Then, the long-run relationship between these variables was estimated by the Continuously-updated and Fully-Modified (CUP-FM) method, considering the existence of a cross-sectional dependence between the model variables in both groups of studied countries. The results of this study indicate the positive impact of international tourism on air pollution in selected developing countries; while the expansion of international tourism reduces air pollution in studied developed countries.

Keywords: Air Pollution, Tourism Development, Cross-Sectional Dependent, Continuously-Updated and Fully-Modified (CUP-FM).
JEL Classification: C_{23}, Q_{56}, J_{51}, F_{12}.

1. Introduction

The tourism industry is one of the most important and most profitable industries in the world and plays a significant role in providing Foreign exchange earnings and in growing and developing of developed and developing countries (Yavari et al., 2010).

This industry involves the transportation and hosting of tourism consumers and is dependent on a wide range of services in infrastructures such as airports, ports, roads, and railways. Creating infrastructures and lateral development of tourist destinations, including the development of restaurants and resorts, produces a wide

---

1. Faculty of Economics and Administrative Sciences, Lorestan University, Khoram Abad, Iran (Alizadeh.m@lu.ac.ir).

range of environmental impacts. And this causes serious damage to the environment of the countries (Lee and Brahmasrene, 2013: 71). Of course, considering tourism as a trade, in the long run, its impact on the environment can be positive or negative depending on the effects of trade liberalization in different countries (Lee and Brahmasrene, 2013: 71). On the other hand, the increase in economic growth caused by the expansion of the tourism industry also affects the environment. This influence can be direct, inverted and or combinations of both in the long run (Pajouyan and Morad Hasel, 2007). Today, the relationship between economic growth and environmental quality as an inverse U is known as the Environmental Kuznets Curve (EKC) hypothesis. This hypothesis suggests that with increasing economic growth in the early stages due to the overcoming of the scale effect on both combination and technique effects, the quality of environmental reduces (especially in developing countries) and then in the next stages of growth, the quality of the environment increases (especially in developed countries). That is, developing countries are the left side of the Environmental Kuznets Curve (EKC) and developed countries are the right side (Asghari et al., 2012).

According to the above points, what is being asked as the main question of this research is the long-term relationship between international tourism (as an indicator of tourism trade) and air pollution (as an indicator of environmental quality measurement) in both developed and developing countries. Also, in the long run, who is this relationship between international tourism and air pollution in developed and developing countries like?

In this regard, a few foreign and domestic studies have been carried out using econometric analysis tools. For this purpose, the present study tries to use the information and statistical data of 25 developing countries and 25 developed countries, and new methods and tests of econometrics that consider cross-sectional dependent and test CUP-FM approach to the above questions.

2. Review of Literature

In the literature review, the first theoretical foundations and then empirical studies have been introduced.

According to the hypothesis of "export-led growth," tourism can be considered as an export; the only difference with the export of goods and services is that the consumer consumes it in the host country (Marin 1992: 679). Also, the expenditures used in the destination country for tourism can be considered as imports. These intangible imports and exports are called tourism trade (Theobald, 2001). Since tourism is considered a type of trade, its expansion can be seen as commercial liberalization. In general, the effect of trade liberalization on the environment is divided into three broad categories: scale effect, technique effect, and combination effect (Cole et al., 1997):

The effect of scale: refers to the increase in the size of economic activities that tourism trade may be due to an increase in the volume of services and access to markets. Assuming the stability of other conditions, as a result of economic liberalization, environmental degradation is likely to be greater. Most economic activities in the process of extraction of raw materials, or in the exploitation of renewable resources, or in the creation of waste and pollution harm the environment. Because more production involves the use of more productive inputs that can have a negative impact on the environment. An increase in the scale of economic performance means increasing the level of damage to the environment unless strict environmental regulations are enforced; in this case, the additional activity will not result in harm or damage (Dean, 2002).

The effect of technique: the technique effect is a subset of effects of the production of trade, sometimes referred to as the effects of technology, and it is derived from the fact that the method of production may change as a result of business in the service sector. Demand for the environment and the application of environmental laws and regulations in the area of production and consumption will increase with the increase of per capita income from trade and economic growth. Therefore, manufacturers have to reform their production methods and use cleaner technologies. In this case, the effect of the technique is likely to be in the interest of the environment. The effects of positive techniques are obtained when environmental degradation and pollution output are reduced per unit of product (Strutt et al., 2000).

The effect of combination: refers to the fact that trade in the service sector, generally changes the structure and composition of a country's economy. The combination of the economics of a country is a share in which each category of goods and services are allotted to the total production of a country. Trade liberalization will enable countries to increase their production in sectors where they have a comparative advantage and so-called become experts in their production. The positive effect is when the composition of the structure changes so that the share of production increases for the benefit of less polluting industries (Chand Prasad & Asafu-Adjaye, 2003). Negatively, if the goods and services produced by a country are based on the natural resources of that country or if their production process creates pollution, then trade liberalization will increase the contribution of those industries to the national economy. In the case of the absence of appropriate environmental policies, this will lead to increased pollution and accelerate the exploitation of natural resources and lead to unsustainable levels of exploitation (Asghari et al., 2012).

