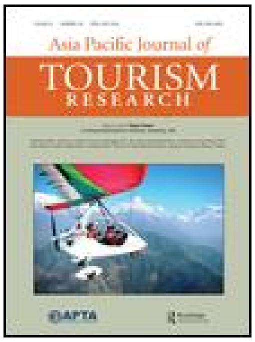

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The relationship between tourism, CO_2 emissions and economic growth: a case of Mediterranean countries

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ABSTRACT
This study explores the impact of tourism on economic growth considering CO_2 emissions utilizing panel data techniques for a sample of Mediterranean countries. The cointegration tests reveal that there is a positive long-run equilibrium between tourism, CO_2 emissions and economic growth. This positive long-run relationship may suggest that tourism increases the level of CO_2 emissions and has a statistically significant impact on economic growth in Mediterranean countries. Emirmahmutoglu and Kose (2011. Testing for Granger causality in heterogeneous mixed panels. *Economic Modelling*, *28*(3), 870–876.) test results reveal that the tourism-led growth hypothesis, which suggests that tourism contributes to economic growth, is valid for Egypt, Italy, and Spain. Additionally, there exists a bidirectional relationship between tourism and economic growth both in Morocco and Turkey.

KEYWORDS
Tourism; CO_2 emissions; Mediterranean countries; panel Granger causality; cointegration; economic Growth; panel model; tourism-led economic growth; tourism development; policy implementation

Introduction

According to the World Travel and Tourism Council (WTTC, 2016), the tourism sector contributed 10.2% to the global GDP in 2016 and 9.6% to the global total employment. The World Tourism Organization (UNWTO) predicts that by the year 2030, the total number of international tourists will soar to a record high of 2 billion travelers, which will translate to a yearly global income of US$2 billion. These figures indicate that tourism plays a key role in stimulating global economic growth. Moreover, the contribution of tourism revenues as a percentage of GDP has continuously increased over the years. The latest figures (2016) extracted from WTTC highlighted that the total contribution of tourism to the total GDP of the Mediterranean region was 11.32% and tourism directly supported 757 million jobs globally. Therefore, it is important to determine the impact of tourism on economic growth in Mediterranean countries.

Dritsakis (2004) argues that tourism affects the economy especially foreign exchange income through several sectors, including, employment, business, income, cultural, and fiscal sectors. The employment sector can be explained as a consequence of employment opportunities in the country. Likewise, the business sector, a rise in tourism leads to an increase in industrial and agricultural production raising both international and domestic trade as well as service-related industries such as transportation, telecommunication, banking. The income sector contributes to the country's national income. An increase in tourism improves people's both living and cultural standards through the cultural sector. Finally, the fiscal sector can be explained as a result of the beneficial effects of tourism activities. Moreover, Balaguer and Cantavella-Jorda (2002) point out that tourism receipts play an important role for financing current account of Spain. Besides, tourism contributes to the Spanish economy in terms of employment opportunities.

While tourism and an increase in the number of tourists have a profound impact on economic growth, it must be noted that all tourist activities rely on energy stemming from fossil-fuels contributing

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CO_2 emissions (Gössling & Peeters, 2015). Moreover, a rise in tourism leads to an increase in energy use for many ways, including transportation, construction, accommodation, and tourist activities resulting in air pollution and climate change (Becken, Frampton, & Simmons, 2001; Gössling, 2002; Becken, Simmons, & Frampton, 2003). Similarly, Scott, Peeters, and Gössling (2010) argue that tourism industry is linked with many economic sectors, such as air travel, making tourism a potential threat to both environmental degradation and high CO_2 emissions. Hall, Scott, and Gössling (2013) point out that although the economic impact of international tourism is vital, CO_2 emissions from tourism and subsequent effects on climate change remain an important challenge for sustainable tourism. To add, UNWTO (2008) estimates that the contribution of CO_2 emissions from tourism may peak at 135% by 2035 compared to 2005. In this respect, an understanding of tourism activities on CO_2 emissions allows policy makers to formulate tourism policies that achieve low CO_2 emissions in tourism for Mediterranean countries. Besides, to achieve a sustainable healthy economic growth, policy makers should take into consideration environmental degradation, and the impact of CO_2 emissions on the environment (Lee & Brahmasrene, 2013).

Mediterranean countries have similarities regarding their weather and tourism offered. However, the economies of these countries are differentiated in terms of governance, performance, and managing institutions. Given that Mediterranean countries benefit from similar tourist resources, but followed various stages of economic development, the contribution of tourism to economic growth in the context of CO_2 emissions for Mediterranean countries are not well investigated. Hence, this study is set forth to determine whether tourism leads to an increase in CO_2 emissions and economic growth or vice versa for the Mediterranean region.

The rest of the paper is structured as follows: Section two reviews the literature. In section three, the model and data used in the paper discussed. Section four presents the methodology. Section five explains the empirical results. Section six concludes the paper.

