Technological and Economic Development of Economy
ISSN: 2029-4913 / eISSN: 2029-4921
2021 Volume 27 Issue 6: 1509–1538
https://doi.org/10.3846/tede.2021.15781

DO ECONOMIC GROWTH AND ENVIRONMENT QUALITY CONTRIBUTE TO TOURISM DEVELOPMENT IN EU COUNTRIES? A PANEL DATA ANALYSIS

Daniel BADULESCU [1], Ramona SIMUT [1], Ioana MESTER [1], Simona DZITAC [2], Mariana SEHLEANU [1], Dorin Paul BAC [1], Alina BADULESCU [1*]

[1]*Department of Economics and Business, Faculty of Economic Sciences, University of Oradea, Oradea, Romania*
[2]*Department of Energy Engineering, Faculty of Energy Engineering and Industrial Management, University of Oradea, Oradea, Romania*

Received 22 March 2021; accepted 28 July 2021

Abstract. The positive impact of the tourism industry on economic growth, revenues, infrastructure, employment, social inclusion and poverty reduction, although widely recognised, has been lately weighted against the appearance and exacerbation of several problems, such as: environmental footprint, increase of income inequality, cost increases related to solid waste collection, energy consumption, increased global CO_2 emissions. On the other hand, the tourism sector is not just an active economic, societal, or environmental change agent; in turn, the tourism sector supports or is highly influenced by various factors, such as climate change, economic, political, or social factors. More recently, this industry has been highly impacted by the pandemic, technological developments and cultural trends. In this article we examined both the short and long-run relationship between tourism development and economic growth, CO_2 emissions and energy consumption in European Union member states (EU27), by using the Principal Component Analysis (PCA) technique and autoregressive distributed lag (ARDL) model for panel data. The findings suggest that economic growth and energy consumption have a statistically significant impact on the tourism index both in the short and long-run, whereas CO_2 emissions only have a significant impact upon the tourism index on the long run.

Keywords: international tourism, economic growth, environment, autoregressive distributed lag, Principal Component Analysis.

JEL Classification: Z32, L83, Q56.

*Corresponding author. E-mail: *abadulescu@uoradea.ro*

Introduction

The probably unique feature of tourism to cross a diversity of economic sectors, interests, political and social systems come with a multitude of demands and expectations regarding its role in stimulating global growth and sustainable development, environment and health protection.

World Travel & Tourism Council [WTTC] data for 2019 reveal a contribution of US $8.9 trillion, meaning 10.3% to global GDP. At the same time, the aforementioned industries represent 28.3% of global services exports, and amount to 330 million jobs. In other words, worldwide, 1 in 10 jobs are in tourism or associated industries (WTTC, 2020a, 2020b). The World Tourism Organization [UNWTO] reported that international tourist arrivals (overnight visitors) reached 1460 million in 2019, with a 4% increase compared to 2018 levels (UNWTO, 2020a). In 2019, international tourism receipts accounted for US$ 1479 billion and international tourism exports reached US$ 1733 billion, the share of tourism exports in total exports of goods and services reaching 7%. In the same reports, the WTTTC has also pointed out that an increase in the number of international tourist arrivals raises mandates that growth be sustainable and inclusive, and the increase in the number of international tourist arrivals must have a positive contribution for the communities, natural ecosystems and cultural heritage (WTTC, 2020b).

However, 2020 has brought an "unprecedented shock, challenges and an existential threat to the tourism sector" due to the COVID-19 pandemic (UNWTO, 2020b), the travel and tourism being one of the most affected sectors of the world economy. According to the WTO, international tourism has registered an immense fall in 2020: international tourist arrivals (overnight visitors) reduced by 74% compared to 2019. The loss in international tourism receipts amounts to US$ 1.3 trillion, leading to a fall in international to levels similar to those registered 30 years ago (UNWTO, 2021). According to the OECD (2020a, p. 15), although in the short-run the tourism industry may be affected by the uncertainty of economic outlook or by external shocks, in the long run, the tourism sector is expected to grow continuously. Nevertheless, most experts expect a fully recovery for 2023 (UNWTO, 2020c).

Over the years, the positive impact of the tourism industry on economic growth, revenues, infrastructure, employment, social-inclusion and poverty reduction has been highlighted by organizations and researchers around the world (UNWTO, 2020a; OECD, 2020a). It is no less true that the tourism sector development is also related to the appearance or deepening of several problems such as: environmental impact (Zhang et al., 2012; Fantinato, 2019) increasing income inequality (Alam & Paramati, 2016), increase of solid waste collection costs (Greco et al., 2018), and others.

The environmental impact of tourism, related to ecosystems (Canteiro et al., 2018; Fantinato, 2019), or CO_2 emissions (Koçak et al., 2020), is a harsh reality that must be taken into account when elaborating different policies. Transport is highly important for tourism development and, according to the World Tourism Organization (UNWTO, 2019, p. 11), three quarters of CO_2 emissions from tourism are related to it, which makes tourism an important player in the reduction process of CO_2 emissions and, therefore, of the process of mitigating climate change.

Sustainable tourism development can be promoted and stimulated by developing specific environmental and tourism-management policies (Buckley, 2012; Butler, 1999; Ritchie & Crouch, 2003; Martin-Rios, 2019; Droj et al., 2020; Ilies et al., 2012). Moreover, attitudes, subjective norms, and personal norms or social involvement can also be used to promote sustainable tourism development (de Lange & Dodds, 2017).

At the same time, tourism is also influenced by important factors such as climate change (Köberl et al., 2016; Dubois et al., 2011; Steiger & Scott, 2020), economic crises (Papatheodorou et al., 2010; Ritchie & Jiang, 2019; Sio-Chong & Yuk-Chow, 2020), terrorism and political instability (Sönmez, 1998; Corbet et al., 2019), epidemics (Page et al., 2006; Sigala, 2020), refugee crises (Pappas & Papatheodorou, 2017; Zenker et al., 2019), digitization (Katsoni, 2017; Madiyarova et al., 2018), innovation (Gavrilut, 2018). The recent works of Sigala (2020), or Zenker and Kock (2020) are aimed at analyzing the recent impacts and implications of the COVID-19 pandemic on the tourism industry. Concurrently, several organizations such as the World Travel & Tourism Council (2020a), UNWTO (2020c) and OECD (2020b) have developed several scenarios regarding the development of the travel and tourism sector in 2020–2023.

The paper is organized as follows: the first part, after the introduction, we review the relevant literature regarding the relationship between tourism and economic growth, tourism and energy consumption as well as tourism and pollution. In the second part we present some descriptive statistics for the indicators used in our research and the methodology used to set up the international tourism development index. In the next part of the paper, we develop an ARDL model for panel data that analyses the impact of several factors on the economic growth and it is followed by results and discussions. The final part covers the conclusions and limits of the paper and indicates several policy recommendations.

1. Literature review

1.1. Tourism and economic growth

In developing economies, tourism development is used as a tool for job creation, SME expansion and economic growth (Khan et al., 2020a), but it is of significant importance in many developed countries as well. As the strategy to consolidate economic growth by exporting commodities has often been inefficient due to the lack of competitiveness (Durbarry, 2004), several developing economies try to use of the tourism sector as an export item in order to stay competitive and to obtain foreign exchange earnings so as to balance the trade deficit (Khan et al., 2020a).

There are four main research hypotheses on the causal relationship between tourism and economic growth (Badulescu et al., 2020), namely: (1) the tourism-led growth hypothesis (TLGH) which emphasizes tourism as a major driver for economic growth; (2) the growth-led tourism hypothesis (GLTH) which considers that economic growth contributes to the development of the tourism sector; (3) the bidirectional relationship between them and (4) a neutral relation between tourism and economic growth.

The TLGH hypothesis is by far the richest, most represented and argued in the literature. We mention here only a few important contributions: Balaguer and Cantavella-Jordá (2002) as regards the case of Spain between 1975–1997; Durbarry (2004) in small island states such as Mauritius; Arslanturk and Atan (2012) and Gunduz and Hatemi-J (2005) in the case of Turkey, Hye and Khan (2013) and Jalil et al. (2013) in the case of Pakistan; Tang and Tan (2015) for Malaysia; Risso and Brida (2009) for Chile, Mishra et al. (2011) for India, or Su et al. (2021) referring to China. We can also mention Sanchez Carrera et al. (2008) regarding Mexico between 1980 and 2007, Bayramoğlu and Arı (2015) for Greece, over various time periods, or Bento (2016) for Portugal (1995–2015). All previously mentioned authors confirm that tourism development leads to economic growth. Moreover, Ohlan (2017), Jayathilake (2013), Srinivasan et al. (2012) support the hypothesis of economic growth driven by tourism (TLGH) for various countries in South and Southeast Asia (India, Sri Lanka, Pakistan, etc.).

Similarly, studies of even larger groups of countries have found a unidirectional causality from tourism to economic growth. The research of Çağlayan et al. (2012) in the case of 135 East and South Asian economies points to this unidirectional causality. By examining the impact that economic growth has upon international tourism during 1995–2015 in CEE economies, Badulescu et al. (2018) have found a long-run relationship between the number of international tourist arrivals and GDP per capita in the cases of Bulgaria, Croatia, Czech Republic, Estonia, Lithuania, Slovenia, Romania and Slovakia; they have also found a relationship between international tourism receipts and GDP per capita in the cases of Bulgaria, Croatia, Slovakia, Latvia, Estonia, Poland, Romania and Czech Republic. Lee and Chang (2008) state that TLGH is up held only in the case of OECD economies. Cárdenas-García et al. (2015), in their investigations on a number of 144 countries, have discovered that tourism often stimulates economic growth in developed economies. When attempting to investgate the impact of tourism on economic growth in the case of South-Eastern European countries, Selimi et al. (2017) identify a positive, but modest impact: for each 1% increase in tourist arrivals, GDP will only increase by about 0.08%. Finally, Tang and Tan (2017), by analyzing data from 167 countries, consider that tourism has a positive influence on economic growth, but it is strongly influenced by income levels and institutional qualities of tourism in host countries.

A second perspective (the growth-led tourism perspective – GLTH) is confirmed by Oh (2005) for the case of South Korea (for 1975–2001), claiming that "the results of cointegration tests indicate that there is no long-run equilibrium relationship between these two series" (Oh, 2005, p. 39). Similar findings come from Katircioglu (2009a) for Cyprus, Payne and Mervar (2010) in the case of Croatia (2000–2008), or Rivera (2017) when trying to assess the dynamic relationship between human development, economic growth and tourism in Ecuador.

The third perspective – of a bidirectional influence of tourism and economic growth – is found in the works of Dritsakis (2004), analyzing international tourism in Greece between 1960–2000, Ongan and Demiroz (2005) in the case of Turkey for 1980–2004, or Cortés-Jiménez et al. (2009) for Italy and Spain, between 1954 and 2000. By analyzing the case of Taiwan, Kim et al. (2006) have found a bi-directional causality between tourism and economic growth, which indicate that tourism and growth amplify each other. Other authors such as Tugcu (2014), in the case of Mediterranean countries between 1988 and 2011, Apergis and Payne (2012) for nine Caribbean countries, Dogru and Bulut (2018) for seven

European countries, and Lee and Chang (2008) for several non-OECD economies, confirm this bi-directional relationship between tourism sector and economic development.

Finally, the last hypothesis, which claims that there is no causality between tourism and economic growth, can be found in the papers of several authors: Brida et al. (2011) for several countries from Latin America, Ozturk and Acaravci (2009) for Turkey, Kasimati (2011) for Greece, Aslan (2014) for Malta and Egypt, Chou (2013) for Bulgaria, Romania and Slovenia. The relation between tourism and economic growth is considered insignificant or unconvincing by Katircioglu (2009b), and "unstable" by Jackman (2012).

