

CO₂ Emissions, Real GDP, Renewable Energy and Tourism: Evidence from Panel of the Most-Visited Countries

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Abstract

Previous studies on the energy-environment-growth literature overlook the investigation of the most-visited countries. Since these countries do not only belong to the largest economies and the top carbon dioxide (CO₂) emitters in the world but are also listed in renewable energy country attractiveness index, this study analyzes the impacts of real GDP, renewable energy and tourism on the level of CO₂ emissions for the top 10 most-visited countries. Applying several panel econometric approaches, we find out that renewable energy mitigates the pollution whereas real GDP and tourism contribute to the level of emissions. Thus, regulatory policies are necessary to increase the awareness of sustainable tourism. In addition, the use of renewable energy and the adoption of clean technologies in tourism sector as well as in producing goods and services play a significant role in CO₂ mitigation.

Keywords

Carbon dioxide emissions, tourism, renewable energy, real GDP, heterogeneity, cross-sectional dependence

JEL code

C32, C33, L83, O44, Q20, Z32

INTRODUCTION

The world has experienced a tremendous increase in the amount of greenhouse gas emissions over the last several decades. More than 190 parties have signed the Kyoto Protocol and participated in many meetings about the climate change and the environment to fight the pollution.² The last United Nations (UN) Climate Change Conference associated with the Kyoto Protocol took place in Paris in November–December 2015. This protocol aims to reduce the level of emissions by targeted rates. In this regard, several potentials have been discussed to keep track of the projected level of emissions. Increases in the share of renewable sources (environmentally-friendly) in energy mix play an important role in this matter. Recent studies Al-Mulali et al. (2015a), Dogan and Seker (2016), Jebli et al. (2016), and Mehdi and Slim (2017) among others show that increases in renewable energy statistically and significantly

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² Please refer to the United Nations website at: <www.un.org> for more information.

reduce emissions. The volume of studies investigating the influence of energy by sources on the pollution is still relatively smaller as compared to studies using the aggregate energy consumption in modeling the energy-environment-growth nexus.

Sustainable tourism is also critical for the climate change as it plays a significant role in reaching goals of the Kyoto Protocol referring to the Second International Conference on Climate Change and Tourism on October 2007 jointly organized by the World Tourism Organization (UNWTO), and the UN Environment Programme. Tourism is a rapidly developing sector that grows each year with more arrival points emerging around the world. The 2016 edition of UNWTO reports that the overall number of tourists travelled around the world increased from 0.025 billion in 1950 to more than 1.2 billion in 2015.³ The large expansion of tourism sector over this period should be connected to the tremendous increase in global carbon emissions. Tourism activities involve energy consumption directly through fossil fuels or indirectly through electricity power in each step from transportation to accommodation. Depending on the source of energy use (e.g. renewable and non-renewable energy), tourism may either mitigate or contribute to emissions. In addition, the influence of tourism on the pollution can alter by supportive policies and government interventions for low level of emissions, and the use of cleaner technologies in the sector activities. Even though tourism is very much related to the environment, only a few studies in the energy-environment-growth literature consider the possible effect of tourism on the pollution and more importantly their findings are mix (Dogan et al., 2015; De Vita et al., 2015).

This study makes several contributions to the existing pool of knowledge: i) this study for the first time analyzes the effects of real gross domestic production (GDP), renewable energy (REN) and tourism (TOUR) on carbon dioxide (CO₂) emissions for the most-visited 10 countries in the world.⁴ Because the top 10 touristic (most-visited) countries have recorded about the half of the worldwide tourist arrivals in late years, we focus on a panel study of these countries. Furthermore, these countries are among the top ones in “Renewables Energy Country Attractiveness Index (RECAI)”. This RECAI is calculated based on 3 drivers, 16 parameters and 53 datasets;⁵ they are among the largest economies and the top emitters in the world; ii) this study uses a source of energy (renewable energy) instead of aggregate energy; iii) the possible presence of issues of cross-sectional dependence and heterogeneity across cross-sections for variables is among main criticisms to panel studies. If both issues appear in the data, a researcher will produce inaccurate and erroneous estimates if the researcher assumes homogeneity and cross-sectional independence in panel time-series data. Accompanying the information that nearly 99% of studies in the energy-environment-growth literature fail to check the mentioned issues and employ first generation econometric approaches, this study first identifies that cross-sectional dependence and heterogeneity exist in the analyzed data for the top 10 economies, and, accordingly, applies second generation econometric techniques. Thus, the results reported herein are more accurate and robust.

This study presents a survey of literature in the next section, provides the model and data in the third section, discusses the issues of heterogeneity and cross-sectional dependence in the fourth section, yields methods and empirical findings in the fifth section, and conclude aims, methods, findings and policy implications in the last section.

1 LITERATURE REVIEW

This section presents and brings together the associated literature in connection with the aim of the current study. The link between tourism and real GDP (or economic growth) is well-established and investigated

³ Available at: <www.unwto.org>.

⁴ The top 10 countries are China, France, Italy, Thailand, the UK, the USA, Turkey, Germany, Russia and Spain.

⁵ Please refer to: <<http://www.ej.com/GL/en/Industries/Power---Utilities/Renewable-Energy-Country-Attractiveness-Index---Methodology>>.

for single country cases and multi-country cases in the literature (Dritsakis, 2004; Oh, 2005; Kim et al., 2006; Santana-Gallego et al., 2010; Arslanturk et al., 2011; Pablo-Romero and Molina, 2013; Balcilar et al., 2014; Bilen et al., 2015; Pérez-Rodríguez et al., 2015; Aslan, 2015; Shahzad et al., 2017). Several studies including Peeters (2007), Gossling et al. (2010), Scott et al. (2010), Scott et al. (2012), Saenz-de-Miera and Rosselló (2014), Gossling and Peeters (2015), Al-Mulali et al. (2015b), Sharif et al. (2017) and Paramati et al. (2017) discuss the emissions-tourism nexus and indicate that tourism adversely impacts the environment. In other words, tourism activities including transportation contribute to the increased level of emissions. Referring to the aforementioned studies, tourism contributes to the output and pollution.