Literature

The literature review gives a clear picture of selected papers related to the study. There is a great deal of literature that analyze the causal relationship between tourism and economic growth. However, the direction of causality remains ambiguous due to countries, time span and different methodologies. Brida, Cortes-Jimenez, and Pulina (2016) provide a comprehensive survey of the nexus between tourism and economic growth. The causal relationship between tourism and economic growth can be explained by four main hypotheses. The first relationship is referred to as the tourism-led growth (TLG) hypothesis which postulates that the tourism sector impacts economic growth in a positive way. A one-way causal relationship from tourism to GDP growth was confirmed by a few studies. For instance, Gunduz and Hatemi-J (2005) support the notion that the TLG hypothesis is applicable to Turkey. This finding is confirmed by the results of studies carried out by Kaplan and Çelik (2008), Gokovali (2010), Husein and Kara (2011), and Atan and Arslanturk (2012). Balaguer and Cantavella-Jorda (2002) confirmed TLG hypothesis for Spain. Gokovali and Bahar (2006) provide support for TLG hypothesis for Mediterranean countries. Furthermore, Croes and Vanegas (2008) concluded that tourism could be used as an important tool for the reduction of poverty in Nicaragua. Belloumi (2010) reported that tourism makes a positive contribution to the Tunisian economy. Also, Lean and Tang (2010) point out that Malaysia experiences a form of tourism-induced growth. Similar findings were obtained by Pulina and Cortés-Jiménez (2010) for Spain and Italy. Kreishan (2011) demonstrated that tourism gives rise to the economic growth of Jordan. According to Lee and Brahmasrene (2013), an increase in tourism receipts leads to economic growth in the European Union. In addition, Jalil, Mahmood, and Idrees (2013) indicate that the tourism sector contributes to Pakistan's economic growth. Also, Castro-Nuño, Molina-Toucedo, and Pablo-Romero (2013) affirm the validation of TLG hypothesis for 87 countries, utilizing meta-analysis. To add, Tang and Abosedra (2014) argue that tourism development affects the economic growth of the Middle East and North African (MENA) countries. Lastly, Paramati, Shahbaz, and Alam (2017b) revealed that tourism affects the economies of developed and developing countries positively.

Next, the aforementioned studies particularly about Mediterranean countries are elaborated. Gunduz and Hatemi-J (2005) analyze the number of tourist arrivals, real gross domestic product and real exchange rates in Turkey during 1963–2002. Bootstrap causality tests support the notion that the TLG hypothesis is valid for Turkey.

Kaplan and Çelik (2008) investigate the relationship between real GDP, real total tourism receipts, and the real effective exchange rate using the Granger causality test for the period of 1963–2006 for Turkey. They provided evidence in support of the TLG hypothesis for Turkey. Gokovali (2010) examines the effects of tourism on economic growth using the Gross national product, capital, labor, and tourism revenues by employing the OLS method for the period of 1985–2005. The results show that tourism has a positive and significant effect on the Turkish economy. A similar finding is obtained by Husein and Kara (2011). They examine the relationships between tourism receipts, economic growth and real exchange rate utilizing Johansen multivariate cointegration analysis in Turkey during 1964–2006. Correspondingly Atan and Arslanturk (2012) investigate the relationship between tourism and economic growth using aggregated 15 sectors by employing input-output analysis based on the 2002 data. The empirical results show that TLG hypothesis is supported in the case of Turkey.

Balaguer and Cantavella-Jorda (2002) examine the effect of tourism on economic development in Spain with the variables of real GDP, international tourism earning in real term, real effective exchange rate with the quarterly data covering the period 1975–1997. Granger causality test results provide the existence of TLG hypothesis for Spain. Nowak, Sahli, and Cortés-Jiménez (2007) investigate the impact of tourism exports on economic growth with the variables of real GDP, real tourism exports and real imports of inputs taken the 1960–2003 utilizing Johansen's cointegration approach and the multivariate Granger causality test. Their results confirmed abovementioned hypothesis in the Spanish economy. Ivanov and Webster (2007) propose a methodology to investigate the impact of tourism on economic growth using the growth of real GDP per capita to measure economic growth. Besides they disaggregate economic growth into economic growth generated by other industries and economic growth generated by tourism for Cyprus (1997–2004), Greece (1997–2004) and Spain (1999–2002). The results show that tourism promotes the economic growth of all three countries. Belloumi (2010) investigate the impact of tourism on economic growth with a trivariate model using real gross domestic product, real international tourism receipts and real effective exchange rate during the period of 1970–2007 for Tunisia utilizing Granger causality test. The results reveal that there is an unidirectional relationship between tourism and economic growth. Gokovali and Bahar (2006) examine the validity of tourism-led-growth hypothesis with the variables of capital and labor for the Mediterranean countries over the period of 1987–2002 employing a panel data approach. The results show that a %1 increase in tourism receipts per capita leads to a % 0.1 rise in GDP in Mediterranean countries.

The second relationship is the growth-led-tourism which suggests that economic growth affects tourism. A few studies identified the presence of this relationship; for instance, Oh (2005) for South Korea and Payne and Mervar (2010) for Croatia.

Oh (2005) investigates the relationship between tourism growth and economic expansion for South Korea by using quarterly data from 1975 to 2001 employing Engle and Granger two-stage approach and a bivariate Vector Autoregression (VAR) model. The cointegration test results show that no long-run relationship exists between two variables. On the other hand, Granger causality test results confirmed growth-led tourism hypothesis for South Korea.

Payne and Mervar (2010) investigate TLG hypothesis for Croatia using quarterly data from 2000:1 to 2008:3 for real GDP, real effective exchange rate and real revenues from international tourism by employing Toda–Yamamoto long-run causality tests. He found unidirectional causality from economic growth to tourism.