Since the tourism business affects economic growth, it can indirectly affect the quality of the environment as well. In economic literature, the relationship between per capita GDP (economic growth index) and environmental degradation (air pollution) as a reverse U are known as the EKC. According to this curve, in the early stages of economic development economic growth will be accompanied by increased environmental degradation and air pollution due to various factors such as high priority of production and employment towards the clean environment, low production technology, low level of environmental awareness, etc. But after reaching a certain level of per capita income, this relationship has reversed and increased economic growth will improve the quality of the environment, which can due to an increase in the level of production technology, increased environmental awareness, the adoption and implementation of strict environmental regulations, etc. Also, at higher levels of income, the country's economic structure is shifting to cleaner industries and technology and the development of service sectors, which can be one of the reasons for the decrease of pollution at higher income levels.

In a general conclusion, its impact on the environment can be positive or negative considering the importance of tourism as a business, in the long run, depending on the effects of trade liberalization (scale effect, technique effect and combination effect) in different countries. On the other hand, the increase in the economic growth caused by the expansion of the tourism industry also indirectly affects the environment. This means that if we are at the upward part of the EKC, tourism development indirectly reduces the quality of the environment. Inversely, if we are at the downward part of EKC, tourism development indirectly increases the quality of the environment. Accordingly, it can be said that the ultimate impact of tourism on the quality of the environment depends on its direct and indirect effects on the environment.

In general, in a few empirical studies using econometric analysis tools, the impact of tourism on environmental quality has been studied. Following, the most important of these studies and empirical studies close to the research topic are internal and external studies, respectively.

Azam et al. (2018) studied the impact of the number of international tourists on environmental pollution in Malaysia, Thailand, and Singapore over the years of 1999-2014. The findings of this study indicate a negative and significant effect of the number of international tourists on CO2 emissions in Thailand and Singapore using the Fully Modified Ordinary Least Squares (FMOLS) method. Meanwhile, the increase in the number of international tourists will increase CO2 emissions in Malaysia.

Shakouri et al. (2017), in a study, are looking for an answer to the question of whether tourism development can lead to carbon dioxide emissions? Therefore, a long-term relationship between economic growth, tourism, energy consumption, and CO2 emissions has been investigated in the form of a Kuznets curve environmental hypothesis using the panel data of the Asia-Pacific countries from 1995 to 2013. The results show that in the long run, the number of international tourists has a positive impact on carbon dioxide emissions. The Granger causality test also confirms the existence of a one-way causality relationship of energy consumption to tourists and one-sided causality of CO2 emissions to tourists in the studied countries.

Gupta & Dutta (2018), in their study, develop a tow-sector dynamic model of a less-developed economy with an imported traded good sector and with a none-traded tourism service sector serving international tourists. The model takes care of the negative effect of tourism development on environmental pollution. Environmental quality and capital stock accumulate over time. The findings of this research show that tourism development raises the level of capital stock as well as national income but lowers the quality of the environment in the new steady-state equilibrium leading to a relative expansion (contraction) of the capital (labor) intensive non-tourism (tourism) sector.

Zhang and Gao (2016) examined the impact of international tourists on environmental pollution in China over the period of 1995-2011, using regional panel data. The findings of this study indicate that the EKC hypothesis does not arise from tourism in the center of China, and is only supported in the East and West of China. Also, the results indicate that tourism has a negative impact on CO2 emissions in the east of China.

Dogen et al. (2015) studied the impact of the number of international tourists on carbon dioxide emissions (Air Pollution Index) in OECD countries during the period 1995-2010 and in the form of the EKC. The findings of this study show that the number of international tourists has a positive impact on the emissions of air pollutants in the countries under study, using panel integration with cross-sectional dependence and Dynamic Ordinary Least Squares (DOLS) estimator. Other results of this study indicate that the EKC hypothesis is not approved, and energy consumption and trade have positive and negative effects on air pollution respectively.

Vita et al. (2015) studied the impact of the number of international tourists on carbon dioxide emissions (air pollution index) in Turkey over the period 1960- 2009 and in the form of the EKC. The results of the research by the Dynamic Ordinary Least Squares (DOLS) and ECM method indicate that the number of international tourists has a positive impact on carbon dioxide emissions in the long run. This variable does not have a significant effect on the air pollution index in the short run, meanwhile, the EKC hypothesis is not rejected for Turkey.

Katircioğlu (2014a) studied the impact of the number of international tourists on carbon dioxide emissions (Air Pollution Index) in the form of the EKC hypothesis in Singapore during 1971-

2010. The findings of this study, indicate a negative and significant effect of the number of international tourists on carbon dioxide emissions in the short and long term using the DOLS method. Also, the EKC hypothesis is not rejected for Singapore.