In addition to these nexus, the energy-economic growth nexus is also analyzed for a variety of cases (Ozturk, 2010; Yildirim et al., 2012; Wolde-Rufael, 2014; Bloch et al., 2015; Dogan, 2015). Furthermore, the link between CO₂ emissions, real GDP, aggregate energy consumption is described in a large number of studies including Say and Yucel (2006), Ang (2008), Soytas and Sari (2009), Apergis and Payne (2009), Du et al. (2012), Ozturk and Acaravci (2010), Hossain (2011), Pao and Tsai (2011), Park and Hong (2013), Cowan et al., (2014), Farhani and Ozturk (2015), Baek (2015), Ajmi et al. (2015), Shahbaz et al. (2015), Kasman and Duman (2015), Dogan and Turkekul (2016), Magazzino (2016), and Bekhet et al. (2017). The state-of-the-art reaches a consensus that increases in aggregate energy consumption contribute to the level of emissions. Of those that focus on a panel study mostly employ first generation econometric approaches (e.g. unit root tests by Levin-Lin-Chu (2002), Hadri (2000), Im-Pesaran-Shin (2003), and Pedroni cointegration (Pedroni, 1999; 2004) and Koa cointegration (Kao, 1999)).

As shown in Table 1, several recent studies focus on a type of aggregate energy; namely, renewable energy, and analyze the renewable energy-environment-growth relationship for single country and panel of countries cases. It is worth-noting that the number of studies in this strand is relatively smaller than that in aggregate energy-environment-growth literature. Studies in table 1 (except Farhani and Shahbaz, 2014; Apergis et al., 2010; Boluk and Mert, 2014) yield that increases in renewable energy detract the pollution in a variety of regions and countries by mostly using first generation econometric approaches. In addition, some studies in this group investigate the validity of the EKC hypothesis by including the square of real GDP (GDP²) into the model as similar to those in aggregate energy-environment-growth literature. However, the aim of the current study is not to show whether or not increases in real GDP lead to environmental improvements; instead, to narrowly focus on how tourism and renewable energy impact the level of emissions by controlling for the income in the model since real GDP is a strong determinant of CO₂ emissions.

The last strand of studies examines the relationship among energy, environment, real GDP and tourism for several cases. As shown in the bottom of Table 1, Lee and Brahmaresne (2013), and Katircioglu (2014a) find that tourism decreases CO₂ emissions for the panel of EU countries, and Singapore, respectively, on the other hand, Katircioglu et al. (2014), Katircioglu (2014b), and De-Vita et al. (2015) indicate that tourism stimulates emissions in Cyprus and Turkey. These studies also suggest that the coefficient estimate on real GDP for CO₂ emissions is positive. There is only one panel study in this strand, and it uses first generation econometric tools in identifying the relationship. Because first generation tests have drawbacks of assuming cross-sectional independence, they may produce inaccurate results. Thus, the results in this study are accurate and reliable since we find the issue of dependence across cross-sections, and accordingly employ second generation approaches.

2 MODEL AND DATA

Inspired by the works of Jebli and Youssef (2015), and Katircioglu (2014b) we propose the following model in which CO₂ emissions are the response variable, and real gross domestic product (GDP), renewable energy (REN) and tourism (TOUR) are the dependent variables:

$$\text{CO}_2 = (\text{GDP}, \text{REN}, \text{TOUR}) \quad (1)$$

By including a constant term (β_0) and an error term (e_{it}), we can convert the model in Formula (1) to that in Formula (2) wherein β_k ($k = 1, 2, 3$) are the coefficients on GDP, REN and TOUR.

$$(\text{CO}_2)_{it} = \beta_0 + \beta_1 \text{GDP}_{it} + \beta_2 \text{REN}_{it} + \beta_3 \text{TOUR}_{it} + e_{it} \quad (2)$$

The data used in this study are described as follow. CO_2 emissions is carbon dioxide gas emissions in metric tons; real GDP is the value of real gross domestic product in constant 2005 US\$; TOUR is the number of international tourist arrivals at the sample countries; REN is renewable electricity production measured in kilo-watt hours. Following Apergis et al. (2010), Farhani and Shahbaz (2014), Bhattacharya et al. (2016), and Jebli et al. (2016), renewable electricity is used as proxy for renewable energy. The data for CO_2 emissions, real GDP and tourist arrivals are obtained from the “World Development Indicators”;⁶ and the data for renewable electricity production are drawn from the “US Energy Information Administration.”⁷ The annual data cover the period 1995–2011. It should be noted that we use the longest available data given the fact that the data for TOUR are not available before 1995, and CO_2 emissions are not available after 2011. Even though using a longer data set is an advantage to produce more robust outcome, we believe that this study is still valuable for the literature as it contributes to the existing pool of knowledge by exposing the importance of tourism as well as renewable energy and real GDP for the environment, and by taking into account the issues of heterogeneity and cross-section dependence. The top 10 countries used in this study are China, France, Italy, Thailand, the UK, the USA, Turkey, Germany, Russia and Spain. Since the panel time-series data are converted into their natural logarithm, β_k ($k = 1, 2, 3$) can be interpreted as the elasticities of CO_2 emissions with respect to real GDP, REN and TOUR. Referring to the state-of-the-art, the expected sign of β_1 is positive, and β_2 is expected to be negative; β_3 can be positive or negative depending on the net effect of tourism on the environment that we argue in the introduction section.

3 HETEROGENEITY AND CROSS-SECTION DEPENDENCE

The average annual growth of tourism, carbon emissions, real GDP and renewable energy for the analyzed countries are indicated in Table 2. Because of significant variations in the average annual growth of each variable across countries, one can claim the presence of heterogeneity across the top 10 touristic countries for the analyzed variables. In detail, the average annual growth of tourism arrivals is relatively greater for Turkey, China and Thailand as compared to France, the UK and the USA. Moreover, a similar picture is observed for the average annual growth of real GDP and REN. Furthermore, the average annual growth of carbon emissions is negative for Germany, Italy and the UK whereas it is positive for the rest of sample countries. Furthermore, from the point of view of the development level, countries fall into different groups (i.e. developed countries and developing countries). This also suggests a strong heterogeneity within the panel data. Considering the presence of issue of heterogeneity, we should account for it in panel econometric approaches wherein the parameters are allowed to vary across cross sections.

