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THE EFFECS OF TOURISM AND GLOBALIZATION OVER ENVIRONMENTAL DEGRADATION IN DEVELOPED COUNTRIES

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Abstract: This paper focuses on long-term evidence on economic growth, international tourism, globalization, energy consumption and carbon dioxide (CO_2) emissions in OECD countries for the period of 1994-2014. The empirical analysis reveals that climate change is magnified by energy use, tourism and economic growth. An inverted U-shaped relationship is also found between international tourism and CO_2 emissions. The contribution of international tourism to climate change in the early stages of development is thus diminished by globalization in the later stages. In other words, globalization appears to reduce carbon emissions from international tourism. The empirical results provide additional arguments for shaping regulatory frameworks aimed at reversing the current energy mix in OECD countries by facilitating energy efficiency and promoting renewable sources.

Keywords: Tourism; Globalization; CO_2 Emissions; Economic Growth; Energy

I. Introduction

Climate change today affects our lifestyles, economic growth and, health and social well-being of societies struggling to mitigate climate change and CO_2 emissions (Sinha et al. 2017, Balsalobre-Lorente et al. 2018). International tourism is no exception, and in recent decades it has become a strategic sector in dissimilar economies, serving as an important source of employment and economic growth (UNWTO 2003, Gossling and Hall 2006, Becken and Hay 2007). A number of international institutions (UNWTO 2017, OECD 2009, WTTC 2005, UNWTO 2005) have emphasized that tourism has the potential to bring about the economic transformation of a wide range of destinations. Similarly, in many countries international tourism can offset excessive trade imports in the balance of payments through job creation or development, among others (Lanza et al. 2003, Pulido and López 2014). Tourism not only encourages the growth of the sector, it also stimulates economic growth of the economy as a whole (Lee and Chang 2008). Numerous governments have implemented actions to encourage tourism as a path to greater economic development.

Because tourism is produced and consumed simultaneously (at the destination), the tourism industry is closely related to environmental impact. The specialized literature defends a view of the negative impact of international tourism as it deteriorates environmental quality (Goudie and Viles 1997), but also takes the opposing position: international tourism provides ecological functions or essential services for a country's development (IPCC 2007, WTTC 2011), and promotes energy efficiency and innovation, thus generating a positive impact on the environment (IPCC 2007). Tourism is also recognized as an instrument of environmental protection (Gössling 2002, Imran et al. 2014). The activity levels registered in the travel and tourism industry is a key factor in global environmental changes (Gössling 2002). The existence of a reciprocal dependency between tourism and the environment quality has been tested. Although international tourism per capita increased between 1995 and 2014, per capita CO_2 emissions have shown a slight decline in recent years (Figure-1).

INSERT FIGURE 1

This could be due to a potential positive relationship between international tourism and carbon emissions, as identified by Rasekhi and Mohammadi (2015) while analysing the connection between tourism and environmental performance in the Caspian Sea nations during 2002-2013. Tang (2015) also examined the same connection through a panel data from 1995 to 2012 for Heilongjiang Province, China by Sherafati et al. (2016) explored the connection between tourism and environmental degradation for the five most important Southeast Asian countries between 1979 and 2010, and Rasekhi et al. (2016) carried out the same analysis for 55 selected developing (including Iran) and developed countries during the period 2005-2012. It is worth testing whether these changes in tourism industry have had a parallel impact on the rate of pollution deriving from tourism. The recent context considers both pollution and environment, and the findings are thus applicable in general as well as specifically in tourism. As a highly dynamic economic sector, depending on its level of innovations and resources, tourism can play a key role in tackling climate change (UNEP 2007). Tourism is a very climate-sensitive industry due to its high dependence on natural environment (Serrano-Bernardo et al. 2012) and its quality. Studies on the relationship between environmental quality and tourism demand have found that tourists have fewer cost limitations if they can visit a high-quality environment (Huybers and Bennett 2000). The environmental degradation generated by tourism and the absence of a specialized end-to-end management to preserve natural resources is leading to the economic decline of many tourist destinations (Hall 1998, Zhong et al. 2011).

Otherwise, the global dimension of tourism must also be considered. There is empirical evidence that the globalization process has a positive effect on environment (Shahbaz et al. 2016). Many studies confirm the connection between economic growth, globalization and environmental degradation (Tamazian et al. 2009). Turner and Witt (2001) reported that higher levels of globalization would increase access in sectors such as tourism and contribute to reducing CO_2 emissions. Additional empirical evidence confirms the existence of a direct effect of globalization on environment. For instance, Cavlovic et al. (2000) found a long-term relationship between globalization and economic efficiency, which helps control carbon emissions. Globalization also drives innovation and knowledge, thus reducing carbon emissions in the long term. The possibility can therefore be considered of an inverted U-shaped relationship between globalization and carbon emissions, which may moderate the effects on environment.