Katircioğlu (2014b), in another study, examined the impact of the number of international tourists on energy consumption and economic growth on environmental pollution in Turkey over the period from 1960 to 2010. The findings of this research using the ARDL method show the positive impact of international tourists, energy consumption use and economic growth on carbon dioxide emissions. However, the impact of international tourists is low compared to the other two variables.

Lee and Brahmasrene (2013) have examined the impact of tourism on air emissions in EU countries during the period of 1988-2009. The findings of this study show the negative impact of tourism development on the carbon dioxide emission of carbon dioxide in these countries by using the panel cointegration analysis and the fixed effects (FE) econometric method.

Asghari et al. (2012) measure the effect of scale, technique and combination resulted from tourism business on air pollution in selected EU countries and selected countries of the MENA region during the period 1995-2010. The results of this research using the simple panel method show that the three above-mentioned effects are negative for the selected EU countries and positive for the selected countries of the MENA region. Therefore, the expansion of tourism has reduced air pollution in selected EU countries and increased air pollution in selected countries of the MENA region.

Mubarak and Mohammadlou (2009) have examined the effect of commercial liberalization on greenhouse gas emissions in two groups of developed and developing countries during the period of 1990-2008. The findings of this study, with the use of data panel and the fixed effect method (FE), show that increased trade liberalization and per capita income in developed countries lead to a reduction in the emissions of carbon dioxide and other pollutants and, in developing countries, increase the release of these gases.

Contrary to Azam et al. (2018), which uses time-series data to investigate the impact of tourism on air pollution, and unlike Gupta and Dutta (2018), which deals with theoretical analysis of this issue; and in general, in other empirical studies conducted using econometric instruments, the impact of tourism on environmental quality has been studied, and the study of this subject is increasing in empirical studies. Therefore, in this study, we have tried to evaluate the impact of tourism development on air pollution within the framework of the Kuznets environmental curve in order to complete and continue these studies. First, it is done by using the combined data of developing and developed countries with the aim of providing a general conclusion for each of these countries group and comparing these results to provide appropriate political proposals; second, new econometric methods and tests that consider cross-sectional dependence (unlike the usual tests in combination data), and Continuously-updated and Fully-Modified (CUP-FM) method have been used that makes the results more accurate and reliable.

3. Model and Research Method

In this study, a model with the presence of key variables within the framework of the EKC hypothesis is used in order to investigate and compare the impact of international tourism on the emission of air pollutants in selected developed and developing countries, considering the theoretical foundations and empirical studies on the factors affecting the quality of the environment. Therefore, the elimination of the fundamental variables of the model and the estimation of the model in the framework of the EKC hypothesis may create the problem of the bias caused by the elimination of the variables. For this purpose, models suggested by Dogan et al. (2017) and Vita et al. (2015) have been used as follows:

$$\begin{aligned}\mathrm{Ln(AP)}_{it} &= \alpha_{0i} + \alpha_1 \mathrm{Ln(GDPpc)}_{it} + \alpha_2 [\mathrm{Ln(GDPpc)}_{it}]^2 + \alpha_3 \mathrm{Ln(EC)}_{it} \\ &+ \alpha_4 \mathrm{Ln(Trade)}_{it} + \alpha_5 \mathrm{Ln(Tourism)}_{it} + \varepsilon_{it}\end{aligned}$$

In the above equation, the variables are defined as follows:

Ln (AP): The natural logarithm of the emission of air pollutants, which, according to many empirical studies done in the subject filed of research, is measured by per capita carbon dioxide emissions (in metric tons).

Ln (GDP_{pc}): Natural logarithm of per capita Gross Domestic Product with constant prices of 2005 (in US dollars); as an indicator of economic growth (revenue).

$[(LnGDP_{pc})]^2$: the square of the natural logarithm of per capita GDP; as a measurement indicator of the square of the economic growth.

If $\alpha_2 < 0$ and $\alpha_1 > 0$ and these coefficients are significant, there is an inverse U-shape relationship between the economic growth variables and the air pollution emission index, and the EKC hypothesis is confirmed. In this case, the return point (maximum) of the curve can calculate as follows: (Saboori et al. 2012: 187):

$$GDP_{pc}^{*} = exp\left[-\frac{\alpha_1}{2\alpha_2}\right]$$

Ln (EC): The natural logarithm of energy consumption, which is measured by per capita energy consumption (in kilogram equivalent of oil).

Ln (Trade): The natural logarithm of trade (the degree of trade openness), which is defined as the ratio of total exports and imports to gross domestic product.

Ln (Tourism): Natural logarithm number of international tourist arrivals as a measurement indicator of tourism trade. In most of the empirical studies mentioned above in the subject field of research, the index has been used to measure tourism development.