In addition to heterogeneity, the possible presence of cross-sectional dependence in panel time-series data is another potential issue that should be taken into account in panel models. The correlation among the time-series data for the top 10 countries may be exposed because of common shocks (e.g. great recession, global energy and environmental policies, global credit crunch) that potentially have spill-over effects on cross sections. If a researcher assumes no cross-sectional dependence in a panel data but the panel data definitely show cross-section dependence, this incorrect assumption can cause forecasting errors and incorrect estimations. Henceforth, we use the Pesaran’s CD-test (Pesaran, 2004) to indicate

⁶ <<http://data.worldbank.org>>.

⁷ <www.eia.gov>.

as to whether or not cross-sectional dependence exists within each panel time-series data. The results from the Pesaran's CD-test for testing cross-sectional dependence are posted in Table 3. Referring to the output, we have enough evidence to reject the null hypothesis of cross-section independence in favor of the alternative hypothesis of cross-section dependence for carbon emissions, real GDP, renewable energy and tourism at 1% level of significance. In short, the analyzed variables have cross-sectional dependence.

4 METHODS AND FINDINGS

Since we show the presence of issues of heterogeneity and cross-sectional dependence across the top 10 countries for CO₂ emissions, real GDP, renewable energy and tourism, we should use econometric techniques that account for these problems accordingly.

4.1 Panel unit root tests

The first generation unit root tests (e.g. ADF, IPS, LLC, Hadri unit root tests) do not account for possible existence of cross-sectional dependence in the panel data. Thus, this study employs the second generation unit root tests; namely, the CADF and the CIPS unit root tests (Pesaran, 2007), which consider both heterogeneity and cross-section dependence in identifying stationary process of the panel time-series data. The results from the CADF and CIPS unit root tests are reported in Table 4. The results suggest that although we cannot reject the null hypothesis of unit root at level values, we have enough evidence to reject the null hypothesis of unit root in favor of the alternative hypothesis of no unit root at first-differenced values. In other words, CO₂ emissions, real GDP, renewable energy and tourism contain unit root at their levels but become stationary at their first-differences. Last, we can conclude that the analyzed variables are I (1).

4.2 Panel cointegration tests

The estimation results of non-stationary variables will be economically and statistically unmeaningful and inaccurate unless they are cointegrated and thus show a long-run relationship. Accordingly, this study uses several panel cointegration tests to find whether or not carbon emissions, real GDP, renewable energy and tourism are cointegrated for the sample countries since the analyzed variables are detected to be non-stationary at levels. The Pedroni panel cointegration test (Pedroni, 1999; 2004) is carried out as the first because it is applicable for heterogeneous panels. Pedroni (1999) indicates that there are seven tests statistics shown in Table 5. According to the output posted in table 5, two out of seven tests imply the validity of a long-run relationship among carbon emissions, real GDP, renewable energy and tourism. Although the ADF-statistic has good small sample properties and is more reliable, the outcome is somewhat doubtful. Hence, we need more tests to apply to reach a robust conclusion.

The second panel cointegration test that this study uses is the Kao panel cointegration test (Kao, 1999). This test follows a similar procedure as the Pedroni test but includes cross-homogeneous coefficients on the first-stage regressors. Referring to the results from the Kao panel cointegration test in Table 6, the analyzed variables are cointegrated and have a long-run relationship since we have enough evidence to reject the null hypothesis of no cointegration in favor of the alternative hypothesis of cointegration at 5% level of significance.

Even though the Pedroni and the Kao panel cointegration tests have been frequently used in various literature including the energy-environment-growth nexus, both have drawbacks of assuming cross-section independence, and thus are considered as first generation cointegration tests. Failure of considering the presence of cross-section dependence in panel models has consequences of causing loss of power in the procedure of first generation cointegration tests. Therefore, this study also employs a second generation cointegration test; namely, the LM bootstrap panel cointegration test due to Westerlund and Edgerton (2007) in order to check the verdicts of former tests. The LM bootstrap panel cointegration test

accounts for both issues of cross-sectional dependence and heterogeneity in identifying the cointegration relation among the variables, and thus is superior to the first generation cointegration tests. In addition, this test differs from the former tests in that the LM bootstrap cointegration test assumes the null hypothesis of cointegration. The results from the LM bootstrap panel cointegration test are reported in Table 7. Because there is no evidence to reject the null hypothesis of cointegration, this study indicates that CO₂ emissions, real GDP, renewable energy and tourism are cointegrated and have a long-run relationship. The conclusion is that the cointegration relation between the analyzed variables for the top 10 countries become more robust and stronger since the second generation panel cointegration test accounts for heterogeneity and cross-sectional dependence across cross sections for the analyzed variables.

4.3 Long-run estimates

Long-run estimators should produce economically and statistically meaningful, reliable and accurate coefficients on real GDP, renewable energy and tourism for CO₂ emissions since this study in the preceding section confirms that they are cointegrated and moving together in the long-run. The question on which long-run estimator(s) should be used arises from the fact there are many estimators available. This study runs the FMOLS and the DOLS because Lee (2007) suggests that the ordinary least squares (OLS) technique involves invalid standard errors due to second order asymptotic bias. In addition, the weighted DOLS estimator allows for heterogeneity in the long-run variances (Mark and Sul, 2003) and the weighted FMOLS technique is based on heterogeneous cointegrated panels (Kao and Chiang, 2000).⁸ Moreover, Herrerias et al. (2013) suggest that the DOLS approach is the least sensitive one to the issue of cross-sectional dependence.

The results from the FMOLS and the DOLS estimators are posted in Table 8. Because the panel time-series data are transformed into their natural logarithm, the coefficient estimates in the table is equivalent to the elasticities of CO₂ emissions with respect to real GDP, renewable energy and tourism. Both approaches produce identical results in terms of sign and significance, but yield a bit different results in terms of magnitudes and goodness of fit of the model (R²). More precisely, the FMOLS reports that 1% increase in real GDP and tourism raises the pollution by 0.72% and 0.17%, respectively; on the other hand, a 1% increase in renewable energy mitigates carbon emissions by 0.26%. Referring to the DOLS, 1% increases in real GDP and tourism contribute to the amount of carbon emissions by 0.64% and 0.12%, respectively; on the contrary, a 1% increase in renewable energy decreases the pollution by 0.18%. As in line with many studies including Apergis et al. (2010), Lee and Brahmasrene (2013), and Katircioglu (2014b) increase in production leads to bigger carbon emissions. In addition, the adverse of renewable energy on CO₂ emissions is consistent with that of studies including Chiu and Chang (2009), Sulaiman et al. (2013), Shafiei and Salim (2014), Lopez-Menendez et al. (2014), Al-mulali et al. (2015a), Boluk and Mert (2015), Dogan and Seker (2016), and Jebli et al. (2016). The identification of damaging effect of tourism on the environment is in line with that of Katircioglu (2014b), Katircioglu et al. (2014), Solarin (2014), De Vita et al. (2015), Sharif et al. (2017) and Paramati et al. (2017).