1.2. The tourism-environment relationship: energy consumption and pollution

The relationship between the tourism sector and the environment is complicated, dynamic, and intertwined. Namely, tourism is dependent upon the quality of the environment, and if part of the revenues from tourism activities are redirected towards improving the quality of the environment, to the protection of natural sites, education, etc., this will lead to somewhat favorable mutual influences. In most cases, however, tourism generates considerable pressure on the environment, and as such, tourist travel (whether we are referring to road or air travel) contributes to an increase of greenhouse gas emissions and degrades air quality. Transport-related emissions from the tourism sector account for 5% of total global CO_2 emissions (UNWTO, 2019). Infrastructure development and expansion, together with an upgrade of accommodation and leisure spaces also lead to the degradation of local environmental factors (soil, air, water, natural diversity); such expansion activities can also result in an increased demand on natural resources (Cvelbar et al., 2016; Băndoi et al., 2020).

Gössling (2002) has aimed to analyze the major aspects brought forth by environmental changes associated with tourism and travel, leisure, and other tourism-related activities, concluding that the environmental consequences of these activities are considerable, and that developing countries will accumulate most of these negative consequences. Similarly, Gössling and Peeters (2015) warn of a faster growth of resource consumption (water, land) caused by an increase in tourism and international travel, stressing that current growth patterns in this sector are outdated and harmful to the environment and society.

Paramati et al. (2017), by considering and comparing the evolution and pattern of Foreign Direct Investments (FDIs), the commercial trade volume and tourism contribution to environmental degradation (CO_2 emissions), and GDP (Gross Domestic Product) growth in EU countries, assert that tourism contributes to the economic development of EU countries. On the other hand, the same authors also state that tourism affects the quality of the environment, and that this degradation manifests differently from one region to another. They conclude that tourism-related sustainable development policies are necessary for the development of the sector and of the economies of EU member states, such policies being pivotal for the protection of environmental quality and public health.

More specifically, Kort et al. (2002) emphasize the overall importance of environmental quality for the development of sustainable and qualitative tourism, and that implicitly, any investment in tourism and related activities affects the quality of the environment. Therefore, before addressing the issue of the (positive) influence of tourism on protecting the environment, investments in tourism must find a compromise or a balance between the quality of tourism services and maintaining a clean and healthy environment. Finally, Omri et al. (2015), while arguing that increases in tourist flows in MENA (Middle East and North Africa) countries have stimulated economic growth (i.e., the TLGH hypothesis); also consider that these flows have also affected the quality of the environment, the increase of resource consumption, etc.

Khan et al. (2020b), having addressed the causal relationship between tourism (and associated activities), economic growth (GDP, capital investments), energy consumption and environmental pollutants in developing economies, claim that economic growth supports the development of tourism and that tourist arrivals result in a significant and positive impact on energy consumption, on capital investment and on CO_2 emissions, and at the same time, the authors stress that increases in pollutant emissions (CO_2) will lead to negative effects on tourism. Subsequently, the authors state that sustainable tourism remains the only viable option for developing economies. In such situations (of developing countries) tourism has the potential of upholding an environmentally friendly economic development and where tourism policies can be integrated into all economic, environmental and energy policies in order to reduce to a minimum environmental pollution.

Dubois et al. (2011) have argued that the current global mobility, in which the tourism and travel industry play an important role, is leading to a considerable increase in harmful emissions into the atmosphere, thus affecting the natural environment and the diversity of the biosphere. Moreover, the impact can be lasting and difficult to combat, with irreversible effects, especially with regard to climate change.

The case of Spain, an economically developed European country that has traditionally had considerable tourist inflows, is often discussed in research on this topic. Hence, by researching the relationship between tourism and harmful emissions (CO_2, PM10), Saenz-de-Miera and Rossello (2014) have highlighted the negative externalities that can arise from tourism activities, which can lead to climate damage, pollution and abasement brought to the quality of life. However, they do consider that the impact of tourism, although noticeable in terms of CO_2 emissions, is not as impactful as the pressure manifested by the (resident) population and the increase in consumption needs (especially associated with PM10) which ultimately led to climate change and air pollution. Cadarso et al. (2015), examining the impact of domestic and international tourism on CO_2 emissions, have found that tourism significantly contributes to carbon emissions, and that both domestic and international tourism travel increases carbon emissions. Pablo-Romero et al. (2017) have investigated the connection between tourist stays and electricity consumption in Spain in the 1999–2013 time-period, their results refuting the EKC hypothesis. Tourism activity constantly increases energy consumption, and the quantities consumed significantly differ within the provinces. They argue that measures aimed at a more efficient consumption and the widespread use of renewable energy can improve the situation of the surrounding environment.

Similarly, Katircioglu et al. (2014) have analysed the relationship between tourism, energy, and carbon emissions in another well-known tourist destination, namely Cyprus, and have found that, in the long run, energy consumption and tourism have an impact upon the growth of CO_2 emissions. More specifically, tourism has a negative impact upon the surrounding environment and leads to an increase in energy use. Sherafatian-Jahromi et al.

(2017) validate the existence of EKC on a significant panel of Southeast Asian countries and show that tourism exerts a significant influence on environmental pollution. Finally, Ng et al. (2016), having analyzed the evolution of CO_2 emissions generated by electricity production, heating, and transport specifically for tourism activities in Malaysia, confirm a long-term association between these variables.

Although the arguments supporting a direct and causal relationship between the expansion of tourism and the increase in pollution and resource consumption are overwhelming, there are researchers who consider that these effects are not general and do not apply to all cases and for all timeframes; the same arguments supporting such a relationship claim that the effects are mixed. In this respect, Ozturk (2016) confirms the long-term connection between energy, environment, growth on one side, and tourism indicators on the other side, in 34 developed and developing countries. Moreover, the author emphasizes that health expenditure displays positive relationship with tourism indicators, whereas energy consumption has a negative association with the travel and tourism indicators in the region.

Jebli and Hadhri (2018), by using the VECM and causality approach for 10 tourist destinations, identified a one-way causal relationship between CO_2 and GDP, and a feedback response between energy and GDP, tourism, and growth. By accepting the statement that tourist arrivals supplement the amount of CO_2 emitted into the atmosphere, and, conversely, that the level of pollution can affect the arrivals of tourists, Tugcu and Topcu (2018) having made use of an ARDL approach on a panel data argue that the influence of various emissions on tourism related revenues is mixed for 10 tourist destinations.

Using the PCA technique that combines tourist arrivals, tourism receipts and international tourism expenditures in a tourism development index, Zaman et al. (2016) validate the inverted U-shaped relationship between carbon emissions and per capita income in 34 countries. The authors support the causal relationships between tourism, energy production and consumption, investment and carbon emissions, respectively, but they also favor the claim that economic growth, investment and healthcare spending will stimulate the growth of the tourism industry.

Sghaier et al. (2019) analyze the link between tourism growth and environmental quality as regards Morocco, Tunisia, and Egypt. Their findings suggest a long run association between tourism and GDP. Even so, this relationship is variable and is dependent on different contexts. What is more, the link between tourism development and the quality of the environment varies from country to country and over time. Azam et al. (2018) analyse the impact that tourism has on pollution levels in Malaysia, Thailand and Singapore, and find that the link is positive for Malaysia, but negative in the case of Thailand and Singapore.

The use and allocation of resources implies numerous effects not only upon the environment, but it also manages extend its reach to social and behavioural elements, affecting community sustainability and the work-force of regions. Kožić (2019) exemplifies on Croatian municipalities involved in tourism that tourism development can affect human capital. Meleddu et al. (2015) have shown that the relationship between the presence of tourists/tourism activities and the quality of life can range from acceptance and openness, to displeasure.

Tourism is an economic sector requiring a significant use of energy. Additionally, tourists consume energy to a greater extent than the resident population and oftentimes to the disadvantage of the latter (Earth Changers, 2019). It is easily estimated that, maintaining the current level of development (and more so if assuming sustained growth) that the energy consumption of the tourism sectory will increase. Of course, tourism is both an agent and a victim of climate change, but, should the sector not pay more attention to the use of renewable, non-polluting energy sources, the consequences will be severe not only for tourism businesses, but to the world population. Subsequently, the industry must be stimulated to accelerate a transition to renewable energy sources, reduced greenhouse gas emissions and innovative energy solutions in urban areas and transportation. Tourism and energy production should not be opposed to one another, but complementary, in the context of accessible renewable energy sources (solar, wind, hydropower employing rain- and tidal water or wave power, and geothermal heat). Finally, tourism is, or should be, at the forefront of campaigns searching for sustainable energy solutions (Earth Changers, 2019).

Serrano-Bernardo et al. (2012) highlight the reduction of pollutant and greenhouse gas emissions as an essential aspect of sustainability in the tourism and travel sector, but mention that, from a certain level, the decrease of greenhouse gas emissions originating from tourism mobility is economically unsustainable. Balancing sustainability with economic and satisfaction criteria can limit such initiatives, but likewise the existence of various approaches, solutions and a sense of responsibility can contribute to their success. Consequently, various policies and measures can be introduced in order to heighten the sustainability of tourism activities, as well as incentives and rewards for tourists and host communities (Serrano-Bernardo et al., 2012). Finally, directly supporting local communities to adopt practical strategies aiming at mitigating climate change, disease control and promoting healthy behaviours, reducing water and energy use, supporting waste collection, sorting and recycling, or conserving biodiversity, are all possible and can be successful. According to numerous specialists, implementing efficient energy solution synchronous with waste reduction (and implicitly reducing the amount of energy required to eliminate said waste) appears to be the quickest and most accessible approach to reduce fossil fuel use and could reduce direct energy consumption by a third (Indrawati, 2015). Implementing measures targeting an increased efficiency of energy production and use, and likewise promoting renewable energy sources, are feasible and necessary in developed and developing countries alike (Pablo-Romero et al., 2017). As an example, Ahmad et al. (2018) mentions that China's rapid economic development had a significant negative impact on the environment and suggests tourism as an alternative which takes into account both economic and environmental development, especially in western China, as a part of the One Belt One Road initiative (Ahmad et al., 2018). The authors suggest linking administrative measures and development plans with financial incentives (financial support, reduced taxation) for low-carbon footprint industries, reforming polluting industries, building a cleaner infrastructure and transport system, collaboration between regions and improving environmental quality. Other authors analyse the situation of Mediterranean islands facing similar issues and vulnerabilities in the relationship between tourism, sustainable development and energy use. To this end, renewable energy sources that are abundant in these islands can be employed effectively and adapted to modern challenges, in order to transform the islands into "qualitative tourism" sites (Evanthie, 2008).

1.3. The environment-tourism relationship: the asymmetry of consequences

The literature, especially published in the last 20 years, highlights the remarkable role of the tourism industry, as well as the value of a clean environment, in fostering economic progress and improving the quality of life. However, multiple contributions warn of the growing threat of environmental degradation due to the steady increase in tourist flows, leading to an uncontrolled increase in the consumption of resources, the degradation of unique natural sites and possible additional carbon emissions as a result of international tourist travel. Currently, evidence concerning the above-mentioned issues is mixed, as most studies have initially focused on developed countries. Gradually, given constant expansions and additions to literature, studies will also take into account developing countries, as well as the interdependencies that appear in the global economy and society.