Despite the relationship between energy consumption, economic growth, tourism, globalization and environment, it has so far attracted little attention. On one hand, when the developed nations are counting on commercial energy consumption for achieving economic growth even at the cost of environmental quality, the development of tourism sector might offset that deterioration while contributing to economic growth. This paradox of duality has been catalysed by the globalization. From the perspective of sustainable development, this association might prove to be significant, as the opposing roles being played by these drivers of economic growth have never been analysed in the literature of energy and environmental economics. There lies the contribution of our study. In the present study, we have analysed the impact of energy consumption, economic growth, tourism, and globalization on environmental quality for the OECD countries. There is a specific reason for considering the OECD countries as a sample of the developed countries in this study. Over the years, these countries have identified the tourism sector as a mode of ascertaining inclusive growth and reducing income inequality in these nations. In this pursuit, these countries are putting effort to align the various government policies through comprehensive stakeholder engagement and revisiting the sustainable development goal (SDG) objectives. Therefore, sustainability of the tourism sector in the OECD countries is much linked with the economic growth pattern of these nations. Mishra et al. (2019) has discussed this scenario in case of the USA. In order to align the economic growth pattern with the tourism sector, the growth drivers and consequences are also being realigned. Globalization has to play a major role in this scenario, as the cross-border diffusion of culture and technological exchange are driven by the tourism infrastructure in these nations. Globalization has impacted these international transactions of culture and technologies, and thereby elevating the developmental trajectory of tourism sector in these nations, as a way to ascertain sustainable development. Moreover, ecotourism is one of the major avenues of tourism in the OECD countries, and in order to boost this form of tourism, the policymakers of these nations need to assure the gradual upholding of the environmental quality of these nations, by means of maintaining ecological balance and bringing transformation in the energy consumption pattern. Therefore, from the sustainable development perspective, it can be assumed that tourism development through the channel of economic growth and globalization can have an impact on the environmental quality, and this aspect of the OECD countries has been largely ignored in the literature of tourism economics. There lies the contribution of the study by divulging the association between the tourism development, globalization, GDP, energy consumption, and environmental quality, for the OECD countries, as a sample of developed nations.

In the course of the study, we have analysed how the progression in tourism development, globalization, and GDP helps in reducing deterioration in environmental quality, while energy consumption catalyses it. One of the major findings of the study is that during the initial phases of growth, tourism development and globalization start worsening environmental quality, and with their progression, environmental quality improves. Therefore, these drivers of economic growth gradually start internalizing the negative externalities caused by them, following the EKC hypothesis. In this process, the progression of these drivers also offsets the negative externalities caused by energy consumption. This internalization of the negative environmental externalities can bring forth significant policy implication in the context of developed nations, which is the OECD countries in this case. Focusing on this aspect contributes to the literature of energy and environmental economics.

This study is organized as follows: Section-II contains a literature review of studies on the relationship between international tourism, energy consumption, economic growth and globalization, Section-III describes the dataset and methodology, Section-IV shows the empirical results, which are discussed in Section-V, and Section-VI concludes the study with policy implications.

II. Literature Review

II.I. Tourism and Environmental Degradation

The increasing importance of tourism, the need to adapt rapidly to consumers' expectations and the ever more complicated requirements of climate change all demand new analyses of the best practice for promoting economic growth and reducing CO_2 emissions. Among other factors, sustainability and competitiveness depend on how tourism responds to climate change (Weaver 2011). Tourism is an extremely climate-sensitive sector, like transportation, agriculture or energy (Willbanks et al. 2007, Liu et al. 2011). Although numerous theoretical academic studies suggest that tourism increases energy consumption and damages the environment (Katircioglu 2014, Katircioglu et al. 2014), only a few examine the influence of tourism on environmental degradation (Lee and Brahmasrene 2013, Solarin 2014, Dogan and Aslan 2017, Paramati et al. 2017a, Gao et al. 2019, Mishra et al. 2019, Koçak et al. 2020). The tourism sector includes connection with other sectors with considerable polluting potential. Transportation, for example, and especially air travel, is a major energy consumer and hence the sector that contributes most to carbon emissions (Becken et al. 2001, Gössling 2002, Liu et al. 2011).

The tourism industry also depends on a large number of infrastructures with a wide range of environmental and ecological impacts (Gössling 2002, Gössling et al. 2002, 2006). Tourism is also associated with a higher demand for energy for transportation, accommodation and the management of tourist attractions, which increases pollution levels (Becken et al. 2001, 2003, Gössling 2002). Although the recent literature has extensively addressed the relationship between economic growth and environment, there is still a lack of studies that analyse the relationship between economic growth, tourism and environmental degradation. The empirical evidence assumes that tourism is an engine of income growth but also contributes substantially to increasing energy consumption (Liu et al. 2011). Although the link between energy use, climate change and economic growth is now attracting more attention (Jayanthakumaran et al. 2012, Park and Hong 2013, Zhang et al. 2013), a relatively minor number of studies focus on the impact of tourism on energy use and support the direct implications of tourism on environment and on climate change (Becken 2001, 2002, Gössling et al. 2002, Becken and Simmons 2002, 2003, Warnken and Bradley 2004, Becken 2005, Tsagarakis 2011). Other studies highlight the need for efficient energy forecasting when seeking to mitigate the contribution of the energy sector to environmental degradation (Tsagarakis et al. 2011). Tourists from countries with higher energy and climate change awareness tend to choose more energy-efficient infrastructures and renewable energy sources (Tsagarakis et al. 2011). Lee and Brahmasrene (2013) point out that while tourism and CO_2 emissions facilitate economic growth, tourism has a negative impact on environment in the European Union (EU).