Tourism sector in the top 10 most-visited countries boosts the amount of carbon emissions through several links such as transportation, building of touristic facilities, and local and government services. Some policies for the sake of low emissions may be active in sample countries but clearly not sufficient to fight for the environment. One obvious solution to control for the level of carbon emissions is the adoption of the use of more renewable energy and cleaner technologies in not only overall production process but also tourism sector in particular. In this regards, touristic facilities (e.g. hotels) may build their solar panel system for producing energy to meet their needs accompanying the information that solar is a clean

⁸ For more information, please refer to the references.

energy and a type of renewable energy. In addition, a bicycle-oriented tourism should be supported and adopted in replacement of motorized and environmentally unfriendly transport. Furthermore, the top 10 countries should aim to increase the share of renewable sources in energy mix, and financially support institutions, universities, researchers to work for the invention of cleaner technologies, particularly, those directly related to tourism sector. Last, policy makers should impose policies in regard to environmental protection and awareness of renewable energy and sustainable tourism.

CONCLUSIONS

This study aims to investigate the relationship of CO₂ emissions, real GDP, renewable energy and tourism for the top 10 most-visited countries for the period 1995–2011. Moreover, we also consider the validity of issues of cross-sectional dependence and heterogeneity in panel data while analyzing stationary properties, cointegration relationship and the long-run estimates. Thus, the results found in the current study are more robust and reliable as compared to those in previous studies. The findings and policy recommendations can be summarized as follow:

- By looking at the average annual growth rates of each variable, and applying the Pesaran's CD test to the panel time-series data, we detect the presence of heterogeneity and cross-sectional dependence across countries for the analyzed data.
- The CADF and the CIPS unit root tests report that the analyzed variables are not stationary at levels but become stationary at first differences.
- The LM bootstrap cointegration test shows that CO₂ emissions, real GDP, renewable energy and tourism are cointegrated and hence have a long-run relationship.
- The DOLS and FMOLS estimators indicate that increases in renewable energy lead to environmental improvements whereas increases in real GDP and tourist arrivals lead to environmental degradation in the top 10 most-visited countries.
- Regulatory policies should be introduced to increase the awareness of renewable energy and sustainable tourism.
- The use of renewable energy and the adoption of renewable energy technologies should be implemented more in production processes and tourism sector in particular.
- Bicycle-oriented tourism should be supported and adopted in replacement of motorized and environmentally-unfriendly transport.
- More projects on the development of environmentally-friendly technologies, especially those in relation with tourism sector, should be sponsored by governments.

References

- AJMI, A. N., HAMMOUDEH, S., NGUYEN, D. K. AND SATO, J. R. On the relationships between CO₂ emissions, energy consumption and income: The importance of time variation. *Energy Economics*, 2015, 49, pp. 629–638.
- AL-MULALI, U., OZTURK, I. AND LEAN, H. H. The influence of economic growth, urbanization, trade openness, financial development, and renewable energy on pollution in Europe. *Natural Hazards*, 2015a, 79(1), pp. 621–644.
- AL-MULALI, U., FEREDOUNI, H. G. AND MOHAMMED, A. H. The effect of tourism arrival on CO₂ emissions from transportation sector. *Anatolia: An International Journal of Tourism and Hospitality Research*, 2015b, 26(2), pp. 230–243.
- AL-MULALI, U., SABOORI, B. AND OZTURK, I. Investigating the environmental Kuznets curve hypothesis in Vietnam. *Energy Policy*, 2015c, 76, pp. 123–131.
- ANG, J. B. Economic development, pollutant emissions and energy consumption in Malaysia. *Journal of Policy Modeling*, 2008, 30(2), pp. 271–278.
- APERGIS, N. AND PAYNE, J. E. CO₂ emissions, energy usage, and output in Central America. *Energy Policy*, 2009, 37(8), pp. 3282–3286.
- APERGIS, N., PAYNE, J. E., MENYAH, K. AND WOLDE-RUFAYEL, Y. On the causal dynamics between emissions, nuclear energy, renewable energy, and economic growth. *Ecological Economics*, 2010, 69(11), pp. 2255–2260.