Of course, most researchers agree that these effects of tourism on the local economy, social cohesion, quality of environment and quality of life (as perceived by the local community that inhabits the touristic destination) are manifested differently according to the stages of tourism development, and the life cycle phase of the tourist destinations (Bakker & Messerli, 2017; Mathew & Sreejesh, 2017) or given the level of development of the region or of the concerned country. More precisely, it seems that most of the positive effects are grouped or focused within tourist destinations in already developed areas/regions/countries, whereas in developing countries, local communities face a greater number of negative consequences (Ren et al., 2019; De Vita & Kyaw, 2016). In other words, the positive effects of tourism development are especially relevant for high-income per capita countries, while in low developed economies tourism does not contribute to economic development. Rauf et al. (2018) by analysing 47 countries involved in the Belt and Road Initiative (BRI), have proved that for the 1980–2016 period, increased production, energy consumption, urbanization etc. have all led to the aggravation of ecological problems. Most of these countries, which are generally considered developing countries, are facing a key development dilemma: even though they cannot ignore the harmful effects that development has upon the environment, the health of its population and even on the growth prospects of important, promising sectors (tourism, transport, etc.), in the same time, they can neither give up on the opportunities for economic development, international trade and, implicitly, for the growth of the well-being of their citizens. Thus, the authors argue that actions aimed at limiting the use energy sources based on the mass expansion of the green economy and renewable energy concepts and practices can, to some extent at least, mitigate the impact of pollution and environmental degradation in BRI countries.

When studying the relation between economic development, tourism, energy consumption and pollution over the last few decades, China is one of the most emblematic cases. On one hand, China's impressive development in this period has involved a huge consumption of resources and energy. Subsequently, China has sometimes dramatically worsened the quality of the environment, by accumulating waste and by generating huge quantities of harmful emissions. On the other hand, the natural attractions and cultural richness of this country make it an increasingly popular tourist destination, and efforts to modernize its infrastructure, urbanization and increase the quality of health services have all massively stimulated inflows of tourist (both domestic and international) in the area. As a result, we are witnessing the birth of new complex and dynamic relationships between general economic development, the expansion of tourism and the expectations of tourist consumers, the amount of energy consumed, and pollution levels. The sheer size of the Chinese territory, its geographical and environmental diversity and the unequal levels of development have all lead to an increasing literature on these topics. Hence, Tang et al. (2014) have found that, given the considerable increases in total emissions during 1990–2012, transportation sector generates 80% of the emission and the aggregate economic contribution of tourism sector and tourist travels are significantly higher than compared to their contribution to total CO_2 emissions. When attempting to quantify the impact of direct and indirect CO_2 emissions associated to tourism activities in China, Meng et al. (2016), Zhang and Gao (2016), Qiu et al. (2017) consider that tourism and travel have contributed to both economic growth and increase of CO_2 emissions, but to a much lesser extent as compared to other industry sectors; in the same time, the authors point out that the results are mixed at regional level. However, researchers agree that in large cities, pollution has a negative effect on tourism development. The same researchers share opportunistic views in regards to potential development: that this is the key to developing energy efficiency measures, green solutions, sustainability in the relationship between economic development, tourism and a clean environment (Liu et al., 2017; Shuai, et al., 2018). Some progress has gained momentum and is becoming increasingly visible, with significant differences existing between cities in terms of tourism development and environmental protection measures (Lu et al., 2018).

Ahmad et al. (2018) aimed to examine the impact that tourism poses on the environmental pollution of five Chinese provinces in the 1991–2016 period, by using the fully modified ordinary least squares (FMOLS) approach and the Gregory-Hansen test for robustness check. Their results confirm a negative impact of tourism on the environment for four of these provinces and, respectively, a positive one for the fifth. However, we must bear in mind the fact that the negative impact of energy consumption and economic development on the quality of the surrounding environment is significantly higher than that of tourism. In this respect, the authors acknowledge that the different results obtained are explained by both the specific characteristics of the provinces analysed, and also by government policies. What is more, the authors also favour the fact that the smart and sustainable development of tourism can improve economic and environmental sustainability in these provinces.

In other words, whether we are referring to highly developed countries with a traditional and prosperous tourism sector, or whether we are talking about developing countries, or even countries with struggling economies but which are hoping that tourism will contribute to an economic revitalization and improved living conditions for its inhabitants, the principles of sustainability become obvious. Sustainable tourism can no longer be considered (only) a "fashion statement", associated only with solitary environmentalists worried about the degradation of natural resources or some alarmists, or with opponents of development. It becomes a high-level economic policy agenda of international bodies, tourism associations, governments or the responsible population.

2. Data and methodology

To investigate the relationship between international tourism development (TOUR), GDP per capita (GDP), CO_2 emission (CO_2) and energy consumption (EC) in inside the EU 27, this study employs the Principal Component Analysis (PCA) technique and an autoregressive distributed lag (ARDL) model for the panel data. We aim to build a composite index of the international development of tourism, starting from the study conducted by Zaman et al. (2016); what is more, we aim to determine the relationship between this composite index and 3 factors, namely: GDP per capita, CO_2 emissions as well as energy consumption. To determine this composite index, we will make use of the PCA technique for the following three tourism development indicators: international tourism – receipts, international tourism – expenditures, and the number of international tourists' arrivals. We consider that by building a single relatively weighted index that includes all these 3 tourism development indicators, we will be able to capture to a greater extent the influence that economic growth and environmental conditions have on tourism development in the 27 EU countries. We used data from The World Bank database (2020). Given the limited availability and accessibility of the data for energy consumption and CO_2 emission variables, this study used data from the 1995–2016 period. In Table 1 we have presented the descriptive statistics for the six analysed indicators.

According to the data presented in Table 1, the variables come in a variety of statistical units. The international tourism – receipts and the international tourism – expenditure variables are measured in current US$, GDP per capita is measured in current international $, CO_2 emissions is measured in metric tons/capita, the energy consumption variable is measured in kg of oil equivalent/capita, while the international tourism arrivals variable is measured in number of tourists. Therefore, in order to be able to process these variables correctly, we have to place them on the same measurement scale. Also, given that we want to build a

Table 1. Descriptive statistics (source: own computations based on data provided by The World Bank database, 2020)

	International tourism			GDP per capita	CO_2 emissions	Energy consumption
	Receipts	Expenditures	Arrivals			
	current US$	current US$	Number	current international $	metric tons / capita	kg of oil equivalent / capita
Mean	11411964189	9478255231	12285875.42	172046.3625	7.88	3504.99
Median	4984000000	2878000000	5604500	28936.1103	7.30	3150.79
Std. Dev.	15568447731	17027764555	17743427.12	558851.1806	3.51	1718.60
Skewness	3.860203113	12.69225272	5.431944363	22.74620354	4.87	38.15
Kurtosis	2.123070535	3.389698958	2.421400445	4.826218361	1.79	3.94
Minimum	37000000	724000	509000	4426.046335	2.68	1591.66
Maximum	71656000000	105691000000	84452000	3622416.42	24.824	24579
Observation	594	594	594	594	594	594

composite index of tourism development, before the variables are aggregated into composite indicators, they must be standardized or normalized (Freudenberg, 2003). In our study, we will use the standardization according to which all variables are converted to a common scale that assumes a "normal" distribution (i.e. an average of 0 and a standard deviation of 1).

The first descriptions of the PCA technique were given by Pearson (1901) and developed independently by Hotelling (1933). This analysis of the main components is used so as to compress the dimensionality of a larger dataset in which there are interrelated variables, by keeping the variation present in the dataset. Therefore, the PCA calculates new variables called principal components (PCs). These PCs are obtained as linear combinations of the initial variables (Larouse, 2006). This PCA technique has been analyzed over several decades by other authors such as (Rao, 1964; Cattell, 1966; Wold et al., 1987; Jolliffe, 2002), which is the best modern reference, and also by Jolliffe and Cadima (2016).

In order for this PCA technique to be relevant, a testing step is required to determine the adequacy of the data for such a method. Thus, a series of tests have been developed to help us determine whether or not there is a correlation in order to perform such an analysis. A first test would be the Kaiser-Meyer-Olkin (KMO) statistic, followed by Bartlett's test of sphericity. The PCA analysis is adequate if the value of KMO statistics is at least 0.5 (Kaiser, 1974), higher than 0.5 (Field, 2000; Lebart et al., 2006; Hair et al., 2010); respectively the value of KMO must be at least 0.6 or higher as according to (Pallant, 2013). A second test which has been used is Bartlett's test of sphericity, with the hypothesis $H_{0,q}$: $\lambda_{q+1} = \lambda_{q+2} = \ldots = \lambda_p$ and the alternative hypothesis: at least two of the last (p-q) eigenvalues are different (Jolliffe, 2002). An extremely low p-value will indicate the rejection of the $H_{0,q}$ (i.e., the variables are correlated). Therefore, if p-values < 0.05, there is sufficient correlations between the variables and therefore the PCA analysis is adequate (Hair et al., 1995; Larouse, 2006; Pallant, 2013; Field, 2000).

The most commonly used procedures for determining the number of components are the Kaiser criterion (Kaiser, 1960), where only those components with an Eigenvalue value greater than 1 are retained, and the scree test first proposed by Cattell (1966), that recommend to keep only those components above the inflection point on a plot of decreasing ordered eigenvalues.

In order to determine if there was a sufficiently high correlation to perform the PCA analysis, we have applied the adequacy measure of the KMO sampling and the Bartlett test of sphericity.

According to the results presented in Table 2, the KMO statistic has a value of 0.523, which is higher than 0.5. Therefore, according to Hair et al. (1995), this test considers that the level of correlation is sufficient for a PCA. Because the p-value for Bartlett's test of sphericity is 0.0000, the null hypothesis is rejected, and as such, we accept the alternative hypothesis according to which the variables are correlated. Consequently, we proceed with the PCA technique.

In this subsection, we intend to construct a composite index in order to evaluate international tourism development in the 27 EU countries, by using the PCA technique for the panel data. This composite index will be determined by using EViews10 software.

Table 2. KMO and Bartlett's Test (source: own computations using EViews 10)

KMO Measure of Sampling Adequacy		0.523
Bartlett's Test of Sphericity	Approx. Chi-Square	1715.340
	Df	3
	Significance	0.0000

Table 3. Eigenvalues of the principal components (source: own computations using EViews 10)

PCA
Period: 1995 2016
Observations: 594
Computed using: Ordinary correlations

Eigenvalues: (Sum = 3, Average = 1)				Cumulative	Cumulative
Number	Value	Difference	Percentage	Value	percentage
1	2.483700	2.014545	0.8279	2.483700	0.8279
2	0.469154	0.422008	0.1564	2.952854	0.9843
3	0.047146	–	0.0157	3.000000	1.0000

In Table 3, the eigenvalues and the cumulative percentage of variance for the 3 principal components are presented. According to Kaiser's criterion (Kaiser, 1960), only the components that have the eigenvalues greater than 1 will be kept in the model. Therefore, as per this criterion, we will retain only the first principal component ($\lambda_1 = 2.48$). Regarding the cumulative percentage of variance, although there is no fixed threshold, certain percentages have been suggested over time. Thus, according to Hair et al. (1995), as natural sciences are concerned, factors should not be stopped until the variance is explained for at least 95%, while as per social sciences, the explained variance accounts for 60% of the total variance. Therefore, by taking into account the cumulative percentage of variance presented in Table 3, we can ratify and confirm that the first principal component explains 82.79% of the information contained in the underlying correlation matrix, the second, explains 15.64% and the third, 1.57%.

The results presented in Table 3, are plotted in a simple line plot, namely the Scree plot. The Scree plot (Figure 1) shows that only the first component is representative, whereas the other two components have values that tend towards zero.