Previous analyses on the linear connection between international tourism and environment have produced contradictory empirical results (Katircioglu 2009, Jatuporn and Chien 2011, Nademi 2011, Amzath and Zhao 2014, Rasekhi and Mohammadi 2015, Sherafati et al. 2016, Rasekhi et al. 2016). On the one hand, tourism has been shown toincrease environmental degradation. While the development of travel and tourism industry generally boosts economic growth (Brida et al. 2016), it also accelerates energy capacity and energy consumption, thus contributing to raising CO_2 emissions (Katircioglu 2009, Jatuporn and Chien 2011, Amzath and Zhao 2014, Katircioğ 2014, Solarin 2014, Nademi (2011) stated that policymaking is critical to reducing pollution levels. Another group of studies suggests that tourism and environmental performance are positively related. Support for renewable energy use also has a positive effect on tourism sector as it can lower CO_2 emissions (Ben Jebli et al. 2014, Rasekhi and Mohammadi 2015). This appears to be especially the case in developed countries, while tourism activities in developing economies produce an increase in pollution (Rasekhi et al. 2016).

The non-linear relationship between economic development and CO_2 emissions was analysed and revealed an inverted U-shaped relationship (Sherafati et al. 2016, Zaman et al. 2016). Tourism has been reported to have a similar impact on environmental degradation (Sherafati et al. 2016, Rasekhi et al. 2016). Sherafati et al.

(2016) tested the relationship between tourism and carbon emissions for the five most important Southeast Asian countries between 1979 and 2010. An inverted U-shaped relationship also confirmed the existence of an environmental Kuznets curve (EKC) in the Southeast Asian tourism industry. Based on the traditional EKC (Grossman and Krueger 1991), which has been widely developed in the economic literature (Coondoo and Dinda 2002, Dinda 2004, Stern 2004, Shahbaz and Sinha 2019), we expected to see an inverted-U-shaped relationship between international tourism and environmental degradation: the tourism Kuznets curve (TKC).

This implies that tourism could contribute to mitigating CO_2 emissions once environmental regulations have been introduced in all the connected sectors thanks to the technological readiness accelerated by globalization. In other words, once the tourism sector has attained a certain level of development, rising levels of international tourism expenditures do not necessarily lead to increased CO_2 emissions.

II.II. Tourism and Globalization

The effect of globalization on the connection between tourism and environment has been explored in the previous literature (Laws 1991, Goudie and Viles1997). Globalization produces a technical effect due to improvements and new technologies that facilitate the reduction of CO_2 emissions (Tisdell 2001). Globalization has a positive impact on economic efficiency (technique effect), which improves environmental quality (Cavlovic et al. 2000). List and Co (2000) concluded that globalization helps promote energy efficiency and reduces CO_2 emissions, while Tamazian et al. (2009) found that globalization through foreign direct investment (FDI) encourages technological innovation and the adoption of new technologies that develop more energy-efficient processes and promote sustainable economic growth. Moreover, the development of tourism may be fostered by globalization. In fact, globalization, understood as an increase in trade openness, can drive greater access to markets, services and trade (Turner and Witt 2001), implying better infrastructures and other improvements in connected sectors and allowing tourism to develop at a faster rate.

Despite the global economic downturn, travel and tourism industry has seen sustainable growth rates that have outperformed the world economy (WEF, 2017). Globalization has had a significant effect on tourism in recent decades even though it is geographically asymmetrical (Pulido and López 2011). Trade (as a proxy of globalization) was found to have a negative effect on tourism (Laws 1991, Goudie and Viles 1997). Nevertheless, tourism also appears to be positively affected by trade openness. Rasekhi and Mohammadi (2015) found that trade openness has a positive effect on the link between tourism and environmental degradation, and the implementation of policies for globalization and trade openness can be expected to enhance the tourism industry and environmental quality.

III. Data and Methodology

Our paper analyses some of the factors that might influence carbon emissions in OECD countries, with a special focus on the role of international tourism and globalization and their relationship with environmental degradation (Table-1). The sample is limited to the period for which annual data is available: from 1994 to 2014 in the World Bank database (WDI 2018). Selected OECD countries are: Australia, Austria, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.

PLEASE INSERT TABLE 1

A FMOLS approach is applied to assess this new EKC hypothesis between international tourism (T_{it}) and per capita CO_2 emissions (C_{it}). Some additional explanatory variables are included: economic growth (Y_{it}), energy use (E_{it}) and globalization (G_{it}). As a novelty, and in order to understand how globalization mitigates the effects of tourism on CO_2 emissions, the interaction between tourism and globalization ($G*T_{it}$) is included. The descriptive statistics (Table-2) show that the distribution of variables is skewed and more concentrated than the normal distribution.

PLEASE INSERT TABLE 2

While the OLS regression approach may yield biased results, the FMOLS (Fully Modified Least Squares) regression approach, which describes the complete representation of the heterogeneous impact of factors driving carbon emissions. A panel-FMOLS framework is used to explore the integration properties of the variables in the model. The baseline equation for this study has been slightly moderated compared to previous empirical literature, considering the effect of rising international tourism on CO_2 emissions and the effect of globalization on tourism. An inverted U-shaped pattern is expected between international tourism and environmental degradation. Four models based on carbon emissions function for selected OECD countries are used to estimate the impact of different variables on environmental degradation:

$$C_{it}=\alpha_0+\alpha_1 T_{it}+\alpha_3 G_{it} + \alpha_5 Y_{it} + \alpha_7 E_{it}+\alpha_8 G{*}T_{it}+\varepsilon_{it} \quad (1)$$

$$C_{it}=\alpha_0+\alpha_1 T_{it}+\alpha_2 T_{it}^2+\alpha_3 G_{it} + \alpha_5 Y_{it} + \alpha_7 E_{it}+\alpha_8 G{*}T_{it}+\varepsilon_{it} \quad (2)$$