- APERGIS, N. AND PAYNE, J. E. Renewable energy, output, CO₂ emissions, and fossil fuel prices in Central America: evidence from a nonlinear panel smooth transition vector error correction model. *Energy Economics*, 2014, 42, pp. 226–232.
- APERGIS, N. AND PAYNE, J. E. Renewable energy, output, carbon dioxide emissions, and oil prices: evidence from South America. *Energy Sources, Part B: Economics, Planning, and Policy*, 2015, 10(3), pp. 281–287.
- ARSLANTURK, Y., BALCILAR, M. AND OZDEMIR, Z. A. Time-varying linkages between tourism receipts and economic growth in a small open economy. *Economic Modelling*, 2011, 28(1), pp. 664–671.
- ASLAN, A. Does tourism cause growth? Evidence from Turkey. *Current Issues in Tourism*, 2015, pp. 1–9. DOI:10.1080/13683500.2015.1015970.
- BAEK, J. AND PRIDE, D. On the income–nuclear energy–CO₂ emissions nexus revisited. *Energy Economics*, 2014, 43, pp. 6–10.
- BAEK, J. Environmental Kuznets curve for CO₂ emissions: The case of Arctic countries. *Energy Economics*, 2015, 50, pp. 13–17.
- BALCILAR, M., VAN EYDEN, R., INGLESİ-LOTZ, R. AND GUPTA, R. Time-varying linkages between tourism receipts and economic growth in South Africa. *Applied Economics*, 2014, 46(36), pp. 4381–4398.
- BEKHET, H. A., MATAR, A. AND YASMIN, T. CO₂ emissions, energy consumption, economic growth, and financial development in GCC countries: Dynamic simultaneous equation models. *Renewable and Sustainable Energy Reviews*, 2017, 70, pp. 117–132.
- BENGOCHÉA, A. AND FAET, O. Renewable energies and CO₂ emissions in the European Union. *Energy Sources, Part B: Economics, Planning, and Policy*, 2012, 7(2), pp. 121–130.
- BİLEN, M., YİLANCI, V. AND ERYÜZLÜ, H. Tourism development and economic growth: a panel Granger causality analysis in the frequency domain. *Current Issues in Tourism*, 2015, 8, pp. 1–6. DOI:10.1080/13683500.2015.1073231.
- BHATTACHARYA, M., PARAMATĪ, S. R., OZTURK, I. AND BHATTACHARYA, S. The effect of renewable energy consumption on economic growth: Evidence from top 38 countries. *Applied Energy*, 2016, 162, pp. 733–741.
- BLOCH, H., RAFIQ, S. AND SALİM, R. Economic growth with coal, oil and renewable energy consumption in China: Prospects for fuel substitution. *Economic Modelling*, 2015, 44, pp. 104–115. DOI:10.1016/j.econmod.2014.09.017.
- BOLUK, G. AND MERT, M. Fossil & renewable energy consumption, GHGs (greenhouse gases) and economic growth: Evidence from a panel of EU (European Union) countries. *Energy*, 2014, 74, pp. 439–446.
- BOLUK, G. AND MERT, M. The renewable energy, growth and environmental Kuznets curve in Turkey: an ARDL approach. *Renewable and Sustainable Energy Reviews*, 2015, 52, pp. 587–595.
- CARRIÓN-Í-SILVESTRE, J. L., KİM, D. AND PERRON, P. GLS-based unit root tests with multiple structural breaks under both the null and the alternative hypotheses. *Econometric Theory*, 2009, 25(6), pp. 1754–1792.
- CHIU, C. L. AND CHANG, T. H. What proportion of renewable energy supplies is needed to initially mitigate CO₂ emissions in OECD member countries? *Renewable and Sustainable Energy Reviews*, 2009, 13(6), pp. 1669–1674.
- COWAN, W. N., CHANG, T., INGLESİ-LOTZ, R. AND GUPTA, R. The nexus of electricity consumption, economic growth and CO₂ emissions in the BRICS countries. *Energy Policy*, 2014, 66, pp. 359–368.
- DE VITA, G., KATIRCIOĞLU, S., ALTINAY, L., FETHI, S. AND MERCAN, M. Revisiting the environmental Kuznets curve hypothesis in a tourism development context. *Environmental Science and Pollution Research*, 2015, 22(21), pp. 16652–16663. DOI: 10.1007/s11356-015-4861-4.
- DRITSAKIS, N. Tourism as a long-run economic growth factor: an empirical investigation for Greece using causality analysis. *Tourism Economics*, 2004, 10(3), pp. 305–316.
- DOĞAN, E. Revisiting the Relationship Between Natural Gas Consumption and Economic Growth in Turkey. *Energy Sources, Part B: Economics, Planning, and Policy*, 2015, 10(4), pp. 361–370.
- DOĞAN, E. AND TURKEKUL, B. CO₂ emissions, real output, energy consumption, trade, urbanization and financial development: testing the EKC hypothesis for the USA. *Environmental Science and Pollution Research*, 2016, 23(2), pp. 1203–1213. DOI: 10.1007/s11356-015-5323-8.
- DOĞAN, E. AND SEKER, F. The influence of real output, renewable and non-renewable energy, trade and financial development on carbon emissions in the top renewable energy countries. *Renewable and Sustainable Energy Reviews*, 2016, 60, pp. 1074–1085.
- DOĞAN, E., SEKER, F. AND BULBUL, S. 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*, 2015, pp. 1–19.
- DU, L., WEI, C. AND CAI, S. Economic development and carbon dioxide emissions in China: Provincial panel data analysis. *China Economic Review*, 2012, 23(2), pp. 371–384.
- FARHANI, S. AND SHAHBAZ, M. What role of renewable and non-renewable electricity consumption and output is needed to initially mitigate CO₂ emissions in MENA region? *Renewable and Sustainable Energy Reviews*, 2014, 40, pp. 80–90.
- FARHANI, S. AND OZTURK, I. Causal relationship between CO₂ emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia. *Environmental Science and Pollution Research*, 2015, pp. 1–14.
- GOSSLING, S., HALL, C. M., PEETERS, P. AND SCOTT, D. The future of tourism: Can tourism growth and climate policy be reconciled? A mitigation perspective. *Tourism Recreation Research*, 2010, 35(2), pp. 119–130.