As regards the covering proportion, we can maintain that the first principal components preserve 82.79% of the total variance. Thus, if we want to reduce the dimensionality of our original variables, our analysis indicates that we can reach more than half the basic dimensionality problem from 3 to 1, while retaining almost 83% of the original information.

In order to determine which variables, have the highest influence on each component, we have used a loading plot. Loadings can take values between –1 and 1. Thus, Loadings close to –1 or close to 1 show that the variable has a strong influence on the component, whereas Loadings close to 0 show that the variable weakly influences the component. Within the coordinates system of the two components, powerfully correlated variables are presented and what is more, the nature of each principal component is determined. As we can see, Component 1 is strongly correlated to all three tourism indicators, the Loadings being closer to 1 (Table 4).

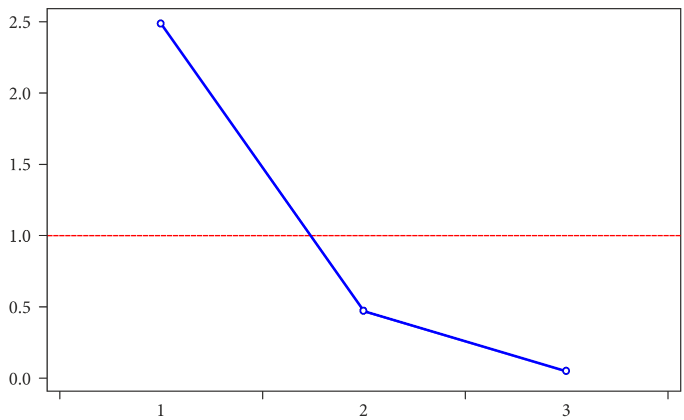

Figure 1. Eigenvalues of the principal components
(source: own computations using EViews 10)

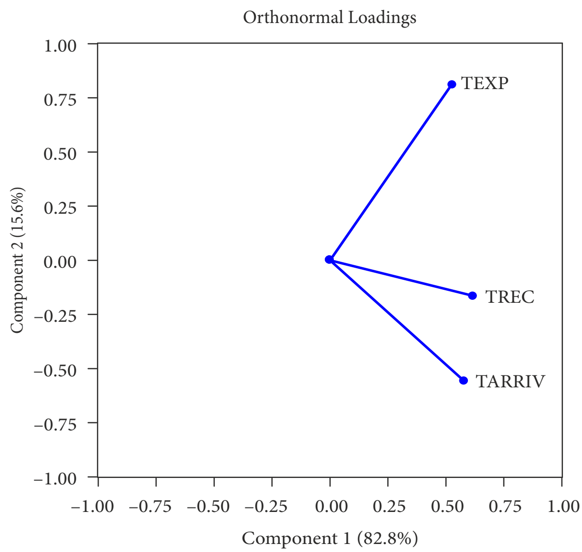

Figure 2. The main principals' components based on the financial determining factors
(source: own computations using EViews 10)

Table 4. Component Matrix (source: own computations using EViews 10)

	Component 1
International tourism – receipts	0.980
International tourism – expenditures	0.829
International tourism – number of arrivals	0.915

It is noted that the new principal component shows a very strong and positive correlations with all three-initial variables, correlations which are all over 80%. The highest influence is represented by International tourism receipts (98%), followed by International tourism – number of arrivals with a weight of 91.5% and finally, by International tourism expenditures, with a weight of 82.9%. The same conclusion was drawn following the analysis of Figure 2.

In the first part of the Table 5, we presented the eigenvectors associated with each of the principal eigenvalues and the proportion of the eigenvector length assigned to that variable. These eigenvectors are used to calculate the scores of the principal components and consist of coefficients corresponding to each variable. The higher the absolute value of these coefficients, the greater the importance of a variable in a principal component. The relative importance of a variable in a principal component is the proportion of the length of the eigenvectors assigned to that variable.

According to the results presented in the first part of Table 5, we can see that only in the case of PC1 we have positive coefficients, whereas in the case of PC2 and PC3, some of the coefficients are negative and have a low influence. Consequently, in our study we will use only the first principal component for the construction of the composite index of the international development of tourism. In the second part of the Table 5 we have presented the ordinary correlation between the tourism indicators. The results indicate that the international tourism receipts variable has a strong and positive correlation with both international tourism – expenditures and international tourism – arrivals, while between international tourism – expenditures and international tourism – arrivals we have identified a medium and positive correlation as regards the EU countries.

Table 5. Eigenvectors of the principal components (source: own computations using EViews 10)

PCA Period: 1995 2016 Observations: 594 Computed using: Ordinary correlations Eigenvectors (loadings):			
Variables	PC1	PC2	PC3
International tourism – receipts (TREC)	0.621548 (0.386)	–0.165509 (0.027)	–0.765692 (0.586)
International tourism – expenditures (TEXP)	0.526069 (0.276)	0.812427 (0.660)	0.251423 (0.063)
International tourism – number of arrivals (TARRIV)	0.580456 (0.336)	–0.559078 (0.312)	0.592032 (0.350)
Ordinary correlations:	TREC	TEXP	TARRIV
International tourism – receipts (TREC)	1.000000		
International tourism – expenditures (TEXP)	0.739952	1.000000	
International tourism – number of arrivals (TARRIV)	0.918113	0.552346	1.000000

Note: In parenthesis we have calculated the proportion of the eigenvector length assigned to that variable.

3. ARDL model for panel data

The next purpose of our paper is to analyse the long-run and short-run role, as well as the impact of different factors on the tourism development index by using an ARDL model for panel data. The autoregressive distributed lag (ARDL) model reveals both long-run and short run dynamics between the variables. An ARDL (*p*, *q*, *q*, ... *q*) model can be written as follows:

$$y_{it} = \sum_{j=1}^{p} \delta_j y_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} X_{i,t-j} + \varphi_i + e_{it}. \quad (1)$$

In the above formula, y_{it} is the dependent variable, X_{it} is a $k \times 1$ vector of independent variables, δ_j is the coefficient of the lagged dependent variable, β'_{ij} is a $k \times 1$ coefficient vector, φ_i is the unit specific fixed effects, $i = \overline{1,N}$ $t = \overline{1,T}$ p and q are optimum lag orders and e_{it} is the error term.

Starting from the initial model, a re-parameterized ARDL (*p*, *q*, *q*, ... *q*) error correction model will be specified as:

$$\Delta y_{it} = \theta_i \left[y_{i,t-1} - \lambda'_i X_{i,t} \right] + \sum_{j=1}^{p-1} \xi_{ij} y_{i,t-j} + \sum_{j=0}^{q-1} \beta'_{ij} \Delta X_{i,t-j} + \varphi_i + e_{it}. \quad (2)$$

This will reveal the long run relationship between the variables.

In the above formula, we have the following:

$\theta_i = -(1 - \delta_i)$ group specific speed of adjustment; λ'_i = vector of longrun relationship; ECT = $\left[y_{i,t-1} - \lambda'_i X_{i,t} \right]$ the error correction term; ξ_{ij} and β'_{ij} are the short run dynamic coefficients.

The variables used in our model are: the composite index of the international development of tourism computed as explained previously, GDP per capita, CO_2 emissions as well as energy consumption.

In our model, we also want to include the GDP squared in order to determine whether at the level of EU countries there is a U-shaped relationship (concave or convex) between GDP and the tourism index.

We will begin our analysis by checking the correlations between the variables.

The coefficients in Table 6 point to the fact that there is a significant and positive correlation between the tourism development composite index and GDP per capita, CO_2 emissions as well as energy consumption.

Table 6. Spearman's rho rank order correlation (source: own computations using SPSS 16)

	GDP per capita	CO_2 Emissions	Energy consumption	Tourism development composite index
GDP per capita	1			
CO_2 emissions	0.321**	1		
Energy consumption	0.488**	0.721**	1	
Tourism development composite index	0.437**	0.130**	0.269**	1

Note: **Correlation is significant at the 0.01 level (2-tailed).

Table 7. Panel data unit root tests (source: own computations using EViews 10)

	Tourism Index (no constant, no trend)		CO_2 emissions (no constant, no trend)		Energy consumption (with constant and trend)		GDP per capita (with constant and trend)	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	132.52*	–	70.64	465.56*	62.42	294.19*	49.75	146.29*
PP	198.36*	–	52.01	522.6*	56.97	828.06*	21.39	161.60*
LLC	–5.33*	–	–1.64	–21.16*	–3.18	–17.02*	–2.87	–9.54*

Note: The null hypothesis: the unit root exists. *refers that: "the rejection of the null hypothesis at 1% I(0) indicate at the level and I(1) at first difference".

The ARDL/Bounds Testing methodology of Pesaran et al. (1999) and Pesaran et al. (2001) has several advantages over the conventional cointegration testing. For example, data employed in an ARDL model can be either I(0) or I(1). The presence of a trend or of a constant different than zero in all the variables was first investigated. A Dickey and Fuller (1979), as well as Phillips and Perron (1988) unit root tests revealed that all the four variables are either I(0) or I(1), as seen in Table 7.

A Levin et al. (2002) unit root test was also employed to test the presence of a common unit root process. The Schwarz info criterion was used for optimal lag length selection.

Starting from the composite index of the international development of tourism, GDP per capita, CO_2 emissions as well as energy consumption, we have stated and tested the following hypotheses:

H1: At the level of UE countries, there is a short-run relationship between tourism and GDP per capita, CO_2 emissions as well as energy consumption.

H2: At the level of UE countries, there is a long-run relationship between tourism and GDP per capita, CO_2 emissions, energy consumption

H3: At the level of EU countries, there is a U-shaped relationship between GDP and the tourism index

H4: At the level of EU countries, GDP per capita, CO_2 emissions as well as energy consumption is a cause for tourism development.

4. Results and discussions

The Bound test proposed by Pesaran et al. (2001) was chosen to reveal the cointegration between the variables, since this test allows for an optimal lag order structure that can minimize the serial correlation problems that might appear. Since cointegration tests are sensitive to the number of lags, we have first explored the best lag length by using a vector autoregressive (VAR) lag order selection criterion. After running an unrestricted VAR model for the data, the SIC (Schwaz Info Criterion) indicated an optimal lag length equal to 2.

The Pedroni Residual Cointegration test (Pedroni, 1999, 2004) is the most commonly used test for investigating cointegration in panel data because it takes care of the cross-sectional dependence, by allowing considerable heterogeneity. The Pedoni residual cointegration test was run with the assumption of no deterministic trend. Since 7 of the 11 statistics presented in Table 8 are statistically significant and indicate the rejection of null hypothesis of no cointegration, we conclude that the considered variables are cointegrated and that there is a long-term correlation between the tourism index, energy consumption, CO_2 emissions and GDP per capita.