$$C_{it}=\alpha_0+\alpha_1 T_{it}+\alpha_2 T_{it}^2+\alpha_3 G_{it} + \alpha_4 G_{it}^2 + \alpha_5 Y_{it} + \alpha_7 E_{it}+\alpha_8 G{*}T_{it}+\varepsilon_{it} \quad (3)$$

$$C_{it}=\alpha_0+\alpha_1 T_{it}+\alpha_2 T_{it}^2+\alpha_3 G_{it} + \alpha_4 G_{it}^2 + \alpha_5 Y_{it}+\alpha_6 Y_{it}^2 + \alpha_7 E_{it}+\alpha_8 G{*}T_{it}+\varepsilon_{it} \quad (4)$$

Where C_{it} stands for CO_2 emissions per capita ($MTCO_2$) and T_{it} is international tourism expenditures (current US$). In order to test a non-linear quadratic relationship between international tourism and per capita carbon emissions, T^2_{it} is also included in equation-4 (main model), in line with the previous literature (Sherafati et al. 2016, Rasekhi et al. 2016). Globalization in its linear (G_{it}) and quadratic (G^2_{it}) is considered to test its impact on carbon emissions. Equation-4 also posits the existence of an inverted U-shaped relationship between income and carbon emissions, and tests the EKC hypothesis for selected OECD countries. Real GDP per capita (current US$ PPP) is therefore included in both linear (Y_{it}) and quadratic (Y^2_{it}) shapes. We include E_{it}, energy use per capita (kg of oil equivalent per capita). Finally, equation-4 also incorporates the interaction between globalization and international tourism ($G*I_{it}$) to check the modifier effect of globalization and international tourism on carbon emissions in selected OECD countries.

Some preliminary tests are needed: (1) a panel unit test in order to check whether the series are non-stationary; (2) different cointegration tests to verify the possible cointegration between the variables. The methodological scheme is described in Appendix 1.

III.I. Panel Unit Root Analysis

Due to its closeness to time series with large T and even considering $T > N$, panel cointegration can produce spurious results. Observations must therefore be accumulated over time using individual heterogeneous regressions or time series processes to address non-stationarity and cointegration between the series (Baltagi 2008). Along these lines, Levin et al. (2002) suggested a panel unit root test (LLC) that expanded the augmented Dickey-Fuller (ADF):

$$\Delta y_{it} = \varphi_{it\beta_{i,t-1}} + \rho * y_{i,t-1} + \sum_{j=1}^{ni} \varphi_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad (5)$$

Where, deterministic components are included by means of φ_{it}; ρ is the autoregressive coefficient; ξ_{it} the error terms; and n the lag order. While the LLC test adopts ρ as constant across panels (Breitung 2000), Im et al. (2003) accept that ρ varies across panels. The size difference between cross-section and time series or the presence of an individual deterministic trend entails bias, which can be corrected through LLC or IPS

(Breitung 2000). The time-series ADF and Phillips–Perron tests were used for panel data (Choi 2001). This allowed the *p-value* resulting from the unit root tests to be combined for each test series, thereby improving the suggestion of Im et al. (2003) to average individual test statistics. The LLC test was thus extended by allowing ρ to vary across panels (IPS-test). The null hypothesis for the LLC, Breitung, IPS and Fisher unit root tests considers each series to be non-stationary across individuals (H_0: $\rho_i = 0$) while the alternative suggests that one or more individuals in the series are stationary (H_1: $\rho_i < 0$).

III.II. Panel Cointegration Approach

Cointegration tests of Pedroni, Kao and Westerlund are applied to determine the long-term connection between international tourism, globalization, economic growth, energy use and CO_2 emissions, (Pedroni 1999, Kao 1999, Westerlund 2007). Pedroni (2009) covers seven statistics grouped into two fragments: within dimension and between dimensions. Kao (1999) uses ADF, assuming homogeneity in the panels. Westerlund's (2007) panel cointegration test is based on structural dynamics, so the common factor restriction is not necessary. To test the existence of a cointegrating relationship between series $y_{i,t}$ and $x_{i,t}$, we assume the following error correction model:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i (y_{it-1} - \beta_i' x_{i,t-1}) + \sum_{j=1}^{P_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{-q_i}^{P_i} \gamma_{ij} \Delta x_{i,t-j} + \varepsilon_{it} \quad (6)$$

Where, d_t represents the deterministic component assumed to be zero, one, or a vector of $(1, t)'$, and P_i is the lag order, while q_i is the lead order for unit *i*. The cointegration is represented by $y_{it-1} - \beta_i' x_{i,t-1} = 0$. The speed at which the system corrects back to the long-run equilibrium of correction is depicted by coefficient α_i. A negative value of α_i means there is a cointegrating relationship, while a null value implies no error correction and no cointegration.

To test whether there is cointegration for panel analysis, Westerlund (2007) considers that α_i = 0 for all i in the case of non-cointegration (null hypothesis). There are two alternative hypotheses in this case:

(1) α_i = α< 0 for all i, which means the panel is cointegrated. The panel test statistic recommended for this hypothesis is depicted as follows:

$$P_T = \frac{\hat{\alpha}}{SE(\hat{\alpha})};\ P_\alpha = T_{\hat{\alpha}} \tag{7}$$

Where, $\hat{\alpha}_i$ estimates the homogeneous speed of error correction for all units, and the standard error of $\hat{\alpha}$is SE($\hat{\alpha}_i$).