The third relationship called the feedback hypothesis, which indicates that a bidirectional relationship exists between tourism and growth. Some studies affirm the existence of bidirectional relationship between tourism and economic growth for the countries in which they focus; for instance, Dritsakis (2004) for Greece, Kim and Chen (2006) for Taiwan, Khalil, Kakar, and Malik (2007) for Pakistan, Lee and Chien (2008) for Taiwan, Lanza, Temple, and Urga (2003) for 13 OECD countries, Seetanah (2011) for 19 island economies, Cortes-Jimenez and Pulina (2010) for Spain, Demiroz and Ongan (2005) for Turkey, Tugcu (2014) for Albania, Croatia and Greece, Aslan (2016) for Turkey, Perles-Ribes, Ramón-Rodríguez, Rubia, and Moreno-Izquierdo (2017) for Spain, Katircioglu (2009a) for Malta, Bilen, Yilanci, and Eryüzlü (2017) for Mediterranean countries, Roudi, Arasli, and Akadiri (2018) for 10 small island developing states including Cyprus and Malta.

Cortes-Jimenez and Pulina (2010) examine the TLG hypothesis with the production function framework with the variables, real output, international tourism, physical capital and human capital employing Granger causality test for Spain and Italy for the period of 1964–2000 and 1954–2000, respectively. While the results reveal the existence of bidirectional relationship for Spain, for Italy is confirmed unidirectional Granger causality from tourism to economic growth, confirming TLG hypothesis.

Demiroz and Ongan (2005) examine the effect of tourism on economic growth using cointegration and Granger causality tests with the quarterly data covering the period 1980–2004 for Turkey. The empirical results show that there are bidirectional relationships between tourism and economic growth in both the short- and long-run.

Tugcu (2014) investigates the relationship between tourism and economic growth for a sample of Mediterranean countries with the data set including annual real GDP per capita growth, international tourism receipts in current US$ and international tourism expenditures in current US$ for the years from 1998 to 2011 employing Dumitrescu and Hurlin (2012) panel Granger causality test. The results of panel Granger causality analysis reveal that the direction of causality between tourism and economic growth varies across the country group and tourism indicator.

Aslan (2016) examines the impact of tourism on economic growth with the variables of tourism expenditures divided into types of the expenses such as accommodation, transport, sporting activities, sightseeing, clothing and footwear, gift expenditures and economic growth employing Autoregressive Distributed Lag (ARDL) approach and causality test for the period of 2003:1 to 2012:4 for Turkey. ARDL test results provide support the existence of long-run relationship between variables. Additionally, the causality test results confirm TLG hypothesis in the Turkish economy.

Perles-Ribes et al. (2017) analyze the TLG hypothesis with variables of real international tourism receipts and arrivals of international visitors, real gross value added, real gross domestic product, number of jobs and number of employees, real effective exchange rate employing ARDL cointegration approach and Toda and Yamamoto (1995) procedure for Spain for the period of 1955–2014. The test results show that there is a bidirectional relationship between tourism and economic growth in Spain.

Katircioglu (2009a) investigates the relationship between tourism and economic growth using ARDL and Granger causality analysis for the period of 1960–2006 for Malta. To determine the relationship, he uses variables such as real gross domestic product, total number of international tourists visitors accommodated in tourist establishments, and the real effective exchange rate. The results reveal that there is bidirectional causality between international tourism and economic growth exists in Malta.

Bilen et al. (2017) examine the relationship between economic growth and tourism development over the period 1995–2012 using panel frequency Granger causality and Dumitrescu and Hurlin (2012) panel Granger causality tests with variables of real GDP and international tourism receipts for the 12 Mediterranean countries, including Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Malta, Portugal, Spain, Turkey, and Tunisia. While Dumitrescu and Hurlin (2012) panel Granger causality test results show a unidirectional causality from tourism to economic growth, panel Granger causality analysis in the frequency domain test results reveal that there is bidirectional, temporary, and permanent causality between tourism and economic growth.

Roudi et al. (2018) analyze the relationship between between tourism and economic growth incorporating variables of energy consumption and foreign direct investment in the model using relatively new heterogeneous panel autoregressive distributed lag cointegration methods and Granger causality for the small island developing states, including Cyprus and Malta over the period 1995–2014 Dumitrescu and Hurlin panel Granger causality test results reveal bidirectional causality between tourism and economic growth.

The fourth relationship is the neutrality hypothesis which argues that no causality exists between tourism and economic growth. A few studies, such as those conducted by Katircioglu (2009b) for Turkey, Brida, Punzo, and Risso (2011) for Brazil, and Kasimati (2011) for Greece, did not find any relationship at all.

Katircioglu (2009b) investigates the tourism-led-growth (TLG) hypothesis for Turkey over the period 1960–2006 employing ARDL and Johansen approach for cointegration with the variables of real gross domestic product, total number of international tourists visitors and real exchange rates. He concludes that there is no cointegration between international tourism and economic growth, rejecting the TLG hypothesis for Turkey.

Brida et al. (2011) investigate whether tourism-led growth hypothesis is valid for Brazil by applying two different econometric methodologies and with two data sets with variables of real per capita GDP, international tourism expenditure and the real exchange rate. Granger causality test results indicate that no evidence of Granger causality between variables over the period 1965–2007. On the other hand, the relationship between all variables utilized employing dynamic panel data model proposed by Arellano and Bond (1991) with data for the 27 Brazilian states for the period of 1990–2005 and test results show that a %1 increase in tourism receipts leads to a %0.13 rise in GDP of Brazil.