The findings presented in Table 9 suggest that in the short run, CO_2 emissions do not influence the composite tourism development index (p = 0.2948), but that energy consumption (p = 0.0467), as well as GDP per capita (p = 0.0065) and that the squared GDP (0.00657) all have a positive impact on the index. Therefore, the results confirm the first hypothesis (H1) of this study in case of GDP per capita and energy consumption. By considering the long run results, all variables that have been taken into account have a statistically significant impact on the composite tourism development index: CO_2 emissions negatively influence the index and energy consumption has a positive impact on the index (on the long-run). Therefore,

Table 8. Data cointegration analysis (source: own computations using EViews 10)

Alternative hypothesis: common AR coefficients (within-dimension)				
			Weighted	
Panel	Statistic value	Probability	Statistic value	Probability
v-Statistic	1.900620	0.0287	−0.379970	0.6480
rho-Statistic	−0.217461	0.4139	0.131365	0.5523
PP-Statistic	−6.370663	0.0000	−5.666156	0.0000
ADF-Statistic	−6.924327	0.0000	−6.885374	0.0000
Alternative hypothesis: individual AR coefficients (between-dimension)				
Group	Statistic value	Probability		
rho-Statistic	1.908725	0.9719		
PP-Statistic	−5.807994	0.0000		
ADF-Statistic	−7.570719	0.0000		

Table 9. Panel ARDL model estimations (source: own computations using EViews 10)

Dependent Variable: Composite tourism development index					
	Long run coefs.			Short-run coefs.	
Variable	Coefficient	T – statistic	Variable	Coefficient	T – statistic
CO_2	−0.6131***	0.0000	COINTEQ01	−0.0831***	0.0675
ENERGY	0.6932***	0.0004	D(CO_2)	0.1001	0.2948
GDP per capita	−0.2539*	0.0566	D(ENERGY)	−0.3264**	0.0467
GDP per capita ^2	0.0301**	0.0354	D(GDP per capita)	2418.243***	0.0065
			D(GDP per capita^2)	4716.559***	0.0067
			C	0.0876*	0.0787

Note: ***The coefficient is significant at a level of 0.01 (2-tailed). **The coefficient is significant at a level of 0.05 (2-tailed). *The coefficient is significant at a level of 0.1 (2-tailed).

the results confirm the second hypothesis (H2) of this study. Furthermore, in the case of the relationship between GDP per capita and the tourism index, we can accept the existence of a U-shaped relationship (convex curvature), since the value of the squared GDP coefficient is positive and p = 0.0354. Therefore, we can conclude that in the long-run, under the influence of GDP per capita, the tourism index has the tendency to initially decrease and then increase over time the third hypothesis (H3) is confirmed. The diagnostic tests confirms that the model fulfils the requirements for a valid one. The Jarque-Bera normality test revealed the lack of normality but Thadewald and Bunning (2007) affirm that the findings are not prejudiced. The error correction term (ECT) from the long-run representation is statistically significant at a level of 0.1.

The analysis of the cross section results on short run have revealed an entirely opposite situation to the one presented at the panel level (Table 10). CO_2 emissions have a significant impact on the composite tourism development index in most cases (except for the cases of Germany, France, Greece, Croatia, Italy, Holland, Poland, Portugal and Spain). In Belgium, Bulgaria, Czech Republic, Estonia, Finland, Lithuania, and Slovenia, CO_2 emissions negatively influence the index, while in Austria, Cyprus, Denmark, Hungary, Ireland, Luxembourg, Montenegro, Romania, Slovakia and Sweden, CO_2 emissions have a positive and a statistically significant impact on the composite tourism development index.

Energy consumption has a statistically significand short run impact on the composite tourism development index in 13 countries. In Belgium, Estonia, Lithuania and Slovenia, the energy consumption has a positive impact on the short run, while in the Czech Republic, Denmark, Cyprus, Hungary, Ireland, Luxemburg, Montenegro, Romania, and Sweden, the energy consumption has a negative impact on the composite tourism development index. Regarding the influence of GDP on the tourism index, when referring to countries separately (not group of countries as is the EU 27), we notice that in the short run, this indicator does not have a statistically significant influence on the index.

There are several causality tests that are used in literature, the most known being the Granger (1969) test, as well as the Dumitrescu and Hurlin (2012) test. To examine the direction of causality in our panel data, we will use the Dumitrescu and Hurlin test, given that we want the cross-sectional dependence also account for.

Starting from the results presented in Table 11, the composite index of tourism development is a cause for CO_2 emissions, for energy consumption, as well as for an increase of GDP. Hence, economic development, energy consumption and CO_2 emissions do not influence the composite index of tourism development, but GDP per capita influences the index. In conclusion, for the EU 27 countries, we have identified a unidirectional causality that runs from the tourism index to energy consumption and from the tourism index to CO_2 emissions. Regarding the issue of GDP per capita and tourism index, we have identified a bidirectional causality. Therefore, the results confirm the fourth hypothesis (H4) only in case of the GDP.

Considering the results obtained at the level of the panel data, we consider that a grouping of countries according to the composite index of tourism, respectively according to GDP could capture to a greater extent the relationship between tourism development and GDP, CO_2 emission and energy consumption. These groups of countries, being more homogeneous, could provide more information on the intensity of the connection, the meaning of the connection, and the short- and long-term relationship between the analysed variables.

Table 10. Cross section short run coefficients (source: own computations using EViews 10)

Country	CO_2		Energy		GDP		GDP^2	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Austria	0.81*	0.07	–0.82	0.23	1977.04	1.00	4194.63	1.00
Belgium	–0.97**	0.02	0.85*	0.10	2154.26	1.00	4530.67	1.00
Bulgaria	–0.05**	0.01	0.02	0.50	1326.98	1.00	2255.63	1.00
Cyprus	0.25***	0.00	–0.43***	0.01	421.25	0.99	790.94	1.00
Czech Rep.	–0.32***	0.00	0.43***	0.00	4.31	0.63	–2.74	0.80
Germany	0.95	0.89	–1.35	0.90	7231.57	1.00	14689.78	1.00
Denmark	0.05**	0.02	–0.17*	0.10	–7.95	0.88	14.44	0.91
Estonia	–0.02***	0.00	0.07***	0.00	–110.48	1.00	–201.79	1.00
Finland	–0.01***	0.01	–0.0004	0.97	318.78	0.98	662.83	0.99
France	–0.11	0.98	–1.84	0.82	14457.85	1.00	28932.96	1.00
Greece	–0.45	0.43	0.04	0.98	1768.94	1.00	3239.68	1.00
Croatia	–0.08	0.31	–0.04	0.85	9.17	0.98	1.68	1.00
Hungary	0.27**	0.01	–0.27**	0.04	0.64	0.36	–0.07	0.99
Ireland	0.50**	0.02	–1.36**	0.04	–134.90	0.99	–324.45	1.00
Luxemburg	0.05***	0.00	–0.06***	0.00	0.02	1.00	–2.51	0.99
Italy	1.06	0.20	–1.21	0.40	12657.93	1.00	25152.27	1.00
Lithuania	–0.006**	0.03	0.01***	0.00	–33.20	1.00	–73.80	1.00
Montenegro	0.04***	0.00	–0.06***	0.00	171.06	0.99	302.38	0.99
Holland	–1.008	0.13	0.92	0.12	898.81	1.00	1917.98	1.00
Poland	0.30	0.39	0.15	0.90	49.73	1.00	5.27	1.00
Portugal	0.07	0.55	–0.50	0.42	5265.08	1.00	9567.52	1.00
Romania	0.15***	0.00	–0.11***	0.00	628.45	0.99	1096.33	0.99
Slovakia	0.01*	0.07	0.01	0.28	168.28	1.00	263.81	1.00
Slovenia	–0.11***	0.00	0.23***	0.00	499.83	0.98	919.42	0.99
Sweden	0.21***	0.00	–0.08**	0.02	–2.80	0.96	6.02	0.94
Spain	1.03	0.48	–3.15	0.57	15549.78	1.00	29386.05	1.00

Note: ***The coefficient is significant at the level of 0.01 (2-tailed). **The coefficient is significant at the level of 0.05 (2-tailed). *The coefficient is significant at the level of 0.1 (2-tailed).

Table 11. Dumitrescu Hurlin Panel Causality Test (source: own computations using EViews 10)

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
ENERGY does not homogeneously cause CO_2	4.70603*	4.62451	4.E-06
CO_2 does not homogeneously cause ENERGY	5.05731*	5.30185	1.E-07
GDPPC does not homogeneously cause CO_2	6.49057*	8.06548	7.E-16
CO_2 does not homogeneously cause GDPPC	2.34896	0.07958	0.9366
TOURISM_INDEX does not homogeneously cause CO_2	6.99284*	9.03396	0.0000
CO_2 does not homogeneously cause TOURISM_INDEX	2.62903	0.61960	0.5355
GDPPC does not homogeneously cause ENERGY	5.06575*	5.31811	1.E-07
ENERGY does not homogeneously cause GDPPC	2.33372	0.05019	0.9600
TOURISM_INDEX does not homogeneously cause ENERGY	5.41965*	6.00052	2.E-09
ENERGY does not homogeneously cause TOURISM_INDEX	3.10595	1.53921	0.1238
TOURISM_INDEX does not homogeneously cause GDPPC	3.62800*	2.54583	0.0109
GDPPC does not homogeneously cause TOURISM_INDEX	5.67306*	6.48914	9.E-11

Conclusions

Studies concerning tourism and economic growth are numerous, but even so, literature is much poorer when it comes to analyzing the relationship between tourism, economic growth, resource consumption and environmental pollution. When taken together in more complex and long-term models, literature becomes even scarcer. Knowing all the implications related to the development of the tourism industry, the UNWTO (2018, p. 5) emphasizes that the objective for the years to come aims to maximize the social and economic benefits of tourism and to minimize the negative impact on host communities and the environment. The OECD (2020a, p. 16) supports a "greater focus on the environmental and socio-cultural pillars of sustainability". It is obvious that sustainable tourism development can be achieved through a close collaboration between governments, businesses, and individuals, by raising awareness and by increasing involvement for the ensuring of this goal.

In our study, we have examined the relationship between tourism development and economic growth, CO_2 emissions, and energy consumption in the panel of the 27 countries from the European Union. For tourism development, we have used three main indicators, namely: international tourism receipts, international tourism expenditures, international tourism arrivals and have constructed a weighted index that would include the information of all these three indicators into a single factor. In order to determine this index, we have used the principal component analysis. Afterwards, we have computed the tourism index, by analyzing the long and short run relationships between this index and economic growth, CO_2 emissions and energy consumption. For this, an ARDL model for panel data has been used. The results suggest that in the short-run, at panel level, the energy consumption and the economic growth have a statistically significant impact on the tourism index, whereas CO_2 emissions do not influence the tourism index on the short-run. In the long run, all the indicators have a statistically significant impact on the tourism index. Namely, CO_2 emissions and GDP per capita, have had a negative impact on the tourism index, while energy consumption and the squared GDP per capita have had a positive impact. The positive coefficient of the squared GDP has showed us that on the long-run, the tourism index has the tendency to initially decrease and then increase over time, under the influence of GDP per capita. We have also applied the Dumitrescu and Hurlin test in order to determine the causal relationship between these indicators. At panel level, the results suggest a unidirectional causality that runs from: the tourism index to CO_2 emissions, the tourism index to energy consumption and a bidirectional causality between the tourism index and GDP per capita. The main limitations of this study were the difficulty of obtaining a comprehensive data set for a long time, both for measuring the tourism phenomenon, but especially for measuring environmental indicators and also the small number of independent variables. Thus, the time period considered was reduced to 21 years, which limited the econometric methods we could use. These limitations, while not discrediting the results of this analysis, could be overcome by identifying a larger number of independent variables and constructing composite indices for measuring environmental indicators.

We consider that our paper only partly confirms similar studies, which determines us to continue our research on the subject in the future, by taking into account more economic variables and influences, as well as, if possible, longer analysis timeframes. Ultimately, the most important limitation of our study is the relative short length of the time series used (which is also encountered in other analyses), since the earliest available data for the tourism indicators in Romania stem from 1995.

Authors contribution

The paper is a result of a collaborative work. DB, RS and AB conceived the study, DB, AB, MS and DPB reviewed the literature, RS, IM and SD did the data analysis. DB, RS, IM and AB wrote the first draft. All authors revised the paper and prepared the final article.

Disclosure statement

Authors declare they have no competing financial, professional, or personal interests from other parties.