(2) α_i<0 for at least one i, meaning that one or more cross-sectional units are cointegrated. The following group-mean test statistics are considered to test this hypothesis:

$$G_t = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)}; \tag{8}$$

$$G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} \tag{9}$$

where $\hat{\alpha}_i$ is the parameter estimate for unit i and $SE(\hat{\alpha}_i)$ is the associated standard error

$$\hat{\alpha}_i(1) = 1 - \sum_{j=1}^{P_i}\hat{\alpha}_{ij} \tag{10}$$

These tests solve heterogeneity and cross-sectional dependence with an asymptotically normal distribution and good small-sample properties using bootstrap.

III.III. FMOLS Estimation

Cointegrated variables (Pedroni, Kao and Westerlund tests) reveal a long-run reciprocal relationship. The fully modified ordinary least squares (FMOLS) model may be a good option to estimate the panel cointegration vector and solve issues of endogeneity, simultaneity bias and non-stationarity of the regressors (Christopoulos and Tsionas 2004). Spurious regression (i.e., when the series are non-stationary) is the result of using normal OLS techniques. If a long-run relationship exists between variables, i.e., cointegration, equation1 will be tested through the FMOLS method proposed for heterogeneous cointegrated panels. The FMOLS estimation is a non-parametric approach that returns optimal results from cointegrating regressions (Phillips and Hansen, 1990). It also makes adjustments for serial correlation and endogeneity due to the presence of cointegrating relationships (Phillips 1995). Issues related to endogeneity between regressors can be resolved by using FMOLS (Pedroni 2001a, b). The following equation was considered:

$$W_{i,t} = \alpha_i + \beta_i X_{i,t} + \varepsilon_{i,t} \forall_t = 1, \dots, T,\ i = 1, \dots .. N \quad (11)$$

allowing that $W_{i,t}$ and $X_{i,t}$ are cointegrated with slopes β_i, where β_i may or may not be homogeneous across i. Hence, the equation becomes:

$$W_{i,t} = \alpha_i + \beta_i X_{i,t} + \sum_{k=-K_i}^{K_i} \gamma_{i,k} \Delta X_{i,t-k} + \varepsilon_{i,t} \quad \forall t = 1,2, \dots, T,\ i = 1, \dots \quad ..N \quad (12)$$

We consider $\xi_{i,t} = (\hat{\varepsilon}_{i,t}, \Delta X_{i,t})$ and $\Omega_{i,t} = lim_{T\to\infty} E\left[\frac{1}{T}\left(\sum_{i=1}^{T} \xi_{i,t}\right)\left(\sum_{i=1}^{T} \xi_{i,t}\right)\right]$, as the long covariance is divided into $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i^{'}$, where Ω_i^0 is the simultaneous covariance and $\Gamma_i$is a weighted sum of autocovariance. The FMOLS estimator is given as:

$$\hat{\beta}_{FMOLS}^{*} = \frac{1}{N}\sum_{i=1}^{N}\left[\left(\sum_{i=1}^{T}(X_{i,t} - \bar{X}_i)^2\right)^{-1}\left(\sum_{i=1}^{T}(X_{i,t} - \bar{X}_i)\, W_{i,t}^{*} - T_{\hat{\gamma}_i}\right)\right] \quad (13)$$

Where, $W_{i,t}^{*} = W_{i,t}^{*} - \bar{W}_i - \frac{\hat{\Omega}_{2,1,i}}{\hat{\Omega}_{2,2,i}} \Delta X_{i,t}$ and $\hat{\gamma}_i = \hat{\Gamma}_{2,1,i} + \hat{\Omega}_{2,1,i}^{0} - \frac{\hat{\Omega}_{2,1,i}}{\hat{\Omega}_{2,2,i}}(\hat{\Gamma}_{2,2,i} + \hat{\Omega}_{2,2,i}^{0})$. (14)

III.IV. Panel Causality Test

Finally, Dumitrescu and Hurlin (2012) is a version of the Granger (1969) non-causality test for heterogeneous panel data models with fixed coefficients. This test considers two dimensions of heterogeneity: the heterogeneity of the regression model used to test the Granger causality and the heterogeneity of the causality relationships. This test is used for its additional capacity to provide efficient results for unbalanced panels as it considers cross-section dependence. The heterogeneity of the regression model and the causal relation are considered in the *homogeneous non-causality* (*HNC*) hypothesis tested by Dumitrescu-Hurlin (2012) test. The HNC hypothesis is employed for the analysis of causality relationship and heterogeneous models. For T>N asymptotic and for N>T semi-asymptotic, a distribution was used in HNC hypothesis. The HNC or the null hypothesis in this case is defined as follows:

$$H_0: \beta_i = 0;\ \forall_i = 1,2,\dots,N$$

Where, $\beta_i = \left(\beta_i^{(1)}, \beta_i^{(2)}, \dots\dots\dots \beta_i^{(k)}\right)$, although it can change across groups. The non-causality assumption means some of the individual vectors β_i=0. The null hypothesis implies there are $N_1 < N$ individual processes with no causality from X to Y. The alternative would be the following:

$$\begin{aligned} H_1: \beta_i = 0; \quad & \forall i = 1,2,\dots,N_1 \\ \beta_i \neq 0; \quad & \forall i = N_1 + 1,\dots,N \end{aligned}$$

where $0 \leq N_1/N < 1$ and N_1 is unknown. As N_1=N and N_1/N is inevitably less than 1, there is no causality for any of the individuals in the panel, while for N_1=0 causality is detected for all the individuals in the panel. Under the null hypothesis, X does not Granger cause Y for all the units in the panel. In contrast, when the null hypothesis is rejected and N_1=0, X Granger causes Y for all the panel, thus obtaining a homogeneous result for causality. To test the null hypothesis, Wald statistics ($W_{i,\ T}$) are computed for each cross-section and then averaged for each individual in order to determine the panel Wald statistic ($W_{N,T}^{HNC}$).