The effect of tourist activities on environmental issues has been studied by many scholars. Becken and Simmons (2002) argue that tourism is an important contributor to energy consumption, leading to misuse of natural resources and global climate change. They found that some tourist activities, such as scenic flights and jet boating, use more energy than places of attractions – such as museums and experience centers – developed for tourists in New Zealand. Gössling, Hansson, Hörstmeier, and Saggel (2002) concluded that air travel causes substantial energy consumption compared to other transport devices. Gössling et al. (2005) also claim that fossil energy use connected to tourism may lead to environmental problems. Additionally, Gössling et al. (2005) calculated the CO_2 emission for selected countries and found different results across countries, based on the following factors: destination countries, vacation types, and tourist cultures. Also, Becken and Patterson (2006) found out that tourism activities lead to CO_2 emissions. In addition, Kuo and Chen (2009) found that the transportation sector is the main contributor to CO_2 emissions in Penghu Island. Moreover, Katircioglu (2014a) points out that tourism causes significant rises in both CO_2 emissions and energy consumption in Turkey. A similar result is provided by Katircioglu, Feridun, and Kilinc (2014) for Cyprus. Katircioglu (2014b) found that tourism leads to carbon dioxide emissions in Singapore. A similar evidence is confirmed by Tang, Shang, Shi, Liu, and Bi (2014) for China; Akadiri, Akadiri, and Alola (2017) for seven small islands, including, Bahrain, Cuba, Cyprus, Dominican Republic, Haiti, Iceland and Malta; Dogan, Seker, and Bulbul (2017) for OECD countries, and Jebli, Youssef, and Apergis (2014) for South and Central America. Ozturk (2016) found that tourism indicators affect the level of carbon dioxide emissions. Dogan et al. (2017) found that tourism and energy consumption increase CO2 emissions for OECD countries. Tang, Tiwari, and Shahbaz (2016) show that energy consumption is affected both by tourism and economic growth for India. Paramati, Alam, and Chen (2017a) found that while tourism increases the CO_2 emissions level in Eastern Europe, Western Europe experiences a reduction.

A number of studies confirmed the presence of bidirectional Granger causality between CO_2 emissions and economic growth for o sample of countries. For instance, Al-Mulali (2011) investigates the relationship between oil consumption, CO_2 emissions (million metric tons) and economic growth (millions of US dollars) in MENA countries taking the period 1980–2009. Pedroni (2004) and Kao (1999) cointegration test results reveal that there is a long run relationship between variables. Besides, the authors identified bidirectional Granger causality exists both in short and long run. Halicioglu (2009) investigates the relationship between carbon emissions, energy consumption, income, and foreign trade in Turkey over the period 1960–2005 employing Granger causality and ARDL tests. He concludes that there is a bidirectional relationship between carbon emission and economic growth both in short and long run.

Moreover, some studies found an evidence of unidirectional causality between CO_2 emissions and economic growth. Fodha and Zaghdoud (2010) analyze the relationship between carbon emissions and economic growth for the years from 1961 to 2004 for Tunisia utilizing the Granger causality test. The results of this study show that there is unidirectional causality running from economic growth to carbon emission. Jaunky (2011) examines the relationship between income and carbon emission in 36 high-income countries, including Cyprus, France, Greece, Israel, Italy, Malta, and Spain for the period of 1980–2005 using the panel data unit root, co-integration tests, and the Blundell- Bond system generalized methods of moments (GMM). He found unidirectional causality running from real per capita GDP to per capita CO_2 emissions for the whole panel in both the short- and long-run. Saboori, Sulaiman, and Mohd (2012) analyze the relationship between per capita GDP (in constant 2000 US) and CO_2 emissions (in metric tons) in Malaysia during 1980–2009 utilizing Auto Regressive Distributed Lag (ARDL) and Granger causality tests. The ARDL suggest the existence of a long-run relationship between carbon emission and economic growth. Granger causality test results reveal the unidirectional causality running from CO_2 emissions to economic growth in the long run.

Another group of studies found no relationship between CO_2 emissions and economic growth.

Soytas and Sari (2009) analyzed the relationship between economic growth, carbon dioxide emissions and energy consumption in a multivariate framework with gross fixed capital formation and labor using Granger causality tests over the period from 1960 to 2000 for Turkey. The results from the Granger causality test show that there is no evidence to support for Granger causality between carbon emission and economic growth. Zhang and Cheng (2009) investigate the relationship between economic growth, energy use (kt of standard coal equivalent), CO_2 emissions, capital and urban population in China for the period of 1960–2007 utilizing Granger causality and impulse-response tests. They found no evidence of causality between CO_2 emissions and economic growth.

Some studies investigated the impact of CO_2 emissions on economic growth to numerous countries. Arouri, Youssef, M'henni, and Rault (2012) investigate the relationship between carbon emissions, energy consumption and per capita real GDP for 12 selected Middle East and North African Countries, including, Algeria, Egypt, Morocco, and Tunisia taking the period 1981–2005 employing Westerlund and Edgerton (2007) panel cointegration test and common correlated effects mean group (CCE-MG) methodology. The results show that there is a negative relationship between carbon emission and economic growth in MENA countries. Akadiri et al. (2017) investigate the effect of tourism on CO_2 emissions for seven island countries, including Cyprus and Malta for the period of 1995–2013 utilizing a panel-based multivariate model using the variables of energy use and economic growth. The results of panel cointegration tests show that there is a long-run relationship between variables. Besides, tourism has a negative effect on CO_2 emissions in the long run.

Morancho, Tamarit, and Zarzoso (2001) analyze the relationship between economic growth and carbon emission in ten selected European countries, including France, Greece, Italy, and Spain for the period of 1981–1995. The authors conclude that richer countries, such as France and Italy have a higher carbon emission level than poorer countries such as Spain and Greece. Lee and Brahmasrene (2013) examine the impact of tourism on economic growth and CO_2 emissions in European Union, including, Cyprus, France, Greece, Italy, Malta, Slovenia, and Spain over the period 1988–2009 using panel data analysis method. The results of the study show that there is a long run relationship exists between variables. Moreover, they found that while tourism receipts contribute to economic growth, on the other hand, an increase in economic growth leads to a rise in CO_2 emissions. Kasman and Duman (2015) investigate the relationship between CO_2 emissions, economic growth, energy consumption, trade and urbanization in EU countries for the years from 1992 to 2010 employing Pedroni (2004), Kao (1999) and Westerlund (2007) panel cointegration tests and the results provide support for a positive and significant relationship between CO_2 emissions and economic growth.