References

Ahmad, F., Draz, M., Su, L., Ozturk, I., & Rauf, A. (2018). Tourism and environmental pollution: Evidence from the one belt one road provinces of Western China. *Sustainability*, *10*(10), 3520. https://doi.org/10.3390/su10103520

Alam, S., & Paramati, S. (2016). The impact of tourism on income inequality in developing economies: Does Kuznets curve hypothesis exist? *Annals of Tourism Research*, *61*, 111–126. https://doi.org/10.1016/j.annals.2016.09.008

Apergis, N., & Payne, J. (2012). Tourism and growth in the Caribbean – Evidence from a panel error correction model. *Tourism Economics*, *18*(2), 449–456. https://doi.org/10.5367/te.2012.0119

Arslanturk, Y., & Atan, S. (2012). Dynamic relation between economic growth, foreign exchange and tourism incomes: An econometric perspective on Turkey. *Journal of Business Economics & Finance*, *1*(1), 30–37. Retrieved October 6, 2020, from https://dergipark.org.tr/en/pub/jbef/issue/32421/360527

Aslan, A. (2014). Tourism development and economic growth in the Mediterranean countries: Evidence from panel Granger causality tests. *Current Issues in Tourism*, *17*(4), 363–372. https://doi.org/10.1080/13683500.2013.768607

Azam, M., Mahmudul Alam, M., & Haroon Hafeez, M. (2018). Effect of tourism on environmental pollution: Further evidence from Malaysia, Singapore and Thailand. *Journal of Cleaner Production*, *190*, 330–338. https://doi.org/10.1016/j.jclepro.2018.04.168

Badulescu, A., Badulescu, D., & Simut, R. (2018). The complex relationship between international tourism demand and economic growth: An analysis on Central and Eastern European economies. *Amfiteatru Economic*, *20*(12), 935–950. https://doi.org/10.24818/EA/2018/S12/935

Badulescu, A., Badulescu, D., Simut, R., & Dzitac, S. (2020). Tourism – economic growth nexus. The case of Romania. *Technological and Economic Development of Economy*, *26*(4), 867–884. https://doi.org/10.3846/tede.2020.12532

Bakker, M., & Messerli, H. (2017). Inclusive growth versus pro-poor growth: Implications for tourism development. *Tourism and Hospitality Research*, *17*(4), 384–391. https://doi.org/10.1177/1467358416638919

Balaguer, J., & Cantavella-Jordá, M. (2002). Tourism as a long-run economic growth factor: The Spanish case. *Applied Economics*, *34*(7), 877–884. https://doi.org/10.1080/00036840110058923

Băndoi, A., Jianu, E., Enescu, M., Axinte, G., Tudor, S., & Firoiu, D. (2020). The relationship between development of tourism, quality of life and sustainable performance in EU countries. *Sustainability*, *12*(4), 1628. https://doi.org/10.3390/su12041628

Bayramoğlu, T., & Arı, Y. (2015). The relationship between tourism and economic growth in Greece economy: A time series analysis. *Computational Methods in Social Sciences*, *3*(1), 89–93. https://ideas.repec.org/a/ntu/ntcmss/vol3-iss1-15-089.html

Bento, J. (2016). Tourism and economic growth in Portugal: An empirical investigation of causal links. *Tourism & Management Studies*, *12*(1), 164–171. https://doi.org/10.18089/tms.2016.12117

Brida, J., Monterubbianesi, P., & Zapata-Aguirre, S. (2011). The impacts of tourism on economic growth and development: The case of the main Colombian destinations. *PASOS. Revista de Turismo y Patrimonio Cultural*, *9*(2), 291–303. http://www.pasosonline.org/Publicados/9211/PASOS24.pdf

Buckley, R. (2012). Sustainable tourism: Research and reality. *Annals of Tourism Research*, *39*(2) 528–546. https://doi.org/10.1016/j.annals.2012.02.003

Butler, R. (1999). Sustainable tourism: A state-of-the-art review. *Tourism Geographies*, *1*(1), 7–25. https://doi.org/10.1080/14616689908721291

Cadarso, M., Gómez, N., López, L., Tobarra, M., & Zafrilla, J. (2015). Quantifying Spanish tourism's carbon footprint: The contributions of residents and visitors: A longitudinal study. *Journal of Sustainable Tourism*, *23*(6), 922–946. https://doi.org/10.1080/09669582.2015.1008497

Çağlayan, E., Şak, N., & Karymshakov, K. (2012). Relationship between tourism and economic growth: A Panel Granger Causality approach. *Asian Economic and Financial Review*, *2*(5), 591–602. http://www.aessweb.com/pdf-files/591-602.pdf

Canteiro, M., Córdova-Tapia, F., & Brazeiro, A. (2018). Tourism impact assessment: A tool to evaluate the environmental impacts of touristic activities in Natural Protected Areas. *Tourism Management Perspectives*, *28*, 220–227. https://doi.org/10.1016/j.tmp.2018.09.007

Cárdenas-García, P., Sánchez-Rivero, M., & Pulido-Fernández, J. (2015). Does tourism growth influence economic development? *Journal of Travel Research*, *54*(2), 206–221. https://doi.org/10.1177/0047287513514297

Cattell, R. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, *1*(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

Chou, M. (2013). Does tourism development promote economic growth in transition countries? A panel data analysis. *Economic Modelling*, *33*, 226–232. https://doi.org/10.1016/j.econmod.2013.04.024

Corbet, S., O'Connell, J., Efthymiou, M., Guiomard, C., & Lucey, B. (2019). The impact of terrorism on European tourism. *Annals of Tourism Research*, *75*, 1–17. https://doi.org/10.1016/j.annals.2018.12.012

Cortés-Jiménez, I., Pulina, M., Riera i Prunera, C., & Artis, M. (2009). *Tourism and Exports as a means of Growth* (IREA Working Papers 200910). University of Barcelona, Research Institute of Applied Economics. https://ideas.repec.org/p/ira/wpaper/200910.html

Cvelbar, L., Dwyer, L., Koman, M., & Mihalič, T. (2016). Drivers of destination competitiveness in tourism. *Journal of Travel Research*, *55*(8), 1041–1050. https://doi.org/10.1177/0047287515617299

de Lange, D., & Dodds, R. (2017). Increasing sustainable tourism through social entrepreneurship. *International Journal of Contemporary Hospitality Management*, *29*(7), 1977–2002. https://doi.org/10.1108/IJCHM-02-2016-0096

De Vita, G., & Kyaw, K. (2016). Tourism development and growth. *Annals of Tourism Research*, *60*, 23–26. https://doi.org/10.1016/j.annals.2016.05.011

Dickey, D., & Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366), 427–431. https://doi.org/10.2307/2286348

Dogru, T., & Bulut, U. (2018). Is tourism an engine for economic recovery? Theory and empirical evidence. *Tourism Management*, *67*, 425–434. https://doi.org/10.1016/j.tourman.2017.06.014

Dritsakis, N. (2004). Tourism as a long-run economic growth factor: An empirical investigation for Greece using causality analysis. *Tourism Economics*, *10*(3), 305–316. https://doi.org/10.5367/0000000041895094

Droj, L., Droj, G., & Ban, O. (2020, May 4–6). Geospatial and financial analysis of the tourism sector in Romania. In *25th Biennial International Congress. Tourism & Hospitality Industry 2020, Trends and Challenges, Opatija, Croatia. Congress Proceedings* (pp. 92–106). Faculty of Tourism & Hospitality Management, University of Rijeka. https://www.cabdirect.org/cabdirect/abstract/20210089205

Dubois, G., Peeters, P., Ceron, J., & Gössling, S. (2011). The future tourism mobility of the world population: Emission growth versus climate policy. *Transportation Research Part A: Policy and Practice*, *45*(10), 1031–1042. https://doi.org/10.1016/j.tra.2009.11.004

Dumitrescu, E., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, *29*(4), 1450–1460. https://doi.org/10.1016/j.econmod.2012.02.014

Durbarry, R. (2004). Tourism and economic growth: The case of Mauritius. *Tourism Economics*, *10*(4), 389–401. https://doi.org/10.5367/0000000042430962

Earth Changers. (2019). *Sustainable energy*. Retrieved May 08, 2021, from https://www.earth-changers.com/purpose/sustainable-energy

Evanthie, M. (2008). Using renewable energy as a tool to achieve tourism sustainability in Mediterranean islands. *Études caribéennes*, 11. https://doi.org/10.4000/etudescaribeennes.3487

Fantinato, F. (2019). The impact of (mass) tourism on coastal dune pollination networks. *Biological Conservation*, *236*, 70–78. https://doi.org/10.1016/j.biocon.2019.05.037

Field, A. (2000). *Discovering statistics using SPSS for Windows.* Sage Publications. http://index-of.co.uk/Discovering-Statistics/Field2000(Chapter1).pdf

Freudenberg, M. (2003). *Composite indicators of country performance: A critical assessment* (STI Working Paper 2003/16). Organisation for Economic Co-Operation and Development (OECD). https://www.researchgate.net/publication/273697960_Composite_Indicators_of_Country_Performance_A_Critical_Assessment

Gavrilut, D. (2018). Innovation as part of European development. In *Emerging Markets Economics and Business. Contributions of Young Researchers. Proceedings of the 9th International Conference of Doctoral Students and Young Researchers* (pp. 121–124). http://steconomiceuoradea.ro/wp/wp-content/uploads/2014/01/Volum-doctoranzi-2018.pdf

Gössling, S. (2002). Global environmental consequences of tourism. *Global Environmental Change*, *12*(4), 283–302. https://doi.org/10.1016/S0959-3780(02)00044-4

Gössling, S., & Peeters, P. (2015). Assessing tourism's global environmental impact 1900–2050. *Journal of Sustainable Tourism*, *23*(5), 639–659. https://doi.org/10.1080/09669582.2015.1008500

Granger, C. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, *37*(3), 424–438. https://doi.org/10.2307/1912791

Greco, G., Cenciarelli, V., & Allegrini, M. (2018). Tourism's impacts on the costs of municipal solid waste collection: Evidence from Italy. *Journal of Cleaner Production*, *177*, 62–68. https://doi.org/10.1016/j.jclepro.2017.12.179

Gunduz, L., & Hatemi-J, A. (2005). Is the tourism-led growth hypothesis valid for Turkey? *Applied Economics Letters*, *12*(8), 499–504. https://doi.org/10.1080/13504850500109865

Hair, J., Anderson, R., Tatham, R., & Black, W. (1995). *Multivariate data analysis* (4th ed.). Prentice-Hall Inc. https://dl.acm.org/doi/10.5555/207590

Hair, J., Black, W., Babin, B., & Anderson, R. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Pearson. https://www.researchgate.net/publication/237009923_Multivariate_Data_Analysis_A_Global_Perspective

Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. *Journal of Educational Psychology*, *24*(6), 417–441. https://doi.org/10.1037/h0071325

Hye, Q., & Khan, R. (2013). Tourism-led growth hypothesis: A case study of Pakistan. *Asia Pacific Journal of Tourism Research*, *18*(4), 303–313. https://doi.org/10.1080/10941665.2012.658412

Ilieş Al., Dehoorne, O., & Ilieş, D. C. (2012), The cross-border territorial system in Romanian-Ukrainian Carpathian Area. Elements, mechanisms and structures generating premises for an integrated cross-border territorial system with tourist function. *Carpathian Journal of Environmental Sciences*, *7*(1), 27–38. https://www.academia.edu/10711435/The_Cross-Border_territorial_system_in_Romanian-Ukrainian_Carpathian_area._Elements_mechanisms_and_structures_generating_premises_for_an_integrated_cross-border_territorial_system_with_tourist_function

Indrawati, S. M. (2015). *What you need to know about energy and poverty*. Retrived May 09, 2021, from https://blogs.worldbank.org/voices/what-you-need-know-about-energy-and-poverty

Jackman, M. (2012). Revisiting the tourism-led growth hypothesis for Barbados: A disaggregated market approach. *Regional and Sectoral Economic Studies*, *12*(2), 15–26. https://ideas.repec.org/a/eaa/eerese/v12y2012i2_3.html

Jalil, A., Mahmood, T., & Idrees, M. (2013). Tourism-growth nexus in Pakistan: Evidence from ARDL bounds tests. *Economic Modelling*, *35*, 185–191. https://doi.org/10.1016/j.econmod.2013.06.034

Jayathilake, P. (2013). Tourism and economic growth in Sri Lanka: Evidence from cointegration and causality analysis. *International Journal of Business*, *Economics and Law*, *2*(2), 22–27. http://ijbel.com/wp-content/uploads/2014/06/Tourism-And-Economic-Growth-In-Sri-Lanka-%E2%80%93-Evidence-From-Cointegration-And-Causality-Analysis-P.M.-Bandula-Jayathilake.pdf

Jebli, M., & Hadhri, W. (2018). The dynamic causal links between CO_2 emissions from transport, real GDP, energy use and international tourism. *International Journal of Sustainable Development* & *World Ecology*, *25*(6), 568–577. https://doi.org/10.1080/13504509.2018.1434572

Jolliffe, I. (2002). *Principal component analysis* (2nd ed.). Springer-Verlag Press.