Dumitrescu-Hurlin (2012) also used the statistic $W_{N,T}^{HNC}$, which has an asymptotic distribution (T>N) associated with the null HNC hypothesis, and is defined as:

$$W_{N,T}^{HNC} = \sqrt{\frac{N}{2K}\left(W_{N,T}^{HNC} - K\right)} \tag{15}$$

The statistic W_{N}^{HNC}, which has a semi-asymptotic distribution (T<N) associated with the null HNC hypothesis, is defined as:

$$W_N^{HNC} = \frac{\sqrt{N[W_{N,T}^{HNC} - N^{-1}\sum_{i=1}^{N} E(W_{i,T})]}}{\sqrt{N^{-1}\sum_{i=1}^{N} Var(W_{i,T})}} \quad (16)$$

Panel causality is therefore estimated for each cross-section through the Dumitrescu and Hurlin (2012) test, and test statistic averages are generated. Two variables are tested in the pair-wise causality test, and the expected results are whether there is unidirectional causality (X→Y or Y→X), bidirectional causality (X↔Y) or no causality (X ≠Y).

IV. Empirical Results and Discussion

The integrating properties of the variables in the panel must be examined to identify a possible long-run relationship between the variables. The results suggest that the variables are I(1) (Table-3). The LLC, IPS, ADF and PP-Fisher tests show that the series are non-stationary.

PLEASE INSERT TABLE 3

Following the confirmation that all variables were I(1), the cointegration test determines the existence of long-run relationships between the variables. Pedroni (1999), Kao (1999) and Westerlund (2007) cointegration tests are applied (Table-4). Each test (Table-4) uses different techniques to calculate the statistics based on the null hypothesis of no cointegration.

PLEASE INSERT TABLE 4

PLEASE INSERT TABLE 5

Next, Table-5 contains the FMOLS estimation results with CO_2 emissions as the dependent variable and economic growth, international tourism and globalization as independent variables. As proposed by Sherafati et al. (2016) and Rasekhi et al. (2016), an inverted U-shaped relationship was expected between international tourism (T_{it}) and CO_2 emissions (C_{it}). The results ($\alpha_1 > 0$ and $\alpha_2 < 0$) validate this hypothesis. International tourism will therefore increase emissions up to a point where the sector attains a certain development level, after which emissions begin to fall. The coefficients $\alpha_5 > 0$ and $\alpha_6 < 0$ confirm the existence of EKC behaviours between economic growth and environmental degradation (Grossman Krueger 1991, 1995, Panayotou 1993, Selden and Song 1994). Regardless of GDP and its effects on scale, composition and the technical effect, this result confirms that the selected OECD countries transition from a developing to a developed stage, with the main factor in this evolution being the technical effect (Grossman and Krueger 1995, Torras and Boyce 1998).

The results also support the hypothesis that increasing globalization ($\alpha_4 > 0$ and $\alpha_5 < 0$) is more environmentally-friendly as it corrects its impact in OECD countries, possibly because globalization is used as an instrument for improving efficiency and technical progress (Cavlovic et al. 2000, List and Co 2000, Tisdell 2001, Tamazian et al. 2009). The estimation results also show strong evidence of the contribution ($\alpha_7 > 0$) of energy use (E_{it}) to CO_2 emissions, as in previous studies (Apergis and Payne 2009, Ozturk and Acaravci 2013, Shahbaz et al. 2016). The greater share of fossil fuels in the energymix in OECD countries implies higher CO_2 emissions. The positive relationship between CO_2 emissions and energy use points to a need to change the energy mix through innovation and by promoting clean energy sources (Balsalobre and Álvarez 2016, Álvarez el al. 2017). According to the results of the FMOLS estimation, and in line with previous evidence, globalization not only accelerates the technical effect in traditional economic sectors, but also in tourism. Our study aims to shed more light onthe interaction effect of globalization processes on the impact of international tourism (G^*T_{it}) on CO_2 emissions. The coefficient $\alpha_8 < 0$ confirms that globalization enables the international tourism industry to reduce carbon emissions (Rasekhi and Mohammadi 2015). Figure-2 depicts the effect of globalization on international tourism (G*Tit) in terms of reducing CO_2 emissions. It can therefore be expected that environmental quality and tourism industry in the countries analysed here could be improved by promoting policies of adequate globalization and trade openness.

PLEASE INSERT FIGURE 2

The results underline the need to design a legal framework for a cleaner tourism sector, coupled with better infrastructures and the promotion of renewable sources and energy efficiency. The integration of technologies would create competitive value through the use of information and communication technologies and provide competitive advantages (WEF 2017). Finally, Table-6 shows the results of the pair-wise Dumitrescu-Hurlin panel causality test between the variables.