Model and data

Annual data, collected for a specific period – 1995–2014 – is employed for the representative sample of 15 Mediterranean countries.[1] Lee and Brahmasrene (2013), and Tang et al. (2014) use the tourism receipts per capita and CO_2 emissions per capita to explore the impact of tourism activities on economic growth and environmental degradation.

Two empirical models constructed in the study. The first model examines the long-run relationships between economic growth, tourism receipts per capita and CO_2 emissions per capita in the Mediterranean countries following the studies Lee and Brahmasrene (2013), and Tang et al. (2014). The second model investigates the impact of economic growth and tourism receipts per capita on CO_2 emission in the Mediterranean region. Based on these studies, the long run relationship between GDP, CO_2 emissions per capita and tourism receipts per capita are established following Lee and Brahmasrene (2013), and Tang et al. (2014) and are written as follows:

$$GDP_{it} = \alpha_0 + \alpha_1 TR_{it} + \alpha_2 CO_{2it} + \varepsilon_{it} \qquad \text{Model 1}$$

$$CO_{2it} = \beta_0 + \beta_1 TR_{it} + \beta_2 GDP_{it} + u_{it} \qquad \text{Model 2}$$

While t refers to the time period, i refers to the cross-section, and ε_{it} and u_{it} refer to the residual terms. GDP_{it} is the natural log of GDP per capita; TR_{it} is the natural log of tourism receipts per capita, and CO_{2it} is the natural log of CO_2 emissions per capita. The GDP per capita is in millions of constant 2010 US$. Meanwhile, tourism receipts per capita is obtained by dividing the total tourism receipts of each country by their population. The data of GDP, population, tourism receipts, and CO_2 emissions per capita are retrieved from the World Development Indicators database.

The important economic indicators of the tourism industry for the sample Mediterranean countries are summarized in Table 1. The table highlights tourism receipts per capita, the number of arriving tourists per capita, total contribution to GDP, total contribution to employment, and CO2 emissions per capita. According to Table 1, tourism activities contribute to GDP by different margins varying between 6.6% and 26.7% in Mediterranean countries.

Methodology

In the first step of analysis, cross-sectional dependency and slope heterogeneity are tested to specify the appropriate technique. Since we found the existence of cross-sectional dependency across the countries, we used firstly followed unit root tests, namely cross-sectionally augmented Im-Pesaran-Shin (CIPS). Secondly, we employed Westerlund (2007) and Gengenbach, Urbain, and Westerlund (2016) cointegration tests, and thirdly, Common Correlated Effects Mean Group (CCEMG) approach developed by Pesaran (2007) and Augmented Mean Group (AMG) long run estimator proposed by Eberhardt and Teal (2010) regarding the cross-sectional dependency. Finally, the causality method developed by Emirmahmutoglu and Kose (2011) was employed to explore the causality relationship between the variables.

Cross-sectional dependency and homogeneity tests

To test the cross-sectional dependence, Breusch and Pagan (1980) proposed the following Lagrange Multiplier test statistic

$$CD_{LM} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2 \quad (1)$$

$\hat{\rho}_{ij}^2$ denotes estimated correlation coefficients of the residuals from the individual Ordinary Least Squares (OLS) estimations. This test maintained hypothesis is no cross-sectional dependence against the alternative hypothesis of cross-sectional dependence, the LM statistic has χ^2 distribution with $T > N$. However, the LM test is not consistent with large N. To deal with this problem, Pesaran (2004) proposed the following CD statistic

$$CD = \sqrt{\frac{1}{N(N-1)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T\hat{\rho}_{ij}^2 - 1)} \quad (2)$$

To test whether the slope coefficients are homogenous, we utilized the method developed by Pesaran and Yamagata (2008) and Swamy (1970) called the $\tilde{\Delta}$ test. Pesaran and Yamagata (2008) proposed the delta statistic using $\tilde{S}$statistics

$$\tilde{S} = \sum_{i=1}^{N}(\hat{\beta}_i - \hat{\beta}_{WFE})' \frac{X'_i M_t X_i}{\tilde{\sigma}_i^2}(\hat{\beta}_i - \hat{\beta}_{WFE}) \quad (3)$$

Table 1. Tourism Receipts, Tourist Arrivals, Tourism's Total contribution to GDP and Employment, and CO_2 emissions.

Countries	Tourism receipts per capita	Tourist arrivals per capita	Total contribution to GDP	Total contribution to Employment	CO_2 emissions per capita
Cyprus	2381.4	2.342	22.93	24.21	1.88
France	781.25	1.202	9.91	11.07	1.61
Greece	1128.62	1.392	15.55	20.09	2.16
Israel	629.22	0.312	7.78	8.07	2.56
Italy	632.14	0.707	11.28	12.31	2.002
Slovenia	979.06	0.808	11.53	11.88	2.06
Spain	1078.71	1.2	13.97	14.23	1.84
Turkey	272.85	0.305	11.81	8.79	0.99
Albania	349.35	0.484	17.91	16.08	0.34
Algeria	6.55	0.042	6.55	5.57	0.86
Croatia	1529.9	1.789	20.004	20.93	1.24
Egypt	85.58	0.093	14.8	13.04	0.58
Malta	2505.5	3.212	26.75	27.64	1.63
Morocco	173.99	0.205	15.73	14.44	0.39
Tunisia	243.615	0.571	18.93	16.99	0.60

Note: Tourism receipts per capita, the number of arriving tourists per capita, total contribution to GDP, total contribution to employment, and CO_2 emissions per capita are the average for 1995–2014. Tourism receipts per capita, the number of arriving tourists per capita obtained from WDI (2014); CO_2 emissions per capita (in metric tons) extracted from Carbon Dioxide Information Analysis Center; the rest of the data is from the WTTC.