- GOSSLING, S. AND PEETERS, P. Assessing tourism's global environmental impact 1900–2050. *Journal of Sustainable Tourism*, 2015, 23(5), pp. 639–659.
- HADRÍ, K. Testing for stationarity in heterogeneous panel data. *The Econometrics Journal*, 2000, pp. 148–161.
- HERRERÍAS, M. J., JOYEUX, R. AND GIRARDIN, E. Short-and long-run causality between energy consumption and economic growth: Evidence across regions in China. *Applied Energy*, 2013, 112, pp. 1483–1492.
- HOSSAIN, M. S. *Panel estimation for CO₂ emissions, energy consumption, economic growth, trade openness and urbanization of newly industrialized countries*. 2011.
- IM, K. S., PESARAN, M. H. AND SHĪN, Y. Testing for unit roots in heterogeneous panels. *Journal of econometrics*, 2003, 115(1), pp. 53–74.
- IWATA, H., OKADA, K. AND SAMRETH, S. Empirical study on the environmental Kuznets curve for CO₂ in France: the role of nuclear energy. *Energy Policy*, 2010, 38(8), pp. 4057–4063.
- JEBLI, M. B. AND YOUSSEF, S. B. Economic growth, combustible renewables and waste consumption, and CO₂ emissions in North Africa. *Environmental Science and Pollution Research*, 2015, 22(20), pp. 16022–16030.
- JEBLI, M. B., YOUSSEF, S. B. AND OZTURK, I. Testing environmental Kuznets curve hypothesis: The role of renewable and non-renewable energy consumption and trade in OECD countries. *Ecological Indicators*, 2016, 60, pp. 824–831.
- KAO, C. Spurious regression and residual-based tests for cointegration in panel data. *Journal of econometrics*, 1999, 90(1), pp. 1–44.
- KAO, C. AND CHĀNG, M. On the estimation and inference of a cointegrated regression in panel data. *Advances in Econometrics*, 2000, 15(1), pp. 179–222.
- KASMAN, A. AND DUMAN, Y. S. CO₂ emissions, economic growth, energy consumption, trade and urbanization in new EU member and candidate countries: a panel data analysis. *Economic Modelling*, 2015, 44, pp. 97–103.
- KATIRCIOĞLU, S. T. Testing the tourism-induced EKC hypothesis: the case of Singapore. *Economic Modelling*, 2014a, 41, pp. 383–391.
- KATIRCIOĞLU, S. T. International tourism, energy consumption, and environmental pollution: the case of Turkey. *Renewable and Sustainable Energy Reviews*, 2014b, 36, pp. 180–187.
- KATIRCIOĞLU, S. T., FERİDUN, M. AND KILINC, C. Estimating tourism-induced energy consumption and CO₂ emissions: the case of Cyprus. *Renewable and Sustainable Energy Reviews*, 2014, 29, pp. 634–640.
- KIM, H. J. AND CHEN, M. H. Tourism expansion and economic development: the case of Taiwan. *Tourism Management*, 2006, 27(5), pp. 925–933.
- LEE, G. Long run equilibrium relationship between inward FDI and productivity. *Journal of Economic Development*, 2007, 32(2), p. 183.
- LEE, J. W. AND BRAHMASRENE, T. Investigating the influence of tourism on economic growth and carbon emissions: Evidence from panel analysis of the European Union. *Tourism Management*, 2013, 38, pp. 69–76.
- LEVIN, A., LIN, C. F. AND CHU, C. S. J. Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of econometrics*, 2002, 108(1), pp. 1–24.
- LÓPEZ-MENÉNDEZ, A. J., PÉREZ, R. AND MORENO, B. Environmental costs and renewable energy: Re-visiting the Environmental Kuznets Curve. *Journal of environmental management*, 2014, 145, pp. 368–373.
- MAGAZZINO, C. The relationship between CO₂ emissions, energy consumption and economic growth in Italy. *International Journal of Sustainable Energy*, 2016, 35(9), pp. 844–857.
- MAKI, D. Tests for cointegration allowing for an unknown number of breaks. *Economic Modelling*, 2012, 29(5), pp. 2011–2015.
- MARK, N.C. AND SUL, D. Cointegration Vector Estimation by Panel DOLS and Long-run Money Demand. *Oxford Bulletin of Economics and Statistics*, 2003, 65(5), pp. 655–680.
- MEHDI, B. J. AND SLIM, B. Y. The role of renewable energy and agriculture in reducing CO₂ emissions: Evidence for North Africa countries. *Ecological Indicators*, 2017, 74, pp. 295–301.
- PABLO-ROMERO, M. D. P. AND MOLINA, J. A. Tourism and economic growth: A review of empirical literature. *Tourism Management Perspectives*, 2013, 8, pp. 28–41.
- PAO, H. T. AND TSAI, C. M. Multivariate Granger causality between CO₂ emissions, energy consumption, FDI (foreign direct investment) and GDP (gross domestic product): evidence from a panel of BRIC (Brazil, Russian Federation, India, and China) countries. *Energy*, 2011, 36(1), pp. 685–693.
- PARK, J. AND HONG, T. Analysis of South Korea's economic growth, carbon dioxide emission, and energy consumption using the Markov switching model. *Renewable and Sustainable Energy Reviews*, 2013, 18, pp. 543–551.
- PESARAN, M. H. *General diagnostic tests for cross section dependence in panels. Working Papers in Economics No. 0435*, Cambridge: University of Cambridge, 2004.
- PESARAN, M. H. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 2007, 22(2), pp. 265–312.
- OH, C. O. The contribution of tourism development to economic growth in the Korean economy. *Tourism management*, 2005, 26(1), pp. 39–44.
- OZTURK, I. A literature survey on energy–growth nexus. *Energy policy*, 2010, 38(1), pp. 340–349.

- OZTURK, I. AND ACARAVCI, A. The causal relationship between energy consumption and GDP in Albania, Bulgaria, Hungary and Romania: Evidence from ARDL bound testing approach. *Applied Energy*, 2010, 87(6), pp. 1938–1943.
- PARAMATÍ, S. R., SHAHBAZ, M. AND ALAM, M. S. Does tourism degrade environmental quality? A comparative study of Eastern and Western European Union. *Transportation Research Part D: Transport and Environment*, 2017, 50, pp. 1–13.
- PEDRONÍ, P. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and statistics*, 1999, 61(S1), pp. 653–670.
- PEDRONÍ, P. Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric theory*, 2004, 20(3), pp. 597–625.
- PÉREZ-RODRÍGUEZ, J. V., LEDESMA-RODRÍGUEZ, F. AND SANTANA-GALLEGO, M. Testing dependence between GDP and tourism's growth rates. *Tourism Management*, 2015, 48, pp. 268–282.
- PEETERS, P. The impact of tourism on climate change. *Policy dialogue on tourism, transport and climate change: Stakeholders meet researchers*, 2007, pp. 15–04.
- SADORSKY, P. Renewable energy consumption, CO₂ emissions and oil prices in the G7 countries. *Energy Economics*, 2009, 31(3), pp. 456–462.
- SAENZ-DE-MIERA, O. AND ROSSELLÓ, J. Modeling tourism impacts on air pollution: the case study of PM 10 in Mallorca. *Tourism Management*, 2014, 40, pp. 273–281.
- SANTANA-GALLEGO, M., LEDESMA-RODRÍGUEZ, F. J., PÉREZ-RODRÍGUEZ, J. V. AND CORTÉS-JIMÉNEZ, I. Does a common currency promote countries' growth via trade and tourism? *The World Economy*, 2010, 33(12), pp. 1811–1835.
- SAY, N. P. AND YUCEL, M. Energy consumption and CO₂ emissions in Turkey: empirical analysis and future projection based on an economic growth. *Energy Policy*, 2006, 34(18), pp. 3870–3876.
- SCOTT, D., PEETERS, P. AND GOSSLING, S. Can tourism deliver its “aspirational” greenhouse gas emission reduction targets? *Journal of Sustainable Tourism*, 2010, 18(3), pp. 393–408.
- SCOTT, D., GOSSLING, S. AND HALL, C. M. International tourism and climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 2012, 3(3), pp. 213–232.
- SHAFIEI, S. AND SALIM, R. A. Non-renewable and renewable energy consumption and CO₂ emissions in OECD countries: a comparative analysis. *Energy Policy*, 2014, 66, pp. 547–556.
- SHAHBAZ, M., NASREEN, S., ABBAS, F. AND ANIS, O. Does foreign direct investment impede environmental quality in high-, middle-, and low-income countries? *Energy Economics*, 2015, 51, pp. 275–287.
- SHAHZAD, S. J. H., SHAHBAZ, M., FERRER, R. AND KUMAR, R. R. Tourism-led growth hypothesis in the top ten tourist destinations: New evidence using the quantile-on-quantile approach. *Tourism Management*, 2017, 60, pp. 223–232.
- SHARÍF, A., AFSHAN, S. AND NÍSHA, N. Impact of tourism on CO₂ emission: evidence from Pakistan. *Asia Pacific Journal of Tourism Research*, 2017, pp. 1–14.
- SOLARIN, S. A. Tourist arrivals and macroeconomic determinants of CO₂ emissions in Malaysia. *Anatolia*, 2014, 25(2), pp. 228–241.
- SOYTAS, U. AND SARI, R. Energy consumption, economic growth, and carbon emissions: challenges faced by an EU candidate member. *Ecological economics*, 2009, 68(6), pp. 1667–1675.
- SULAIMAN, J., AZMAN, A. AND SABOORI, B. The potential of renewable energy: using the environmental Kuznets curve model. *American Journal of Environmental Science*, 2013, 9(2), pp. 103–112.
- WESTERLUND, J. AND EDGERTON D. L. A panel bootstrap cointegration test. *Economics Letters*, 2007, 97, pp. 185–190.
- WOLDE-RUFAEL, Y. Electricity consumption and economic growth in transition countries: A revisit using bootstrap panel Granger causality analysis. *Energy Economics*, 2014, 44, pp. 325–330.
- YILDIRIM, E., SARAC, S. AND ASLAN, A. Energy consumption and economic growth in the USA: Evidence from renewable energy. *Renewable and Sustainable Energy Reviews*, 2012, 16(9), pp. 6770–6774.
- ZIVOT, E. AND ANDREWS, D. W. K. Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics*, 2002, 20(1), pp. 25–44.