Also, (i = 1, ..., 25) represents 25 developing countries (Iran, Algeria, Azerbaijan, Bangladesh, Bolivia, Brazil, Cameroon, Chile, Djibouti, Ecuador, Egypt, Ghana, Guatemala, India, Jordan, Mexico, Nigeria, Oman, Pakistan, South Africa, Thailand, Tunisia, Venezuela, Peru, Kyrgyzstan) and 25 developed countries(Norway, USA, New Zealand, Australia, the Netherlands, Canada, Sweden, Germany, South Korea, Switzerland, Japan, France, Finland, Belgium, Denmark, Spain, United Kingdom, Italy, Austria, Slovenia, Greece, Portugal, Malta, Slovakia, Andorra). (t = 1, …, 25) represents the time interval (1995-2014). The source of all the data variables in this research is the world development indicators.

The model in this paper is a compound equation (panel). The first step in the econometric analysis of panel data is the recognition of cross-sectional independence between data; because cross-sectional dependence can be existed between different sections due to factors such as Externalities, regional and economic relationships, interrelation of remaining uncalculated components and unexplained unexpected factors (Aghaei et al., 2012: 159). Therefore, several tests have been performed such as Breusch and Pagan (1980) and Pesaran's Cross-Sectionall Dependence (2004) tests, that, in this study, Pesaran's Cross-Sectional Dependence test has been used. This test is applicable to balanced and unbalanced panel data and has good descriptors in small samples. Also, unlike the Breusch and Pagan methods, for large cross-sections and small-time dimensions, reliable results are presented and in relation to occurring one or more structural failures are resistant to individual regression slope coefficients (Pesaran's Cross-Sectionall Dependence, 2004).

The null hypothesis in the Pesaran's Cross- Sectional Dependence test indicates a lack of cross-sectional dependence, and for balanced panels, the CD test statistic can be calculated as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\widehat{P}_{ij}\right) \rightarrow N(0,1) \quad (1)$$

In which, $\widehat{P}_{ij}$ are the correlation coefficients of the in pairs of Pearson from the residual terms of the regression equation $y_{it} = \alpha_i + \beta_i x_{it} + u_{it}$. If a computational CD statistic is greater than the critical value of the standard normal distribution at a given significant level, then the null hypothesis of this test is rejected and the cross-sectional dependence is deduced.

If cross-sectional dependence is not rejected in panel data, then in the next step, the existence of a long-run relationship between the variables of the model should be tested by using unit root and cointegration tests. For this purpose, we used the Cross-sectional generalized unit root Test by Im, Pesaran, and Shin (CIPS) (presented by Pesaran (2007)) and the Westerlund Cointegration Test (2007) for data with cross-sectional dependence. In these tests, the null hypothesis indicates the existence of unit root (non- stationary) and lack of cointegration, respectively. In the last step, the model should also be estimated. If the cross-sectional dependence between the model variables is not rejected, then we cannot use the usual methods of estimating the model in the combined data.

In this regard, Bai et al. (2009) proposed (CUP-FM) estimator for panel data in which there is a cross-sectional dependence problem based on estimator Fully Modified Ordinary Least Squares (FMOLS). This estimator, like the FMOLS estimator, is resistant to sequential auto-correlated bias and resistant endogenous bias, and, moreover, is indifferent to the Stationary and non- stationary of explanatory variables. In order to introduce this estimator, we assume that there is a panel pattern as follows:

$$y_{it} = \acute{x}_{it}\beta + e_{it} \qquad i = 1, \dots, n, \quad t = 1, \dots, T \quad x_{it} = x_{i,t-1} + \varepsilon_{it} \quad (2)$$

y_{it} is a dependent variable, x_{it} is a set of k non-stationary explanatory variable, β is a $k \times 1$ vector of slope parameters, and e_{it} is the regression equation distortion term. The estimator of the least combined squares for β parameter is presented as follow (Bai et al. 2009, 89):

$$\hat{\beta}_{LS} = \left(\sum_{i=1}^{n}\sum_{t=1}^{T}\acute{x}_{it}x_{it}\right)^{-1}\sum_{i=1}^{n}\sum_{t=1}^{T}x_{it}\,y_{it} \qquad (3)$$

Considering the analysis by Phillips and Hansen (1990), the border distribution of this estimator is shifted away from zero due to the existence of bias between e_{it} and ε_{it}, unless in a circumstance that x_{it} is strictly exogenous. In this light, the FMOLS estimator can be presented as Phillips and Hansen method for panel data in order to achieve long-term consistency and asymptotic normal distribution. On the other hand, the cross-sectional independent hypothesis is too limited in economic time series studies and cannot be justified easily. Bai et al (2009) for considering cross-sectional dependence assumed that equation error term and regression comply with factor pattern of the following relation:

$$e_{it} = \acute{\lambda}_{it}F_t + u_{it} \qquad (4)$$

Where F_t is an r × 1 vector of latent common factors, λ_i is an $r \times 1$ vector of factor weights; then panel pattern of relation (2) can be defined as follow:

$$y_{it} = \acute{x}_{it}\beta + \acute{\lambda}_{it}F_t + u_{it} \tag{5}$$

Separating F_t from the error term and adding it to the regression function can improve the estimations. If some components of x_{it} are stationary and F_t Correlated with X_{it}, β estimation will be inconsistence considering Ft as a part of the Distortion term.