Then the delta statistic can be shown as

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}\right) \tag{4}$$

with $(N, T) \to \infty$, under the null hypothesis of slope homogeneity, the $\tilde{\Delta}$ test has N (0,1), while error terms are normally distributed. $\tilde{\Delta}$ test can be developed using the adjusted version in small version.

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\tilde{Z}_{iT})}{\sqrt{Var(\tilde{Z}_{iT})}}\right) \tag{5}$$

$E(\tilde{Z}_{iT})$ and $Var(\tilde{Z}_{iT})$ denote k, $2k(T-k-1)/T+1$, respectively.

Panel unit root test

A commonly used second generation test, the Cross-Sectional Augmented Dickey–Fuller (CADF) regression, developed by Pesaran (2007), accounts for cross-sectional dependence between countries. The test is as follows:

$$\Delta Y_{it} = \alpha_i + \rho_i Y_{i,t-1} + \beta_i \bar{Y}_{t-1} + \sum_{j=0}^{k} \gamma_{ij} \Delta \bar{Y}_{i,t-1} + \sum_{j=0}^{k} \delta_{ij} Y_{i,t-1} + \varepsilon_{it} \tag{6}$$

where α_i denotes deterministic term, $\bar{Y}_{t-1} = (1/N) \sum_{i=!}^{N} Y_{i,t-1}$ and $t_i(N, T)$ denote the t-statistics for estimation, and ρ_i for computing for each individual ADF- statistics. Pesaran (2007) developed the CIPS statistics on the grounds of the average of each individual CADF statistics

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i(N, T) \tag{7}$$

Panel cointegration and panel long-run estimator

To investigate whether a cointegration exists between variables, we utilized Westerlund (2007) and Gengenbach et al. (2016) panel cointegration tests. Westerlund (2007) employs four different statistics. While two of them are panel tests statistics, with P_t and P_α under the assumption of the null hypothesis representing no-cointegration against the alternative hypothesis of cointegration; the two others are group-mean test statistics denoting G_t and G_α with the assumption of the null hypothesis of no cointegration against the alternative hypothesis at least one in the panel is cointegrated. Gengenbach et al. (2016) proposed the panel cointegration test on the grounds of the error correction model taking into consideration the cross-section dependence and using cross-section averages.

In this study, we perform our analysis by utilizing the CCEMG approach developed by Pesaran (2006) and the Augmented Mean Group (AMG) estimator proposed by Eberhardt and Teal (2010). CCEMG estimator allows cross-sectional dependence using cross-sectional averages of the dependent variable and independent variables. According to Kapetanios, Pesaran, and Yamagata (2011), CCEMG estimators are consistent even in the existence of unit root and unobserved factors and are also robust to structural breaks, non-cointegrated common factors, and certain serial correlation. Eberhardt and Teal (2010) proposed an AMG approach as an alternative to Pesaran's (2006) CCEMG estimator, which accounts for cross section dependence by including a "common dynamic process" in the group-specific regressions.

Panel causality test

In order to test the causality relationship between variables, we utilized a panel Granger causality methodology proposed by Emirmahmutoglu and Kose (2011) which controls for heterogeneity and cross-sectional dependence in a panel. This test extends the probability values of Toda and Yamamoto (1995) by employing Fisher (1932)'s meta-analysis. The method considers a level VAR model with ($k_i + d\max_i$) lags in heterogeneous mixed panels

$$x_{i,t} = \mu_i^x + \sum_{j=1}^{k_i+d\max_i} A_{11,ij} x_{i,t-j} + \sum_{j=1}^{k_i+d\max_i} A_{12,ij} y_{i,t-j} + u_{i,t}^x \tag{8}$$

$$y_{i,t} = \mu_i^y + \sum_{j=1}^{k_i+d\max_i} A_{21,ij} x_{i,t-j} + \sum_{j=1}^{k_i+d\max_i} A_{22,ij} y_{i,t-j} + u_{i,t}^x \tag{9}$$

where $d\max_i$ denotes the maximal order of integration for each cross section, A is the fixed matrices of parameters that allows to vary across countries. The bootstrap method utilized by Emirmahmutoglu and Kose (2011) to the causality from x to y is outlined in the following 5 steps:

Step 1. Augmented Dickey Fuller (ADF) unit root test is used to determine the maximal order of integration of variables for each cross section unit. Next, the regression Eq. (9) estimated utilizing the OLS method for each unit selecting the lag order k_i's by Akaike information criteria (AIC) or Schwarz information criteria (SIC).

