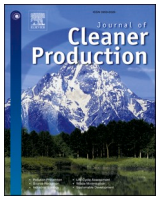
Journal of Cleaner Production 478 (2024) 143947

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Unpacking the economic impact of tourism: A multidimensional approach to sustainable development

Ceyhun Elgin [a,b,*], Adem Yavuz Elveren [c,d]

[a] American University in Bulgaria, USA
[b] Bogazici University, Turkey
[c] Fitchburg State University, USA
[d] Izmir University of Economics, Turkey

ARTICLE INFO

Handling Editor: Shen Qu

Keywords:
Sustainable development
Tourism revenue
Tourist arrivals
Panel data
Cross-country analysis

ABSTRACT

While the literature has extensively explored the advantages and drawbacks of tourism, as well as attempts to establish connections between growth/development and tourism, comprehensive studies addressing the sustainable development impact of tourism remain scarce. Addressing this gap, our investigation focuses on understanding the association between tourism and the achievement of sustainable development goals. Using a panel dataset encompassing 160 economies from 1995 to 2019, we explore the link between two distinct measures of tourism (tourist arrivals as a fraction of total population and tourism revenue as a percentage of total exports) and various indicators of sustainable development, encompassing health, economy, education, social progress, and the environment. Our findings reveal a significant interaction between tourism and sustainable development, with the relationship notably differing between developed and developing economies, particularly in light of GDP per capita. Our research addresses a critical gap in existing literature by focusing on the sustainable development implications of tourism, an area where comprehensive studies remain scarce. By analyzing the complex relationship between tourism and sustainable development across diverse economies, our study provides valuable insights for policymakers and stakeholders seeking to navigate the challenges of balancing economic growth with environmental and social sustainability.

1. Introduction

Tourism stands as a formidable global industry, exerting profound economic, social, and environmental influences. Its impact has reshaped economies, molded cultural landscapes, and guided policy decisions worldwide. However, amidst its expansion, concerns about sustainability have escalated, and the existing literature has failed to reach a consensus on the relationship between sustainability and tourism. Balancing the economic advantages of tourism with its potential adverse effects on the environment and society necessitates a deep understanding of the relationship between tourism and sustainable development.

Achieving sustainable development requires a delicate equilibrium between fostering economic growth, enhancing societal welfare, and preserving the environment. The multi-dimensional nature of tourism positions it both as a potential contributor to and detractor from Sustainable Development Goals (SDGs). Tourism has traditionally been seen as a driving force behind progress and growth (Sharpley, 2020). It stands as one of the largest sectors, with annual international tourist arrivals skyrocketing from 687 million in 2000 to 1.401 billion in 2018 and projected to reach 1.8 billion by 2030 (UNWTO, 2019). The concept of sustainable development, introduced in the Brundtland Report, has prompted policymakers and researchers to explore pathways that meet present needs without compromising future generations' abilities to achieve their needs (WCED, 1987, p 16). Subsequently, 'sustainable tourism' emerged, with the goal of balancing economic, ecological, and social needs while considering the impacts of tourism.

This study aims to address the gap in the literature by providing a comprehensive analysis of the intricate relationship between tourism and sustainable development. By spanning both time and geography, our research employs a robust methodological approach to investigate this relationship across 160 economies from 1995 to 2019. Utilizing a panel dataset, we explore two distinct measures of tourism—tourist arrivals as a fraction of the total population and tourism revenue as a percentage of total exports—and their association with various

* Corresponding author. American University in Bulgaria, USA.
E-mail addresses: celgin@aubg.edu (C. Elgin), aelveren@fitchburgstate.edu (A.Y. Elveren).

https://doi.org/10.1016/j.jclepro.2024.143947
Received 1 April 2024; Received in revised form 14 September 2024; Accepted 10 October 2024
Available online 14 October 2024

indicators of sustainable development, including health, economy, education, social progress, and the environment.