TABLES

Table 1 A survey of literature

Study	Case	Period	Variables	Methodology	Conclusion
Chiu and Chang (2009)	Panel of OECD countries	1996–2005	CO ₂ , GDP, CPI, REN	Threshold effect	GDP and REN increase CO ₂ for lower threshold; REN decreases CO ₂ for upper threshold
Sadorsky (2009)	Panel of G7 countries	1980–2005	REN, GDP, CO ₂ , P(Prices)	Breitung, IPS, LLC, ADF, PP, Pedroni cointegration, FMOLS, DOLS	GDP and CO ₂ are major determinants of REN
Iwata et al. (2010)	France	1960–2003	CO ₂ , GDP, GDP ² , nuclear, URB, TR	PP, ARDL model	Nuclear decreases CO ₂
Apergis et al. (2010)	Panel of developed and developing countries	1984–2007	CO ₂ , GDP, Nuclear, REN	LLC, IPS, ADF, PP, LLL cointegration	Nuclear decreases CO ₂ , REN and GDP increase CO ₂
Bengochea and Faet (2012)	Panel of EU countries	1990–2004	REN, GDP, CO ₂ , P	OLS with FE and RE, FGLS	GDP and CO ₂ increase REN
Sulaiman et al. (2013)	Malaysia	1980–2009	CO ₂ , GDP, GDP ² , REN, TR	ADF, PP, ARDL model	TR and REN decrease CO ₂
Boluk and Mert (2014)	Panel of EU countries	1990–2008	CO ₂ , GDP, GDP ² , REN, NREN	OLS with FE	REN and NREN contribute to CO ₂
Farhani and Shahbaz (2014)	Panel of MENA countries	1980–2009	CO ₂ , GDP, GDP ² , REN, NREN	Breitung, IPS, Pedroni cointegration, FMOLS, DOLS	REN and NREN increase CO ₂
Lopez-Menendez et al. (2014)	Panel of EU countries	1996–2010	CO ₂ , GDP, GDP ² , GDP ³ , REN	OLS with FE and RE	REN decreases CO ₂
Shafiei and Salim (2014)	Panel of OECD countries	1980–2011	CO ₂ , GDP, GDP ² , REN, NREN, POP	ADF, PP, Breitung, Johansen cointegration, Westerlund cointegration, GMM, AMG	REN decreases CO ₂ ; NREN increases CO ₂
Baek and Pride (2014)	USA, Japan, France, Korea, Spain, Canada	1970–2007	CO ₂ , GDP, nuclear	DFGLS, Johansen cointegration	Nuclear decreases CO ₂ in all countries, GDP decreases CO ₂ in USA, Canada and France
Apergis and Payne (2014)	Panel of Central American countries	1980–2010	CO ₂ , REN, GDP, P	LLC, IPS, ADF, PP, non-linear panel cointegration, FMOLS	GDP, CO ₂ and P increase REN
Al-Mulali et al. (2015c)	Vietnam	1982–2011	CO ₂ , REN, NREN, GDP, IM, EXP, CA, L	ARDL model	NREN and IMP increase CO ₂ ; REN is insignificant
Boluk and Mert (2015)	Turkey	1961–2010	CO ₂ , GDP, GDP ² , REN	ADF, KPSS, ARDL model	REN decreases CO ₂
Jebli and Youssef (2015)	Panel of North Africa	1971–2008	GDP, CO ₂ , combustible and waste (CRW)	Breitung, LLC, IPS, Pedroni cointegration, FMOLS, DOLS	CO ₂ and CRW increase GDP
Al-mulali et al. (2015a)	Panel of European countries	1990–2013	CO ₂ , GDP, TR, URB, FD, REN by sources (wind, solar, hydro, nuclear, and CRW)	IPS, ADF, PP, Pedroni cointegration, FMOLS	Five sources of REN decrease CO ₂ ; GDP increases CO ₂

Note: IPS (Im-Pesaran-Shin test), LLC (Levin-Lin-Chu test), PP (Phillips-Perron test), ADF (Augmented Dickey-Fuller test), KPSS (Kwiatkowski-Phillips-Schmidt-Shin test), FE (Fixed effects), RE (Random effects), REN (renewable energy), NREN (non-renewable energy), FMOLS (Fully Modified Ordinary Least Squares), DOLS (Dynamic Ordinary Least Squares), TR (trade), FD (financial development), URB (Urbanization).