According to the above, the CUP-FM estimator, which provides a consistent estimate of the equation coefficients, is introduced and defined as follows.

$$\hat{\beta}_{Cup-FM} = \left[\sum_{i=1}^{N} \acute{x}_i M_{\hat{F}}\, x_{it}\right]^{-1} \sum_{i=1}^{n} (\acute{x}_i M_{\hat{F}} y_i{}^{+} - T(\hat{\bar{\Delta}}^{+}{}_{\varepsilon ui} - \hat{\delta}_i \acute{\hat{\bar{\Delta}}}^{+}{}_{\eta u})) \tag{6}$$

$$\hat{F}V_{nt} = \left[\frac{1}{nT^2}\sum_{i=1}^{n}(y_i - x_i\hat{\beta}_{Cup-FM})(y_i - x_i\hat{\beta}_{Cup-FM})'\right] \tag{7}$$

In the two equations above, $\bar{\Delta}$ is the one-way covariance matrix operator, V_{nt} is the diagonal matrix from r to the largest special values of the intra-bracket matrix that are arranged in decreasing order, and the variables x_i, F, $y_i{}^{+}$and ui are representative of the following vectors:

The variable η is auto-regression process distortion term of F_t and with assuming the non-stationary of F_t and is introduced as follows (same: 86):

$$F_t = F_{t-1} + \eta_t \tag{8}$$

Also, it is assumed that the relation $u_{it} = a_i\eta_t + b_{it}$ exists between the distortion terms sentences (errors), two equations (4) and (8). In this way, the CUP-FM estimator is obtained as a result of the repeated solution of two unknown $\hat{\beta}_{Cup-FM}$ and $\hat{F}$ in two equations of (6) (same, 86-85).

4. Model Estimation and Analysis of Results

The first step in estimating panel data is to conduct a cross-sectional dependent test. In this study, the cross-sectional dependent test of Pesaran (2004) was performed for the model in both developed and developing countries and the test statistic was obtained -2/94 and -3/54 respectively. Regarding the critical values of this test, which has a normal distribution (and at levels of 1%, 5% and 10% -1/64, -1/96 and -2/57, respectively), the zero-hypothesis is rejected based on the lack of cross-sectional dependent at level of one percent, and the existence of cross-sectional dependent between model variables in both groups of studied countries is concluded. Based on the cross-sectional dependent of the model, the CIPS statistics of Pesaran (2007) were used to examine the existence or loss of the unit root. The results of this test are for all variables, once with Constant (C) and once with constant and time trend (C + t) at the level and with a

Table 1: The Results of Pesaran's Unit Root Test (2007)

Variable	CIPS Statistics in Developing Countries				Degree of Stationary
	at Level		With First Difference		
	C	C+T	C	C+T	
Ln(AP)	-1.042	-1.112	-2.192	-2.585	I(1)
Ln(GDPpc)	-1.611	-2.012	-2.758	-3.212	I(1)
$[Ln(GDP_{PC})]^2$	-0.482	-0.115	-2.352	-2.756	I(1)
Ln(EC)	-1.212	-1/832	-3.005	-3.881	I(1)
Ln(Trade)	-2.021	-2.412	-4.115	-4.211	I(1)
Ln(Tourism)	-0.221	-1.241	-2.514	-2.785	I(1)
Ln(AP)	-0.822	-1.212	-2.421	-3.012	I(1)
Ln(GDPpc)	-1.385	-0.965	-3.254	-4.244	I(1)
$[Ln(GDP_{PC})]^2$	-0.525	-0.211	-2.942	-2.711	I(1)
Ln(EC)	-1.122	-1.526	-2.954	-3.442	I(1)
Ln(Trade)	-1.948	-2.245	-3.856	-3.554	I(1)
Ln(Tourism)	-0.341	-0.856	-2.295	-3.854	I(1)

Critical Values of Pesaran's Unit Root Test (2007)

Type	1%	5%	10%
C	-2.32	-2.15	-2.07
C+T	-2.83	-2.67	-2.58

Source: Critical values of Pesaran's unit root test, from the table provided by Pesaran (2007: 281-280) and other results based on the research calculations.

difference in Table (1). Based on these results and the critical values provided by Pesaran (2007: 280-281) at the bottom of the table (1), we conclude that all variables. In both groups of countries are not stable (at the level of 5%); however, they become stable at their first difference, and first-order accumulation, which means I(1).