PLEASE INSERT TABLE 6

Table-6 shows the unidirectional causality running from economic growth to carbon emissions (Paramati et al. 2017b), energy use (Kraft and Kraft 1978, Ozturk et al. 2010, Azam et al. 2015a, b) and international tourism (Lanza et al. 2003, Algieri 2006, Khalil et al 2007, He and Zheng 2011, Ahiawodzi 2013, Paramati et al. 2017b). The unidirectional causality from economic growth to international tourismin the literature is known as the *growth-led tourism hypothesis*, according to which growth is an important dynamic incentive for tourism (Ozturk et al. 2010). Lanza et al. (2003) confirm the existence of unidirectional causality running from growth to tourism for OECD countries, and Algieri (2006) obtains similar results for high-growth-rate countries. Khalil et al. (2007) find that tourism development in Pakistan is required for economic expansion. He and Zheng (2011) obtain unidirectional causality running from economic growth to tourism for China between 1990 and 2009, while Ahiawodzi (2013) finds unidirectional causality for Ghana in the period 1985–2010. The *growth-led tourism hypothesis* is consistent with the theory that economic growth contributes to promoting tourism and not vice-versa (Oh 2005, Parrilla et al. 2007, Payne and Mervar

2010, Lee 2012, Ivanov and Webster 2012, Bouzahzah and Menyari 2013). Kim et al. (2006) examine the causal relationship between tourism development and economic growth, validating a bidirectional causality between tourism and economic growth in Taiwan.

Table-6 shows a feedback between energy use and carbon emissions. Alam et al. (2011) find a bidirectional (feedback) Granger causality between energy consumption and carbon dioxide in India for the period 1971-2006. In line with these results, Gökmenoğlu and Taspinar (2016) obtain similar results for Turkey in the period 1974–2010. The hypothesis supports unidirectional causality from economic growth to energy consumption, where a reduction in energy use will not adversely affect economic growth (Ozcan 2013, Gökmenoğlu and Taspinar 2016); and unidirectional causality from international tourism to carbon emissions (Tang et al. 2014, León et al. 2014, Isik et al. 2017, Paramati et al. (2017b) and energy use (Katircioglu et al. 2014). Tang et al. (2014) conclude that the tourist boomhas increased CO_2 emissions in China over the period 1990–2012. Katircioglu et al. (2014) explore the impact of tourism on energy use and climate change in Cyprus, and their empirical results show that tourism increases energy use and carbon emissions. León et al. (2014) obtain similar results in developing and developed countries. Isik et al. (2017) find unidirectional causality from international tourism to carbon emissions, and confirms that Greek tourism, as a leading sector, has negative long-term environmental impacts. Paramati et al. (2017b) find unidirectional causality from tourism to carbon emissions in eastern EU countries. Katircioglu (2014) examines the effects of tourism growth on energy use, and concludes that the growth of tourism not only causes climate change but increases energy use.

There is also a unidirectional causality from globalization to carbon emissions (Liddle 2001, Shahbaz et al. 2015, Shahbaz et al. 2018), energy use (Dreher 2006, Lean and Smyth 2010, Shahbaz et al. 2013), economic growth (Nair and Winhold 2001, Hansen and Rand 2006, Hsiao 2006) and international tourism (Haley and Haley 1997, Shan and Wilson 2001, Massidda and Mattana 2013, Paramati et al. 2017b). Liddle (2001) proved that trade openness improves environmental quality through the technical effect, while Shahbaz et al. (2015) report that globalization increases carbon emissions in India. Shahbaz et al. (2018) confirm that globalization causes CO_2 emissions in some developed European and Asian countries. The results show that globalization contributes to the dynamic evolution of carbon emissions. Dreher (2006) concludes that globalization is one of the driving forces for reducing energy use in India. In line with this finding, Lean and Smyth (2010) show unidirectional Granger causality from exports to energy consumption for Malaysia for the period 1971-2006. Shahbaz et al. (2013) find that international trade causes energy consumption for the Chinese economy. Nair and Winhold (2001) report that FDI (as a proxy for globalization) exerts a significant and positive impact on economic growth in selected developing countries. Along the same lines, Hansen and Rand (2006) find through a Granger causality test between FDI and GDP that FDI impacts positively on GDP in the long run. Hsiao (2006) proves the existence of the unidirectional effects of globalization on GDP through trade for a selected set of east and Southeast Asian economies. Haley and Haley (1997) find that FDI drives the development of tourism industry by supplying investment to boost trade, and generates a greater awareness of goods and services among tourists. These results are consistent with the additional literature; for instance, Shan and Wilson (2001) establish the existence of a unidirectional causality from trade to tourism in China in the period 1987-1998, while Massidda and Mattana (2013) confirm this unidirectional causality in Italy for 1987-2009. FDI appears to play a key role in expanding tourism in the EU countries. Paramati et al. (2017b) validate unidirectional causality from FDI and trade to tourism for the EU countries between 1991 and 2013, while Katircioglu (2009) confirms the presence of unidirectional causality from international tourism to growth in FDI inflows in Turkey.