Jolliffe, I., & Cadima, J. (2016). Principal component analysis: A review and recent developments. *Philosophical Transactions. Series A*, *Mathematical*, *Physical*, *and Engineering Sciences*, *374*(2065), 20150202. https://doi.org/10.1098/rsta.2015.0202

Kaiser, H. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, *20*(1), 141–151. https://doi.org/10.1177/001316446002000116

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika*, *39*, 31–36. https://doi.org/10.1007/BF02291575

Kasimati, E. (2011). Economic impact of tourism on Greece's economy: cointegration and causality analysis. *International Research Journal of Finance and Economics*, *79*, 79–85. http://www.internationalresearchjournaloffinanceandeconomics.com/ISSUES/IRJFE_Issue_79.htm

Katircioglu, S. (2009a). Tourism, trade and growth: The case of Cyprus. *Applied Economics*, *41*(21), 2741–2750. https://doi.org/10.1080/00036840701335512

Katircioglu, S. (2009b). Revising the tourism-led-growth hypothesis for Turkey using the bounds test and Johansen approach for cointegration. *Tourism Management*, *30*(1), 17–20. https://doi.org/10.1016/j.tourman.2008.04.004

Katircioglu, S., Feridun, M., & Kilinc, C. (2014). Estimating tourism-induced energy consumption and CO_2 emissions: The case of Cyprus. *Renewable and Sustainable Energy Reviews*, *29*, 634–640. https://doi.org/10.1016/j.rser.2013.09.004

Katsoni, V. (2017). An investigation into the sharing economy phenomenon in the Greek tourism industry in the accommodation sector. *Journal of Tourism and Regional Development*, *7*, 5–12. https://scholar.google.co.th/citations?view_op=view_citation&hl=th&user=Go8djJwAAAAJ&citation_for_view=Go8djJwAAAAJ:z_wVstp3MssC

Khan, A., Bibi, S., Lorenzo, A., Lyu, J., & Babar, Z. (2020a). Tourism and development in developing economies: A policy implication perspective. *Sustainability*, *12*(4), 1618. https://doi.org/10.3390/su12041618

Khan, A., Bibi, S., Ardito, L., Lyu, J., Hayat, H., & Arif, A. (2020b). Revisiting the dynamics of tourism, economic growth, and environmental pollutants in the emerging economies – Sustainable tourism policy implications. *Sustainability*, *12*(6), 2533. https://doi.org/10.3390/su12062533

Kim, H., Chen, M.-H., & Jang, S. (2006). Tourism expansion and economic development: The case of Taiwan. *Tourism Management*, *27*(5), 925–933. https://doi.org/10.1016/j.tourman.2005.05.011

Köberl, J., Prettenthaler, F., & Bird, D. (2016). Modelling climate change impacts on tourism demand: A comparative study from Sardinia (Italy) and Cap Bon (Tunisia). *Science of the Total Environment*, *543*(part B), 1039–1053. https://doi.org/10.1016/j.scitotenv.2015.03.099

Koçak, E., Ulucak, R., & Ulucak, Z. (2020). The impact of tourism developments on CO_2 emissions: An advanced panel data estimation. *Tourism Management Perspectives*, *33*, 100611. https://doi.org/10.1016/j.tmp.2019.100611

Kort, P., Greiner, A., Feichtinger, G., Haunschmied, J., Novak, A., & Hartl, R. (2002). Environmental effects of tourism industry investments: an intertemporal trade-off. *Optimal Control Applications and Methods*, *23*(1), 1–19. https://doi.org/10.1002/oca.692

Kožić, I. (2019). Can tourism development induce deterioration of human capital? *Annals of Tourism Research*, *77*, 168–170. https://doi.org/10.1016/j.annals.2018.12.018

Larouse, D. (2006). *Data mining. Methods and models.* John Wiley & Sons. https://onlinelibrary.wiley.com/doi/book/10.1002/0471756482

Lebart, L., Piron, M., & Morineau, A. (2006). *Statistique exploratoire multidimensionnelle. Visualisation et inférence en fouille de données* (4th ed.). Dunod. https://www.dunod.com/sciences-techniques/statistique-exploratoire-multidimensionnelle-visualisation-et-inference-en

Lee, C.-C., & Chang, C.-P. (2008). Tourism development and economic growth: A closer look at panels. *Tourism Management*, *29*(1), 180–192. https://doi.org/10.1016/j.tourman.2007.02.013

Levin, A., Lin, C., & Chu, C. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1–24. https://doi.org/10.1016/S0304-4076(01)00098-7

Liu, J., Zhang, J., & Fu, Z. (2017). Tourism eco-efficiency of Chinese coastal cities – Analysis based on the DEA-Tobit model. *Ocean & Coastal Management*, *148*, 164–170. https://doi.org/10.1016/j.ocecoaman.2017.08.003

Lu, C., Li, W., Pang, M., Xue, B., & Miao, H. (2018). Quantifying the economy-environment interactions in tourism: Case of Gansu Province, China. *Sustainability*, *10*(3), 711. https://doi.org/10.3390/su10030711

Madiyarova, A., Ziyadin, S., Blembayeva, A., & Doszhan, R. (2018). Modern trends in digitalization of tourism industry. In *Proceedings of the 32nd International Business Information Management Association Conference, IBIMA 2018 – Vision 2020: Sustainable Economic Development and Application of Innovation Management from Regional expansion to Global Growth* (pp. 7990–7997).

Martin-Rios, C. (2019). *Sustainable tourism: The 10 most important trends in 2020*. Retrieved October 2, 2020, from https://hospitalityinsights.ehl.edu/sustainable-tourism-trends

Mathew, P., & Sreejesh, S. (2017). Impact of responsible tourism on destination sustainability and quality of life of community in tourism destinations. *Journal of Hospitality and Tourism Management*, *31*, 83–89. https://doi.org/10.1016/j.jhtm.2016.10.001

Meleddu, M., Royuela, V., Biagi, B., & Ladu, M. (2015). *Tourism and quality of life: A capability approach* (Working Paper CRENoS 201519). Centre for North South Economic Research, University of Cagliari and Sassari, Sardinia. https://ideas.repec.org/p/cns/cnscwp/201519.html

Meng, W., Xu, L., Hu, B., Zhou, J., & Wang, Z. (2016). Quantifying direct and indirect carbon dioxide emissions of the Chinese tourism industry. *Journal of Cleaner Production*, *126*, 586–594. https://doi.org/10.1016/j.jclepro.2016.03.067

Mishra, P., Rout, H., & Mohapatra, S. (2011). Causality between tourism and economic growth: Empirical evidence from India. *European Journal of Social Sciences*, *18*(4), 518–527. https://www.researchgate.net/publication/280305614_Causality_between_tourism_and_economic_growth_Empirical_evidence_from_india

Ng, T., Lye, C., & Lim, Y. (2016). A decomposition analysis of CO_2 emissions: Evidence from Malaysia's tourism industry. *Internationl Journal of Sustainable Development* & *World Ecology*, *23*(3), 266–277. https://doi.org/10.1080/13504509.2015.1117534

OECD. (2020a). *OECD tourism trends and policies 2020*. Retrieved July 12, 2020, from https://doi.org/10.1787/6b47b985-en

OECD. (2020b). *Rebuilding tourism for the future: COVID-19 policy responses and recovery*. Retrieved January 20, 2021, from http://www.oecd.org/coronavirus/policy-responses/rebuilding-tourism-for-the-future-covid-19-policy-responses-and-recovery-bced9859/

Oh, C.-O. (2005). The contribution of tourism development to economic growth in the Korean economy. *Tourism Management*, *26*(1), 39–44. https://doi.org/10.1016/j.tourman.2003.09.014

Ohlan, R. (2017). The relationship between tourism, financial development and economic growth in India. *Future Business Journal*, *3*(1), 9–22. https://doi.org/10.1016/j.fbj.2017.01.003

Omri, A., Shahbaz, M., Chaibi, A., & Rault, C. (2015). *A panel analysis of the effects of oil consumption*, *international tourism*, *environmental quality and political instability on economic growth in MENA region* (Working Paper 2015–613). Department of Research, Ipag Business School, Paris. https://ideas.repec.org/p/ipg/wpaper/2015-613.html

Ongan, S., & Demiroz, D. (2005). The contribution of tourism to the long-run Turkish economic growth. *Ekonomický časopis* (*Journal of Economics*), *53*(9), 880–894. http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.9ad9f1f3-3f76-340f-b771-2f191e29997e

Ozturk, I. (2016). The relationships among tourism development, energy demand, and growth factors in developed and developing countries. *International Journal of Sustainable Development* & *World Ecology*, *23*(2), 122–131. https://doi.org/10.1080/13504509.2015.1092000

Ozturk, I., & Acaravci, A. (2009). On the causality between tourism growth and economic growth: Empirical evidence from Turkey. *Transylvanian Review of Administrative Sciences*, *25*(5), 73–81. https://rtsa.ro/tras/index.php/tras/article/view/193/189

Pablo-Romero, M., Pozo-Barajas, R., & Sánchez-Rivas, J. (2017). Relationships between tourism and hospitality sector electricity consumption in Spanish Provinces (1999–2013). *Sustainability*, *9*(4), 480. https://doi.org/10.3390/su9040480

Page, S., Yeoman, I., Munro, C., Connell, J., & Walker, L. (2006). A case study of best practice – visit Scotland's prepared response to an influenza pandemic. *Tourism Management*, *27*(3), 361–393. https://doi.org/10.1016/j.tourman.2006.01.001

Pallant, J. (2013). *SPSS survival manual. A step by step guide to data analysis using SPSS* (5th ed.). Allen & Unwin. www.allenandunwin.com/spss

Papatheodorou, A., Rosselló, J., & Xiao, H. (2010). Global economic crisis and tourism: Consequences and perspectives. *Journal of Travel Research*, *49*(1), 39–45. https://doi.org/10.1177/0047287509355327

Pappas, N., & Papatheodorou, A. (2017). Tourism and the refugee crisis in Greece: Perceptions and decision-making of accommodation providers. *Tourism Management*, *63*, 31–41. https://doi.org/10.1016/j.tourman.2017.06.005