Considering the existence of cross-sectional dependence in the model and the results of the unit root test, and that all variables used in this study are first-order accumulated, the long-term relationship between these models was studied using the Westerlund Cointegration test (2007). The results of this test are presented in Table (2).

Table 2: Westerlund Panel Cointegration Test Results (2007)

Statistic	developing Countries			Developed Countries		
	Statistic Value	Probability	Strong Probability	Statistic Value	Probability	Strong Probability
G_τ	-3.465	0.000	0.000	-2.754	0.000	0.038
G_α	-6.226	0.995	0.001	-8.816	0.000	0.000
P_τ	-25.212	0.000	0.000	-31.924	0.000	0.000
P_α	-9.185	0.000	0.000	-13.114	0.000	0.000

Source: Research results

Note: *The optimal lag length was determined using the Akaike criterion (AIC) and based on the placement in determining the window length of the Bartlett-kernel as $\mathbf{4(T/100)^{2/9} \approx 3}$. The number of bootstraps is also considered to be 500 to determine the bootstrap probability value of probability, which eliminates cross-sectional effects in panel data.

According to the results of table (2) (statistics value and calculated level of probability), it can be said that the zero-hypothesis is rejected based on the lack of co-integration among the variables of the model based on two average statistics of the G_τ group and two statistics of P_τ and P_α panels at the level of one percent in the developing countries.

Column 3 of the table (2) shows the strong probability values of the Westerlund test (2007) obtained by the bootstrap method to eliminate the effect of cross-sectional dependent between variables.

Based on these values, the zero-hypothesis is rejected based on the lack of co-integration between the model variables in the developing countries, based on two average statistics of the groups G_τ and G_α and two statistics of P_τ and P_α panels in the model. In the case of developed countries, it can be said that the obtained values of probability and strong probability based on all four statistics of Westerlund's cointegration test (2007) suggest a long-term relationship between model variables.

Therefore, according to the Westerlund Cointegration (2007) test, there is a strong long-run equilibrium relationship between model variables in both groups of countries. After proving the existence of cointegration between model variables in both groups of countries, one can estimate the model without worrying about the problem of false regression. As previously explained, because of the cross-sectional dependent of these models, the CUP-FM method has been used to estimate long-run coefficients. The results of this estimate are reported in Table (3).

Table 3: Estimation of long- term Coefficients Using CUP-FM Method

Variable	Developing Countries		Developed Countries	
	Coefficient	t statistic	Coefficient	t statistic
Ln(GDPpc)	1.517^{**}	2.032	1.498^{***}	3.894
$[(\text{LnGDPpc})]^2$	0.071^{**}	1.988	-0.082^{***}	-4/661
Ln(EC)	0.622^{***}	3.842	0.448^{**}	2.156
Ln(Trade)	0.085^{***}	3.375	-0.188^{***}	-5.554
Ln(Tourism)	0.082^{**}	6.469	-0.045^{***}	-4.121

Symptoms ** and * are significant at 5% and 1% respectively.**
Source: Research results

Based on the results of Table (3), the coefficient of the variable of GDP per capita logarithm is positive and is about 1/517, for the developing countries, in the long run. The coefficient of the squared variable of the logarithm of GDP per capita is also -0.071. These results indicate EKC approval in selected developing countries. Now we calculate the EKC return point for these countries:

Therefore, the EKC return point in the selected developing countries will be where at that point the per capita GDP of these countries will be $ 43612/578. Since the average per capita GDP in selected developing countries is lower than GDP per capita at the EKC return point of these countries, we conclude that these countries are on the upside of the EKC and have not yet reached the point of returning this curve. Therefore, increasing the economic growth of the selected developing countries in development until reaching the return point will lead to an increase in environmental degradation. The mark of per capita gross domestic product and square per capita GDP coefficients for developed countries like developing countries are positive and negative respectively, which confirms the existence of the EKC hypothesis in these countries; however, we now calculate the EKC return point for these countries:

Given that the EKC return point for developed countries is estimated at $ 9266 (2005 fixed price), most of these countries now have higher per capita GDP, so they crossed the EKC return point, and are in the downside of this curve. Therefore, increasing economic growth in developed countries, as opposed to developing countries, reduces air pollution. These results are closely aligned with many of the studies conducted in this field, such as Kasman and Duman (2015), Farhani et al. (2014), Salimifar and Dehnavi (2009).

According to Table 3, increasing per capita energy consumption will increase air pollution in selected developing and developed countries; however, the intensity of this effect is higher for the selected developing countries. A one percent increase in per capita energy consumption in selected developing and developed countries will increase air pollution by as much as 0/622 percent and 0/448 percent, respectively. This conclusion suggests a lack of technical efficiency in the production and consumption of energy in selected developing countries.