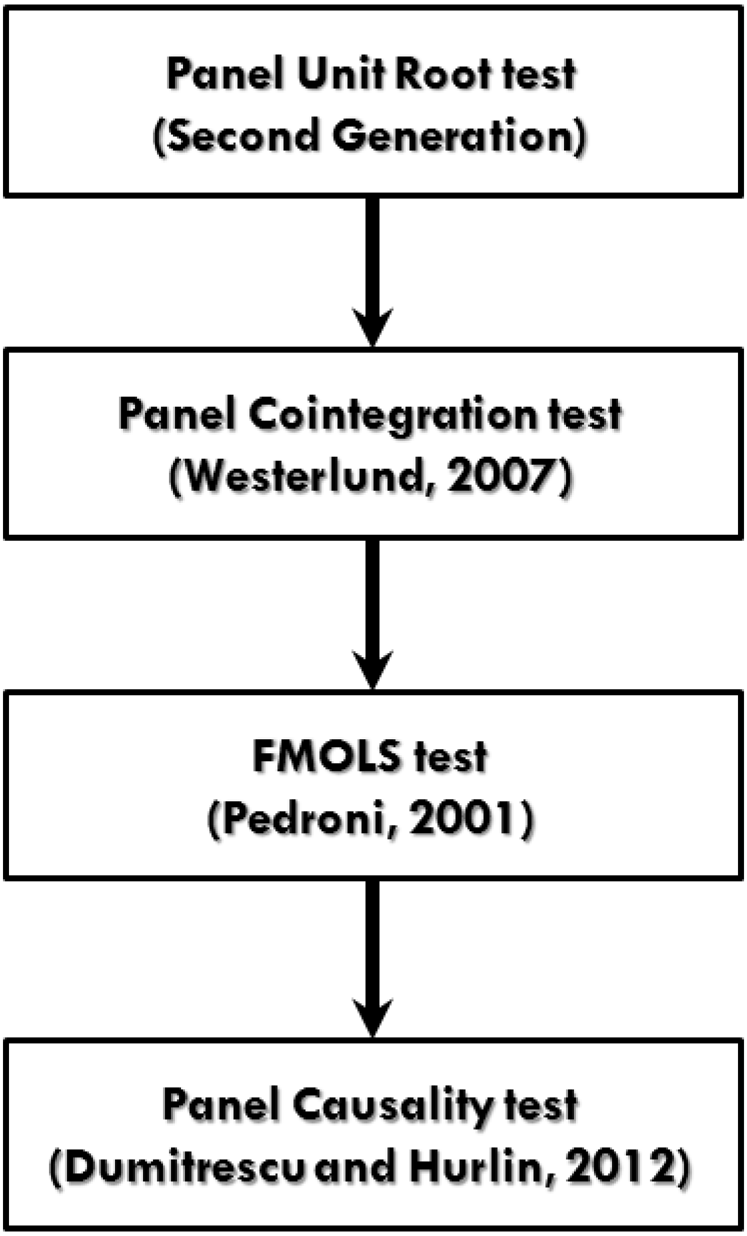
VI. Conclusions and Policy Implications

This paper assesses the impact of international tourism and globalization on environmental degradation. The empirical results obtained from the FMOLS estimation validate an inverted U-shaped connection between international tourism and environmental degradation, where globalization contributes to reducing the negative effect of tourism in the early stages of development. These results show that a rise in international tourism leads to environmental improvements once these economies have reached a certain stage of development in their tourism industry. This study also confirms the existence of an EKC relationship for the selected countries between 1994 and 2014. Its main contribution is the finding that globalization exerts a positive effect on international tourism and accelerates the correction in per capita CO_2 emissions. Globalization can be said to have an impact on promoting clean technologies (technical effect), and also drives the adoption of the necessary regulatory measures to improve competitiveness and efficiency in the international tourism industry. The study also tested and confirmed the hypothesis that economic growth and energy use increase carbon emissions. Policymakers should consider this result, and the recommendation to increase the share of renewable sources in the energy mix of the economies examined here. Societies undergoing economic growth have rising energy requirements that increase the use of fossil sources and, by extension, CO_2 emissions. It is therefore necessary to implement energy regulations to reduce the use of fossil energy sources and stimulate a cleaner energy mix, thus controlling pollution levels. Greater efforts should therefore be made to improve environmental policies and the institutional context rather than simply restricting the use of fossil fuels and globalization activities that reduce environmental quality. Despite the progressive increase in international tourism, CO_2 emissions can be contained through strategies that promote a low-carbon economy and the implementation of clean technologies.

In terms of the sustainable development perspective, the policies can be designed in an inclusive manner. In order to promote tourism, these nations should ponder upon the growth in ecotourism and nature tourism. While doing this, they should look into the energy consumption pattern of the tourism-induced industries being set up around the tourism destinations. In order to promote ecotourism in the OECD nations, the policymakers must put forth efforts to retain and improve the environmental quality, and they can do this by having a control over the energy consumption pattern of the those tourism-induced industries. The policymakers should enforce the clean energy consumption in those places, so that the traditional fossil fuel-based energy solutions are gradually replaced, and the ambient air pollution is reduced. Once this practice is in place, rise in the demand of clean energy solutions might increase the employment opportunities in this domain. Thereby, the tourism sector will be able to help in reducing the income inequality by creating more vocational opportunities. This multiple stakeholder approach can be possible through enforcing the clean energy solutions in the popular tourism destinations in the OECD nations.

Finally, future research should explore the role of information and communication technologies in international tourism and their joint effect on environment and economic growth. In theoretical terms, the future studies on this association can be carried out by considering the moderating effect of global uncertainty and political regimes of the nations, development of shadow economy, and governance effectiveness. On methodological front, advanced quantile modelling for the individual countries can be carried out, as this methodological aspect is comparatively less explored in the area of tourism economics.

Appendix



Appendix 1: Methodological Scheme

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