Paramati, S., Shahbaz, M., & Alam, M. (2017). Does tourism degrade environmental quality? A comparative study of Eastern and Western European Union. *Transportation Research Part D: Transport and Environment*, *50*, 1–13. https://doi.org/10.1016/j.trd.2016.10.034

Payne, J., & Mervar, A. (2010). Research note: The tourism–growth nexus in Croatia. *Tourism Economics*, *16*(4), 1089–1094. https://doi.org/10.5367/te.2010.0014

Pearson, K. (1901). On lines and planes of closest fit to systems of points in space. *The London*, *Edinburgh. and Dublin Philosophical Magazine and Journal of Science*, *2*(11), 559–572. https://doi.org/10.1080/14786440109462720

Pedroni, P. (1999). Critical values for cointegration tests in heterogenous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, *61*(S1), 653–670. https://onlinelibrary.wiley.com/doi/10.1111/1468-0084.0610s1653

Pedroni, P. (2004). Panel cointegration: Asymptotic and finite sample properties of pooled time series tests, with an application to the PPP hypothesis. *Econometric Theory*, *20*(3), 597–625. https://www.cambridge.org/core/journals/econometric-theory/article/panel-cointegration-asymptotic-and-finite-sample-properties-of-pooled-time-series-tests-with-an-application-to-the-ppp-hypothesis/F31DA49F3109F20315298A97EB46A47E

Pesaran, M., Shin, Y., & Smith, R. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*(446), 621–634. https://doi.org/10.2307/2670182

Pesaran, M., Shin, Y., & Smith, R. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616

Phillips, P., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Qiu, X., Fang , Y., Yang, X., & Zhu, F. (2017). Tourism eco-efficiency measurement, characteristics, and its influence factors in China. *Sustainability*, *9*(9), 1634. https://doi.org/10.3390/su9091634

Rao, C. (1964). The use and interpretation of principal component analysis in applied research. *Sankhyā: The Indian Journal of Statistics*, *Series A* (*1961–2002*), *26*(4), 329–358. Retrieved March 13, 2021, from http://www.jstor.org/stable/25049339

Rauf, A., Liu, X., Amin, W., Ozturk, I., Rehman, O., & Sarwar, S. (2018). Energy and ecological sustainability: challenges and panoramas in belt and road initiative countries. *Sustainability*, *10*(8), 2743. https://doi.org/10.3390/su10082743

Ren, T., Can, M., Paramati, S., Fang, J., & Wu, W. (2019). The impact of tourism quality on economic development and environment: Evidence from Mediterranean countries. *Sustainability*, *11*(8), 2296. https://doi.org/10.3390/su11082296

Risso, W., & Brida, J. (2009). The contribution of tourism to economic growth: An empirical analysis for the case of Chile. *European Journal of Tourism Research*, *2*(2), 178–185. https://ssrn.com/abstract=1298404

Ritchie, B., & Jiang, Y. (2019). A review of research on tourism risk, crisis and disaster management: Launching the annals of tourism research curated collection on tourism risk, crisis and disaster management. *Annals of Tourism Research*, *79*, 102812. https://doi.org/10.1016/j.annals.2019.102812

Ritchie, J., & Crouch, G. (2003). *The competitive destination: A sustainable tourism perspective*. Wallingford, U.K.: CABI. https://doi.org/10.1079/9780851996646.0000

Rivera, M. A. (2017). The synergies between human development, economic growth, and tourism within a developing country: An empirical model for Ecuador. *Journal of Destination Marketing* & *Management*, *6*(3), 221–232. https://doi.org/10.1016/j.jdmm.2016.04.002

Saenz-de-Miera, O., & Rossello, J. (2014). Modeling tourism impacts on air pollution: The case study of PM10 in Mallorca. *Tourism Management*, *40*, 273–281. https://doi.org/10.1016/j.tourman.2013.06.012

Sanchez Carrera, E., Brida, J., & Risso, W. (2008). Tourism's impact on long-run Mexican economic growth. *Economics Bulletin*, *23*(21), 1–8. https://doi.org/10.2139/ssrn.1076225

Selimi, N., Sadiku, L., & Sadiku, M. (2017). The impact of tourism on economic growth in the Western Balkan countries: An empirical analysis. *International Journal of Business and Economic Sciences Applied Research*, *10*(2), 19–25. https://doi.org/10.25103/ijbesar.102.02

Serrano-Bernardo, F. A., Bruzzi, L., Toscano, E. H., & Rosúa-Campos, J. L. (2012). *Pollutants and greenhouse gases emissions produced by tourism life cycle: Possible solutions to reduce emissions and to introduce adaptation measures*. IntechOpen. https://doi.org/10.5772/50418

Sghaier, A., Guizani, A., Ben Jabeur, S., & Nurunnabi, M. (2019). Tourism development, energy consumption and environmental quality in Tunisia, Egypt and Morocco: A trivariate analysis. *GeoJournal*, *84*, 593–609. https://doi.org/10.1007/s10708-018-9878-z

Sherafatian-Jahromi, R., Othman, M., Law, S., & Ismail, N. (2017). Tourism and CO_2 emissions nexus in Southeast Asia: New evidence from panel estimation. *Environment*, *Development and Sustainability*, *19*, 1407–1423. https://doi.org/10.1007/s10668-016-9811-x

Shuai, C., Chen, X., Wu, Y., Tan, Y., Zhang, Y., & Shen, L. (2018). Identifying the key impact factors of carbon emission in China: Results from a largely expanded pool of potential impact factors. *Journal of Cleaner Production*, *175*, 612–623. https://doi.org/10.1016/j.jclepro.2017.12.097

Sigala, M. (2020). Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research. *Journal of Business Research*, *117*, 312–321. https://doi.org/10.1016/j.jbusres.2020.06.015

Sio-Chong, U., & Yuk-Chow, S. (2020). The impacts of financial and non-financial crises on tourism: Evidence from Macao and Hong Kong. *Tourism Management Perspectives*, *33*, 100628. https://doi.org/10.1016/j.tmp.2019.1006288

Sönmez, S. (1998). Tourism, terrorism, and political instability. *Annals of Tourism Research*, *25*(2), 416–456. https://doi.org/10.1016/S0160-7383(97)00093-5

Srinivasan, P., Kumar, P., & Ganesh, L. (2012). Tourism and economic growth in Sri Lanka: An ARDL bounds testing approach. *Environment and Urbanization Asia*, *3*(2), 397–405. https://doi.org/10.1177/0975425312473234

Steiger, R., & Scott, D. (2020). Ski tourism in a warmer world: Increased adaptation and regional economic impacts in Austria. *Tourism Management*, *77*, 104032. https://doi.org/10.1016/j.tourman.2019.104032

Su, Y., Cherian, J., Sial, M., Badulescu, A., Thu, P., Badulescu, D., & Samad, S. (2021). Does tourism affect economic growth of China? A panel granger causality approach. *Sustainability*, *13*(3), 1349. https://doi.org/10.3390/su13031349

Tang, C., & Tan, E. (2015). Does tourism effectively stimulate Malaysia's economic growth? *Tourism Management*, *46*, 158–163. https://doi.org/10.1016/j.tourman.2014.06.020

Tang, C., & Tan, E. (2017). Tourism-led growth hypothesis: A new global evidence. *Cornell Hospitality Quarterly*, *59*(3), 304–311. https://doi.org/10.1177/1938965517735743

Tang, Z., Shang, J., Shi, C., Liu, Z., & Bi, K. (2014). Decoupling indicators of CO_2 emissions from the tourism industry in China: 1990–2012. *Ecological Indicators*, *46*, 390–397. https://doi.org/10.1016/j.ecolind.2014.06.041

Thadewald, T., & Büning, H. (2007). Jarque–Bera test and its competitors for testing normality – A power comparison. *Journal of Applied Statistics*, *34*(1), 87–105. https://doi.org/10.1080/02664760600994539

The World Bank. (2020). *World Bank Open Data*. Retrieved April 20, 2020, from https://data.worldbank.org/

Tugcu, C. (2014). Tourism and economic growth nexus revisited: A panel causality analysis for the case of the Mediterranean Region. *Tourism Management*, *42*, 207–212. https://doi.org/10.1016/j.tourman.2013.12.007

Tugcu, C., & Topcu, M. (2018). The impact of carbon dioxide (CO_2) emissions on tourism: Does the source of emission matter? *Theoretical and Applied Economics*, *XXV*, 125–136. http://store.ectap.ro/articole/1324.pdf

Wold, S., Esbensen, K., & Geladi, P. (1987). Principal component analysis. *Chemometrics and Intelligent Laboratory Systems*, *2*(1–3), 37–52. https://doi.org/10.1016/0169-7439(87)80084-9

World Tourism Organization. (2018). *UNWTO Annual report 2017*. Retrieved July 17, 2020, from https://www.e-unwto.org/doi/pdf/10.18111/9789284419807

World Tourism Organization. (2019). *Transport-related CO_2 emissions of the tourism sector. Modelling results*. Retrieved July 20, 2020, from https://www.e-unwto.org/doi/pdf/10.18111/9789284416660

World Tourism Organization. (2020a). *Global tourism dashboard. Global and regional tourism performance*. Retrieved July 11, 2020, from https://www.unwto.org/global-and-regional-tourism-performance

World Tourism Organization. (2020b). *World Tourism Barometer*, *18*(3). Retrieved July 22, 2020, from https://www.e-unwto.org/doi/pdf/10.18111/wtobarometereng.2020.18.1.3

World Tourism Organization. (2020c). *Impact assessment of the Covid-19 outbreak on international tourism*. Retrieved February 3, 2021, from https://www.unwto.org/impact-assessment-of-the-covid-19-outbreak-on-international-tourism

World Tourism Organization. (2021). *2020: A year in review*. Retrieved February 3, 2021, from https://www.unwto.org/covid-19-and-tourism-2020

World Travel & Tourism Council. (2020a). *Global economic impact* & *trends 2020*. Retrieved July 11, 2020, from https://wttc.org/Research/Economic-Impact

World Travel & Tourism Council. (2020b). *Initiatives: Sustainable growth*. Retrieved July 4, 2020, from https://wttc.org/Initiatives/Sustainable-Growth

Zaman, K., Shahbaz, M., Loganathan, N., & Raza, S. (2016). Tourism development, energy consumption and Environmental Kuznets Curve: Trivariate analysis in the panel of developed and developing countries. *Tourism Management*, *54*, 275–283. https://doi.org/10.1016/j.tourman.2015.12.001

Zenker, S., & Kock, F. (2020). The coronavirus pandemic – A critical discussion of a tourism research agenda. *Tourism Management*, *81*, 104164. https://doi.org/10.1016/j.tourman.2020.104164

Zenker, S., von Wallpach, S., Braun, E., & Vallaster, C. (2019). How the refugee crisis impacts the decision structure of tourists: A cross-country scenario study. *Tourism Management*, *71*, 197–212. https://doi.org/10.1016/j.tourman.2018.10.015

Zhang, J.-T., Xiang, C., & Li, M. (2012). Integrative ecological sensitivity (IES) applied to assessment of eco-tourism impact on forest vegetation landscape: A case from the Baihua Mountain Reserve of Beijing, China. *Ecological Indicators*, *18*, 365–370. https://doi.org/10.1016/j.ecolind.2011.12.001

Zhang, L., & Gao, J. (2016). Exploring the effects of international tourism on China's economic growth, energy consumption and environmental pollution: Evidence from a regional panel analysis. *Renewable and Sustainable Energy Reviews*, *53*, 225–234. https://doi.org/10.1016/j.rser.2015.08.040