The positive impact of energy consumption on the diffusion of air pollution in developing and developed countries has been concluded in almost all of the foreign and domestic studies carried out in this field. Based on the results of Table (3), the effect of the trade liberalization variable on the amount of air pollution in selected developing and developed countries are positive and negative, respectively. In a way that, with a one percent increase in the trade liberalization index, the rate of air pollution in selected developing and developed countries will be increased by 0.085% and decreased by 0.188%. These results are closely aligned with many of the results of studies conducted in this field such as Kasman and Duman (2015) and Mubarak and Mohammadlou (2009).

According to the results of table (3), the effect of the number of tourists entering the developing and developed countries (tourism development index) on the distribution of air pollution is positive and negative, respectively. So, with a one percent increase in the number of tourists entering developed and developing countries, air pollution will increase by 0.082% and decrease by 0.045% respectively. This means that, in total, the direct and indirect effects of tourism on air pollution, as mentioned in the theoretical foundations, are positive and negative in selected developing and developed countries. Regarding the indirect effect of tourism on air pollution, it can be said that if consider the tourism hypothesis leads to economic growth (which has been proved in most empirical studies), as the results of the study indicate that the developing countries in the upward trend of the EKC and most of the developed countries are on the downside of this curve, with the increase in international tourism and, in the context of economic growth, air pollution in developing countries is increasing, while in developed countries it is decreasing. The result of this study is based on the positive effects of tourism on air pollution in developing countries and its negative impact on air pollution in developed countries is closely related to the studies of Lee and Brahmasrene (2013) and Asghari et al. (2012).

5. Summaries and Suggestions

The main purpose of this paper is to investigate the effect of the spread of tourism on the amount of air pollution (carbon dioxide emissions) in developing and developed countries, and emphasizing the issue of cross-sectional dependent during the period 1995-2014.

In this regard, other important factors influencing air pollution (control variables), including: per capita GDP, square GDP per capita, energy consumption and trade liberalization are also used. Since the existence of a cross-sectional dependent between the variables of the model was probable, Pesaran's cross-sectional dependent test (2004) has been used to determine the existence or absence of cross-sectional dependent. After confirmation of cross-sectional dependent, in order to estimate the long-run equilibrium relationship between the model variables, new methods in panel data that consider inter-sectional dependencies, such as Pesaran's unit root tests (2007), Westerlund's cointegration (2007) and CUP- FM (provided by Bai et al. (2009)) have been used.

The results indicate that the EKC has been approved for developing and developed countries so that the developing countries in the upside and developed countries are on the downside of this curve. Therefore, increasing economic growth in developing and developed countries will contribute to increasing and reducing air pollution respectively. The other results of this study indicate that air pollution is positively influenced by energy consumption, trade and international tourism variables in developing countries. But for developed countries, only energy consumption will cause air pollution and the impact of international trade and tourism on air pollution in these countries is negative.

According to the main result of this research, the positive effect of international tourism on air pollution in selected developing countries and its negative impact on developed countries, it is suggested that developing countries use modern and cleaner technologies to host international tourists and they will highlight the policies implemented in developed countries in order to increase income from expanding tourism without intensifying the pollution of the air.

References

Aghaei, M., Ghanbari, A., Agheli, L., & Sadeghi, H. (2012). Investigating the Relationship between Energy Consumption and Economic Growth in Iran's Provinces Using Cointegration and Multivariate Panel Error Correction Model. *Journal of Economics and Modeling*, *9,* 148-185.

Asghari, M., Yousefi Tudashaki, Sh., & Arbabian, Sh. (2012). The Impact of Tourism on Environmental Quality. *Journal of Economic Development Research*, *7,* 1-28.

Azam, M., Alam, M. M., & Hafeez, M. H. (2018). Effect of Tourism on Environmental Pollution: Further Evidence from Malaysia, Singapore, and Thailand. *Journal of Cleaner Production*, *19,* 330-338.

Bai, J., Kao, C., & Ng, S. (2009). Panel Cointegration with Global Stochastic Trends. *Journal of Econometrics*, *149,* 82-99.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Application to Model Specifications in Econometrics. *The Review of Economic Studies*, *47*, 239–253.

Chand Prasad, B., & Asafu-Adjaye, J. (2003). Trade Liberalization and Environment in Pacific Island Countries (FICs): Is It a Case of “Two Gains for one”? *International Journal of Social Economics, 30*, 1288 – 1305.

Chang, Y. (2004). Bootstrap Unit Root Tests in Panels with Cross-sectional Dependency. *Journal of Econometrics*, *120*, 263-293.

Cole, M. A., Rayner, A. J., & Bates, J. M. (1997). The Environmental Kuznets Curve: An Empirical Analysis. *Environmental and Development Economics*, *2*, 401-416.

Dean, M. (2002). Does Trade Liberalization Harm the Environment? A New Test. *the Canadian Journal of Economics, 35(4),* 819-842.