Source: Own construction

Table 1 A survey of literature

(continuation)

Study	Case	Period	Variables	Methodology	Conclusion
Apergis and Payne (2015)	Panel of South America	1980–2010	CO ₂ , GDP, REN, P	ADF, PP, FMOLS	GDP, CO ₂ and P increase REN
Jebli et al. (2016)	Panel of OECD countries	1980–2010	CO ₂ , GDP, GDP ² , REN, NREN, TR	Breitung, IPS, LLC, ADF, PP, Pedroni cointegration, FMOLS, DOLS	REN decreases CO ₂ , NREN increases CO ₂
Lee and Brahmastre (2013)	Panel of EU countries	1988–2009	CO ₂ , GDP, FD, TOUR	Breitung, IPS, LLC, ADF, PP, Johansen cointegration, OLS with FE	GDP increases CO ₂ , TOUR decreases CO ₂
Katircioglu (2014a)	Singapore	1971–2010	CO ₂ , GDP, GDP ² , EGY, TOUR	Unit root by Carrion-i-Silvestre et al. (2009), Maki cointegration (Maki, 2012), DOLS	EGY increases CO ₂ , TOUR decreases CO ₂
Katircioglu et al. (2014)	Cyprus	1970–2009	CO ₂ , EGY, TOUR	KPSS, ARDL model	TOUR and EGY increase CO ₂
Katircioglu (2014b)	Turkey	1960–2010	CO ₂ , GDP, EGY, TOUR	Zivot-Andrews unit root (Zivot and Andrews, 2002), ARDL model	TOUR, GDP and EGY increase CO ₂
De-Vita et al. (2015)	Turkey	1960–2009	CO ₂ , GDP, GDP ² , EGY, TOUR	Unit root by Carrion-i-Silvestre et al. (2009), Maki cointegration (Maki, 2012),	TOUR and EGY increase CO ₂

Note: IPS (Im-Pesaran-Shin test), LLC (Levin-Lin-Chu test), PP (Phillips-Perron test), ADF (Augmented Dickey-Fuller test), KPSS (Kwiatkowski-Phillips-Schmidt-Shin test), FE (Fixed effects), RE (Random effects), REN (renewable energy), NREN (non-renewable energy), FMOLS (Fully Modified Ordinary Least Squares), DOLS (Dynamic Ordinary Least Squares), TR (trade), FD (financial development), URB (Urbanization).

Source: Own construction

Table 2 Average annual growth of each variable 1995–2011 (in %)

Country	TOUR	CO ₂	GDP	REN
China	6.39	5.69	8.82	8.83
France	1.61	0.15	1.65	0.25
Germany	3.71	-0.88	1.15	8.89
Italy	2.13	-0.38	0.81	3.91
Russia	4.83	0.40	3.45	-0.32
Spain	2.57	0.71	2.62	8.74
Thailand	5.19	3.60	2.79	1.31
Turkey	9.30	3.44	3.61	2.71
UK	1.65	-0.56	2.3	8.36
USA	2.1	0.32	2.34	0.89

Note: The average annual growth rates are calculated by author.

Source: Own construction

Table 3 Results from cross-sectional independence test

	CO ₂	GDP	REN	TOUR
CD-test	4.45**	25.91**	12.36**	22.50**
p-value	0.00	0.00	0.00	0.00

Note: ** denotes the statistical significance at 1% level. The CD-test performs the null hypothesis of cross-section independence.
Source: Own construction

Table 4 Results from panel unit root tests

	CADF		CIPS	
	Level	Δ	Level	Δ
CO ₂	-1.54	(-3.14)**	(-1.72)	(-4.60)**
GDP	-1.94	(-2.99)*	(-1.35)	(-3.02)*
REN	-1.98	(-4.37)**	(-2.22)	(-4.37)**
TOUR	-1.69	(-3.32)**	(-2.02)	(-3.54)**

Note: Δ represents the first-differences. **, * denote the statistical significance at 1% level and 5% level, respectively.
Source: Own construction

Table 5 Results from Pedroni cointegration test

Common AR coefficients (within-dimension)			Individual AR coefficients (between-dimension)		
	Weighted statistic	p-value		Statistic	p-value
Panel v-statistic	-1.52	0.93	Group rho-statistic	3.39	0.99
Panel rho-statistic	2.39	0.99	Group PP-statistic	-5.29**	0.00
Panel PP-statistic	-0.29	0.38	Group ADF-statistic	-4.69**	0.00
Panel ADF-statistic	-0.75	0.22			

Note: ** denotes the statistical significance at 1% level.
Source: Own construction

Table 6 Results from the Kao panel cointegration test

	t-statistics	p-value
ADF	-1.78*	0.03

Note: * denote the statistical significance at 5% level.
Source: Own construction

Table 7 Results from the LM bootstrap panel cointegration test

Tests	LM statistic	Bootstrap p-value
LM bootstrap	Feb-64	1.00

Note: The LM bootstrap test is calculated using 5 000 replications. The LM bootstrap cointegration approach tests the null hypothesis of cointegration against the alternative of no cointegration.
Source: Own construction

Table 8 Results from the panel DOLS and FMOLS

FMOLS				DOLS			
Regressors	Coeff.	t-stat	p-value	Regressors	Coeff.	t-stat	p-value
GDP	0.72**	74.01	0.00	GDP	0.64**	8.5	0.00
REN	-0.26**	-8.59	0.00	REN	-0.18**	-7.6	0.00
TOUR	0.17**	5.18	0.00	TOUR	0.12**	3.36	0.00
R ²	0.994			R ²	0.997		
Coefficient Diagnostic (Null Hypothesis: $\beta_3=0$)				Coefficient Diagnostic (Null Hypothesis: $\beta_3=0$)			
Statistic	Value	d.f.	p-value	Statistic	Value	d.f.	p-value
t-statistic	5.18	147	0.00	t-statistic	3.36	150	0.00
Chi-square	26.83	1	0.00	Chi-square	11.29	1	0.00

Note: ** denotes the statistical significance at 1%. Coefficient diagnostic test evaluates the null hypothesis that the coefficient on tourism is equal to zero. It shows that the inclusion of tourism to the model is statistically significant, and thus increases the goodness of fit of the model.

Source: Own construction