Our methodological framework incorporates advanced statistical analyses, including regression models and Principal Component Analysis (PCA), to elucidate the nuanced patterns and interactions between tourism activity and sustainable development outcomes. This comprehensive approach allows us to uncover differential effects based on a country's GDP per capita, providing valuable insights into how tourism's impact varies between developed and developing economies.

In summary, our empirical findings highlight a notable correlation between tourism and sustainable development, with significant variations depending on a country's GDP per capita. Specifically, in countries with relatively lower GDP per capita, tourism appears to be linked with reduced levels of health and environmental sustainability. Conversely, in developed nations, tourism seems to have a positive impact on these sustainability pillars.

This study makes several innovative contributions to the existing literature on tourism and sustainable development. Unlike previous studies that predominantly focus on either the economic benefits or environmental impacts of tourism in isolation, our analysis adopts a comprehensive approach, considering a broad range of sustainable development indicators across multiple dimensions. By examining the simultaneous influence of tourism on health, education, social welfare, and environmental sustainability, we provide a holistic understanding of the complex dynamics at play.

Our research delves into the role of GDP per capita as a key moderating factor, uncovering differential effects of tourism on sustainable development outcomes between developed and developing economies. This novel insight advances the current understanding of the tourism-sustainable development nexus and offers valuable implications for policy formulation and practice. Policymakers can use these findings to tailor tourism policies that maximize benefits and mitigate adverse effects, particularly in developing economies where the negative impacts of tourism on health and environmental sustainability are more pronounced.

By addressing these critical aspects, our study not only contributes to the academic discourse but also provides practical guidance for achieving a more balanced and sustainable approach to tourism development.

The structure of the remainder of the paper is as follows: We provide an extensive literature review in the next section, delving into both the adverse and beneficial impacts of tourism across different parameters. In the third section, we introduce the data and empirical approaches. Section four then presents and discusses the estimations. Lastly, in the conclusion section, we provide a concise overview of our key findings.

2. Literature review

The capacity of tourism to influence sustainable development has gained prominence in connection with the SDGs of the 2030 Agenda (Hughes and Scheyvens, 2016). This underscores tourism's responsibility to foster global development and sustainability. While these SDGs, such as economic growth (SDG 8), sustainable consumption and production (SDG 12), and ocean conservation (SDG 14), are crucial for tourism, they offer only a limited perspective on the tourism-sustainable development relationship (Saarinen, 2020).

Given the economic significance and expansion of tourism, there exists an extensive body of literature exploring its various impacts at different levels Nevertheless, alongside the interest in these impacts, there is a rising apprehension surrounding the long-term viability and growth limitations of the tourism industry (Gössling et al., 2012, 2018; Saarinen, 2015; Sharpley, 2020). Despite the extensive literature how tourism impacts economic growth and the environment, comprehensive studies are scarce (Cárdenas-García and Pulido-Fernández, 2019).

Sustainable development, as defined in 'Our Common Future,' is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). The interpretation of sustainable tourism has evolved, shifting from an early focus solely on environmental concerns to encompass a broader development approach that considers society and the economy as well (Torres-Delgado and López Palomeque, 2012). Nonetheless, within the realm of tourism studies, substantial apprehensions exist regarding the practicality of attaining and executing a sustainable tourism trajectory (Marsiglio, 2015; Sharpley, 2020).

2.1. The impact of tourism on economic growth

Tourism has long been regarded as an industry capable of fostering a country's economic growth and enhancing the well-being of rural communities (IIED, 2001, p. 41). It contributes substantially to economic development by complementing other economic activities. This includes job creation, particularly benefiting women, augmenting foreign exchange earnings through various tourism-related enterprises such as hotels, restaurants, and guiding services, facilitating foreign direct investment, harnessing revenue from underutilized natural resources, and offering opportunities for differential taxation of tourists. Additionally, it can generate positive economies of scale and scope (Balaguer and Cantavella-Jordá, 2002; Andergassen and Candela, 2013; Cárdenas-García and Pulido-Fernández, 2019; Brida et al., 2016; Markandya et al., 2005: 227). Moreover, tourism has a pivotal role in encouraging investments in new infrastructure, labor, and competition. Its impact extends to other economic sectors, fostering direct, indirect, and induced effects, creating linkages between tourism and especially agriculture, fisheries, manufacturing, construction, and other service sectors (Brida et al., 2016).