Dogan, E., Seker, F., & Bulbul, S. (2017). Investigating the Impacts of Energy Consumption, Real GDP, Tourism and Trade on CO2 Emissions by Accounting for Cross-Sectional Dependence: A Panel Study of OECD Countries. *Current Issues in Tourism, 20*(16), 1701-1719.

Farhani, S., Chaibi, A., & Rault, C. (2014). CO2 Emissions, Output, Energy Consumption, and Trade in Tunisia. *Economic Modeling, 38*, 426-434.

Gupta, M. R., & Dutta, P. B. (2018). Tourism Development, Environmental Pollution and Economic Growth: A Theoretical Analysis. *The Journal of International Trade & Economic Development, 27*(2), 125-144.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, *115*, 53-74.

Kao, C. (1999). Spurious Regression and Residual-Based Tests for Cointegration in Panel Data. *Journal of Econometrics*, *90*, 1-44.

Kasman, A., & Duman, Y.S. (2015). CO2 Emissions, Economic Growth, Energy Consumption, Trade and Urbanization in New EU Member and Candidate Countries: A Panel Data Analysis. *Economic Modelling*, *44*, 97-103.

Katircioğlu, S. T. (2014a). Testing the Tourism-Induced EKC Hypothesis: The Case of Singapore. *Economic Modelling, 41*, 383–391.

---------- (2014b). International Tourism, Energy Consumption, and Environmental Pollution: The Case of Turkey. *Renewable and Sustainable Energy Reviews*, *36*, 180–187.

Lee, J. W., & Brahmasrene, T. (2013). Investigating the Influence of Tourism on Economic Growth and Carbon Emissions: Evidence from Panel Analysis of the European Union. *Tourism Management*, *38*, 69-76.

Levin, A., Lin, C. F., & Chu, C. J. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*, *108*, 1-24.

Marin. D. (1992). Is the Export-Led Hypothesis Valid for Industrialized Countries? *Review of Economics and Statistics*, *74*, 678-688.

Mubarak, A., & Mohammadlou, N. (2009). The Impact of Trade Liberalization on Greenhouse Gases Emissions: An Empirical Test of Pollution Haven Hypotheses and Environmental Kuznets Curve. *Journal of Planning and Budget*, *14,* 31-58.

Pajouyan, J., & Morad Hasel, N. (2007). The Effect of Economic Growth on Air Pollution. *Quarterly Journal of Economic Research*, *4,* 141-160.

Pedroni, P. (2004). Panel Cointegration, Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. *Econometric Theory*, *3*, 597-625.

Pesaran, M. H. (2007). A Simple Panel Unit Root Test in Presence of Cross Section Dependence. *Journal of Applied Econometrics*, *22,* 265–312.

---------- (2004). General Diagnostic Tests for Cross Section Dependence in Panels. *CWPE 0435 Working Paper*, Retrieved from https://www.repository.cam.ac.uk/bitstream/handle/1810/446/cwpe0435.pdf.

Phillips, P. C. B., & Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies, 57*, 99-125.

Saboori, B., Sulaiman, J., & Mohd, S., (2012). Economic Growth and CO2 Emissions in Malaysia: A Cointegration Analysis of the Environmental Kuznets Curve. *Energy Policy*, *51*, 184–191.

Salimifar, M., & Dehnavi, J. (2009). Comparison of Kuznets Environmental Curve in OECD and Developing Countries: Panel Based Analysis. *Science and Development Magazine, 29*, 181-200.

Shakouri, B., Yazdi, S. K., & Ghorchebigi, E. (2017). Does Tourism Development Promote CO2 Emission? *Anatolia: An International Journal of Tourism and Hospitality Research*, *28*(3), 444-452.

Strutt, A., Anna, C., Anderson, K., & Kym, A. (2000). Will Trade Liberalization Harm the Environment? The Case of Indonesia to 2020. *Environmental and Resource Economics*, *17*(3), 203-232.

Theobald, W. F. (2001). *Global Tourism (2nd Ed*.). Oxford: Oxford

Journals.

Vita, G., Katircioglu, S., Altinay, L., Fethi, S., & Mercan, M. (2015). Revisiting the Environmental Kuznets Curve Hypothesis in a Tourism Development Context. *Environmental Science and Pollution Research*, *22*(21), 1–12.

Westerlund, J. (2007). Testing for Error Correction in Panel Data. *Oxford Bulletin of Economics and Statistics*, *69*(6), 709–748.

Yavari, K., Rezagholizadeh, M., Aghaei, M., & Mostafavi, S.M.H. (2010). The Effect of Tourism on Economic Growth: The Case of OIC Member Countries. *Journal of Economic Research*, *45*(2), 219-241.

Zhang, L., & Gao, J. (2016). Exploring the effects of International Tourism on China's Economic Growth, Energy Consumption, and Environmental Pollution: Evidence from a Regional Panel Analysis. *Renewable and Sustainable Energy Reviews, 53*, 225–234.