Step 2. By applying k_i and $d\max_i$ from step 1, Equation (9) is re-estimated by OLS under the non-causality hypothesis and obtains the residuals for each unit.

$$\hat{u}_{i,t}^{y} = y_{i,t} - \hat{\mu}_i^{y} - \sum_{j=k_i+1}^{k_i+d\max_i} \hat{A}_{21,ij} x_{i,t-j} - \sum_{j=1}^{k_i+d\max_i} \hat{A}_{22,ij} y_{i,t-j} \quad (10)$$

Step 3: Stine (1987) proposes that residuals have to be centered with

$$\tilde{u}_t = \hat{u}_t - (T-k-l-2)^{-1} \sum_{t=k+l+2}^{T} \hat{u}_t \quad (11)$$

where $\hat{u}_t = (\hat{u}_{1t}, \hat{u}_{2t}, \ldots, \hat{u}_{Nt})'$, $k = \max(k_i)$, $l = \max(d\max_i)$. Moreover, $[\tilde{u}_{i,t}]_{NxT}$ is computed from these residuals. To preserve the cross covariance structure of the errors, a full column is randomly selected for the replacement from the matrix at a time the bootstrap residuals are expressed as $\tilde{u}_{i,t}^{*}$ where $t = 1,2,\ldots,T$.

Step 4. The bootstrap sample of y is generated in a recursive way, under the null hypothesis

$$y_{i,t}^{*} = \hat{\mu}_i^{y} + \sum_{j=k_i+1}^{k_i+d\max_i} \hat{A}_{21,ij} x_{i,t-j} + \sum_{j=1}^{k_i+d\max_i} \hat{A}_{22,ij} y_{i,t-j}^{*} + \tilde{u}_{i,t}^{*} \quad (12)$$

where $\hat{\mu}_i^{y}$, $\hat{A}_{21,ij}$, $\hat{A}_{22,ij}$ are resulted from Step 2.

Step 5: Replace $y_{i,t}^{*}$ for $y_{i,t}$, estimate (Eq. (9)) without establishing any parameter restraints on it. Next, the individual Wald statistics are computed to analyze non-causality null hypothesis individually for each country. These individual Wald statistics have an asymptotic chi-square distribution with k_i degrees of freedom. Individual p-values are calculated. Afterwards, the mean Wald test statistic is procured. Built on the above steps, the mean Wald test statistic with the bootstrap empirical distribution is obtained by iterating steps 3–5 2000 times and providing the bootstrap critical values by choosing the appropriate percentiles of these sampling distributions.

Empirical results

Pesaran and Yamagata (2008)'s method is employed to see whether or not slope coefficients are homogenous. Table 2 exhibits the slope homogeneity test results. The results confirm that the null hypothesis of $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ can be rejected at 1% significance level; implying the country-specific heterogeneity.

Table 3 shows the CD test results. The results provide an evidence confirming the cross-sectional dependence across countries.

After the determination of the presence of heterogeneity and the cross-sectional dependence across Mediterranean countries, we employ the CIPS panel unit root test developed by Pesaran (2007) to ensure the order of the integration of variables. CIPS panel unit root test results are presented in Table 4. The results reveal that all variables are non-stationary at levels. After taking the first difference, all variables become stationary.

The presence of the long-run relationship between all the variables is confirmed by the panel cointegration test utilized by Westerlund (2007), which accounts for cross-sectional dependence. Table 5 reports the results of the cointegration test suggested by Westerlund (2007). The results confirm a long run cointegration relationship between GDP, tourism receipts per capita and CO_2 for Mediterranean countries.

Table 2. Delta test results.

	Model 1	Model 2
$\tilde{\Delta}$	6.519*	11.972*
$\tilde{\Delta}_{adj}$	7.071*	12.985*

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

Table 3. Cross-sectional dependence test results.

	GDP	TR	CO_2
$\lvert\hat{\rho}_{\varepsilon}\rvert$	0.924	0.749	0.512
CD-test	42.34	34.33	7.06
p-value	0.000	0.000	0.000

Table 4. CIPS panel unit root tests results.

GDP	−2.063
ΔGDP	−3556*
TR	−2.411
ΔTR	−4.090*
CO_2	−1.018
ΔCO_2	−5.004*

Note: *denotes the statistical significance at 1% level. Δ is the first difference term.

Table 5. Westerlund (2007) cointegration test results.

	Value	P-value
G_t	−12.235	0.000
G_α	−0.438	1.000
P_t	−3.884	0.996
P_α	−0.302	1.000

Table 6 reports the results of the ECM cointegration test suggested by Gengenbach et al. (2016). Under the null hypothesis of no-cointegration against the alternative hypothesis of cointegration between variables, in this case, the *p*-value ranges from 0.05 and 0.1, the results indicate that the null hypothesis (i.e. no cointegration at the at the 10% level for Mediterranean) can be rejected.

After confirmation of the order of the integration and long-run cointegration of the studied variables, we used the CCEMG approach and AMG estimator to determine the coefficient of long-run relationships between the independent and dependent variables.

We estimated the long-run coefficients for Model 1 and Model 2 employing CCEMG and AMG tests. The long-run estimates of each model are illustrated in Table 7. Over the studied Mediterranean countries, there is a positive relationship between tourism receipts and economic growth. The elasticities of variables utilizing the two methods are positively significant, with similar results for Model 1 and Model 2. For Model 1, we estimated that tourism receipts have a positive and significant impact on GDP implying that increases in tourism revenues lead to higher levels of economic growth in Mediterranean countries. Furthermore, the results of the CCEMG test show that a 1% increase in tourism receipts per capita leads to a 0.10% increase in economic growth, suggesting tourism expansion may improve the economic performance of the Mediterranean countries. Correspondingly, AMG results indicate that a 1% increase in tourism receipts per capita contributes to economic growth by 0.14%. Overall, our finding is confirmed with the results of Gokovali and Bahar (2006).