In the last couple of decades, an expanding corpus of scholarly work has surfaced, delving into the intricate association between economic growth and tourism (Brida et al., 2020). For instance, researchers, among many other, such as Adedoyin et al. (2022), Narayan et al. (2010), and Cárdenas-García et al. (2013) have confirmed the enduring positive influence of tourism on long-term economic growth (Destek and Aydın, 2022). There have also been findings suggesting that tourism can have adverse effects on real GDP (Mohapatra, 2018). Also, while Brau et al. (2007) argue that small economies experience rapid growth when they specialize significantly in tourism-related activities, Figini and Vici (2010), encompassing a sample of over 150 countries, indicates that countries heavily reliant on tourism have not consistently outpaced their non-tourism-dependent counterparts (Brida et al., 2016).

However, the impact of tourism on economic growth is far from straightforward (Castro-Nuno et al., 2013; Pablo-Romero and Molina, 2013; Brida et al., 2016). For instance, Brida et al. (2016) conducted a comprehensive review of the literature and tested the tourism-led growth hypothesis (TLGH) across 80 countries for 1995–2016 to suggest that, with a few exceptions, the TLGH holds true. Nonetheless, they caution against generalizing these results to all countries. This limitation arises for two primary reasons. First, while the volume of empirical studies is growing, the range of countries examined is narrow and imbalanced. Second, a sample bias is apparent as the countries tested for TLGH tend to be destinations with a high predisposition for tourism, where the tourism sector's weight in the economy is sufficiently significant to have a positive effect on economic growth.

Balaguer and Cantavella-Jordá (2002) and Fayissa et al. (2008), emphasize that while heightened tourism activity may potentially enhance a nation's economic well-being, the economic, social, and environmental benefits for the local population do not automatically materialize. Instead, it has been observed that for the growth in tourism to enhance the quality of life for residents, various stakeholders involved in tourism must effectively manage this growth through policies and actions that channel tourism-related progress into improvements in socio-economic conditions (Cárdenas-García and Pulido-Fernández, 2019). For example, a comprehensive study by Cárdenas-García et al. (2015) showed that augmented tourism engagement resulted in

improved living standards for local residents. However, this improvement was observed exclusively in countries that had already attained higher stages of economic development.

Finally, there are also some regional findings investigating the relationship between tourism and growth. Particularly, Calero and Turner (2020) provides an extensive review of the importance of regional analysis in understanding the impact of tourism on growth. Yenisehirlioglu et al. (2020) provide such an analysis from Turkiye and Alcalá-Ordóñez et al. (2024) small island states.

Overall, tourism possesses the capacity to stimulate economic growth, but its impact is contingent on various factors, including effective management and the broader economic context.

2.2. Tourism and its impact on poverty

Tourism has been widely regarded as a potential contributor to poverty reduction. The concept of "pro-poor tourism" has gained traction since the late 1990s (Scheyvens and Hughes, 2019). Tourism may reduce or exacerbate poverty (Markandya et al., 2005). Firstly, tourism serves as a significant source of employment in many countries, particularly for unskilled and semi-skilled laborers (Li et al., 2018). Secondly, tourism development projects can lead to positive environmental changes by improving access to services like clean water and sanitation, as well as education. Additionally, increased government revenue generated from tourism can benefit the impoverished through social expenditures. However, tourism can also influence price fluctuations that affect real incomes (Li et al., 2018), strain access to water and energy resources due to tourist demand and have adverse health effects due to environmental degradation.