For the model 2, both CCEMG and AMG tests results show that a 1% increase in tourism receipts per capita leads to a 0.09% and 0.14% increase CO_2 emission per capita, respectively, implying that increases in tourism revenues lead to higher levels of CO_2 emission in Mediterranean countries.

Next, causality between GDP and tourism receipts per capita analyzed utilizing the heterogeneous causality test proposed by Emirmahmutoglu and Kose (2011).

Table 8 demonstrates Bootstrap Granger causality between tourism receipts and economic growth for 15 Mediterranean countries. There is a unidirectional causality running from tourism receipts per capita to economic growth for Egypt, Italy, and Spain at %5 significance level. This indicates that an increase in tourism receipts per capita leads to an increase in GDP in those countries. Besides, the results confirmed a bidirectional relationship between GDP and tourism receipts per capita for Turkey at the %1 significance level and Morocco at the %10 significance level, supporting the feedback hypothesis. Our results

Table 6. Gengenbach et al. (2016) cointegration test results.

Coefficient	T-bar
−1.198***	−3.563

Note: ***indicates a rejection of the null of no cointegration at the 10% significance level.

Table 7. Results from long-run estimates.

	GDP	CO_2	TR	Constant
Model 1				
CCE-MG		0.686*	0.100**	0.267
AUG		0.305*	0.042***	7.578*
Model 2				
CCE-MG	0.261*		0.098**	−0.187
AUG	0.138**		0.145*	−0.844**

Note: *, **, *** denote the statistical significance at %1, %5, %10, respectively.

Table 8. Bootstrap Granger causality between tourism receipts and economic growth.

Country	lag	Tourism-led growth hypothesis		lag	Growth-led hypothesis	
		Wald	*p*-value		Wald	*p*-value
Algeria	1	0.183	0.669	3	1.788	0.617
Albania	3	2.285	0.515	3	3.979	0.264
Croatia	1	0.287	0.592	1	0.672	0.412
Cyprus	1	0.018	0.894	3	3043	0.385
Egypt	1	5.604	0.018**	2	1.584	0.453
France	3	2.813	0.421	3	3.393	0.335
Greece	3	3.275	0.351	3	2.346	0.504
Israel	1	0.042	0.837	2	2.664	0.264
Italy	1	4.123	0.042**	1	0.043	0.725
Malta	3	4.952	0.175	2	3.350	0.187
Morocco	1	4.977	0.026**	2	4.929	0.085***
Slovenia	1	2.004	0.157	3	1.454	0.693
Spain	2	9.042	0.011**	2	1.759	0.415
Tunisia	3	3.477	0.324	1	0.078	0.78
Turkey	3	21.071	0.000*	3	66.626	0.000*

Note: *, **, *** denote the statistical significance at %1, %5, % 10, respectively.

are consistent with the previous studies such as Balaguer and Cantavella-Jorda (2002), Nowak et al. (2007), Ivanov and Webster (2007), and Tugcu (2014) in Spain; Demiroz and Ongan (2005) in Turkey. No causality found between tourism receipts per capita and GDP in Algeria, Albania, Croatia, Cyprus, France, Greece, Israel, Malta, Slovenia, and Tunisia. This finding is confirmed by Tugcu (2014) for Algeria, Cyprus, Egypt, Israel, Malta, and Tunisia, when tourism is proxied by the tourism receipts.

Some of the possible reasons why no causality obtained in the relationship between tourism and economic growth for some Mediterranean countries, but not for others may be attributed to selecting wrong variables for measuring tourism in the model, period of time taken, and chosen methodology (Sokhanvar, Çiftçioğlu, and Javid (2018)). Moreover, Sokhanvar et al. (2018) point out the reasons behind no causality relationship exists between tourism and economic growth as follows: the impact of the import of tourism inputs on economy, tourism's economic and environmental expenses, the effects of other sectors, and the negative externalities of the tourism industry.

Conclusion

This paper examines the impact of tourism on economic growth considering CO_2 emissions employing panel data techniques, and heterogeneous causality test proposed by Emirmahmutoglu and Kose (2011) for a sample of Mediterranean countries for the period of 1995–2014. The findings provide an evidence of a long-run relationship between tourism, carbon emissions, and economic growth. The bootstrap Granger causality test results of Emirmahmutoglu and Kose (2011) provide evidence of unidirectional causality running from tourism to economic growth for Egypt, Italy, and Spain; implying that tourism expansion improves the economic performance of those countries. Additionally, we found that the feedback hypothesis is valid for Turkey and Morocco. The panel test results show that tourism contributes to economic growth for Mediterranean countries, hence policy makers should implement policies ensuring balanced sustainable tourism without harming the environment and other tourist attractions. Moreover, in the study, the panel model is utilized in this study to determine the impact of tourism on CO2 emission for Mediterranean countries. The results show that tourism receipts contribute to CO_2 emissions in a panel of Mediterranean countries implying that CO_2 emissions reduction policies should be taken into consideration by policy makers to achieve the sustainable tourism development in the Mediterranean countries.

Considering the 7% increase in 2017 in international tourist arrivals it will be no surprise that the international tourist numbers will continue to grow steadily. Therefore, policy makers and host countries as well as tourists themselves must play important roles in protecting the environment, and reducing CO_2 emissions. Policy makers and the tourism industry should closely work with technology firms to promote a low carbon economy and use more environment-friendly equipment, energy saving applications such as electrical panels that self-produce electricity from sun-light and purification systems that rotate waste water to toilets are applicable to reduce CO_2 emissions.

Note

1. Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Malta, Morocco, Slovenia, Spain, Tunisia, and Turkey.

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No potential conflict of interest was reported by the authors.

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