The question of whether tourism can be pivotal in achieving SDG1, which aims to "end poverty in all its forms everywhere," remains complex. Poverty, as defined by the World Bank, encompasses various dimensions, including asset deficiency, lack of basic resources, absence of essential infrastructure, and a lack of voice and independence (Ashley and Mitchell, 2009). When evaluating tourism's role in advancing SDG1, which aims to eradicate poverty, it is essential to recognize the multifaceted nature of poverty.

Several studies emphasized positive contributions of tourism, such as revenue generation, job creation, and poverty reduction (Deller, 2010; Scheyvens and Russell, 2012; Li et al., 2018). However, some researchers, like Lindberg et al. (2001), argue that the gains from tourism do not necessarily outweigh the losses experienced by local people, resulting in an overall inverse impact on welfare. For example, Thomas (2014) demonstrated that the influence of tourism is strongly contingent upon the specific poverty threshold selected. Scheyvens and Momsen (2008) emphasize that the growth of tourism in small island developing countries does not guarantee poverty reduction. Moreover, comparing 13 tourism-dependent countries found that tourism growth did not lead to reduced income inequality (Scheyvens and Hughes, 2019).

2.3. Tourism and its role in sustainable development

SDGs are central to the United Nations' 2030 agenda, promoting sustainable development by monitoring and managing natural resource use, fostering conservation, generating local employment, preserving culture and local products, and promoting sustainable marine resource utilization in underdeveloped nations and small island developing states (UNWTO, 2015). Tourism can have positive or negative environmental impacts, making it relevant to several SDGs, including Goal 8 (decent work and economic growth), Goal 12 (responsible consumption and conservation), and Goal 14 (sustainable use of oceans and seas) (UNWTO, 2015). As a result, the SDGs have taken center stage as a focal point for studying how tourism affects sustainable development.

Tourism exerts several detrimental impacts on the environment (Markandya et al., 2005: 234), including congestion, resource consumption (especially freshwater and energy), solid waste generation, cultural heritage degradation, ecological impacts, and induced settlement. On the positive side, tourism can generate revenue for environmental preservation. The tourism industry has been responsible for environmental harm, notably by generating elevated CO2 emissions because of its substantial energy consumption. Two major negative environmental consequences of tourism are pollution and resource use. Tourism relies on transportation and lodging infrastructure that generates carbon dioxide and greenhouse gas emissions, as well as high energy consumption for food production and waste management.

Studies have found a negative association between tourism revenues and environmental quality while some others suggest that transitioning to sustainable tourism practices can have an improving effect on the environment (Lee and Chen, 2021; Destek and Aydın, 2022). Recently, Destek and Aydın (2022) conducted one of the few compressive works examining the effect of tourism on sustainable development. Using data on sustainable development indices for the ten most visited countries over two decades (1995–2015), they found that tourism development can be detrimental to sustainable development.

SDG5, "achieve gender equality and empower all women and girls," and SDG8 are particularly significant in the context of sustainable tourism. Women constitute a significant portion of the tourism labor force, frequently holding less secure, lower-ranking positions. Recognizing the potential of tourism as a powerful instrument for reducing poverty, particularly among women, is crucial (UNWTO, 2019; UN Women, 2018). UNWTO underscores that tourism can empower women through job opportunities and income generation in various tourism and hospitality-related enterprises. Globally, women constitute 55% of tourism workers, and in some regions, this figure reaches up to 70% (Alarcón and Cole, 2019). However, a critical issue is that women tend to be concentrated in roles that align with traditional gender stereotypes (Markandya et al., 2005).

Moreover, we believe that tourism can influence health and social indicators through two primary channels: economic and social mechanisms. Economically, the revenue generated from tourism can be invested in improving healthcare infrastructure, public health campaigns, and mental health services, thereby reducing infant and maternal mortality rates, increasing immunization rates, and providing support to reduce teenage pregnancies and suicide rates. Socially, the cultural exchange and interaction with tourists can lead to greater health education and awareness, adoption of better health practices, and changes in social norms and behaviors, which can positively impact these indicators.

To conclude, Alarcón and Cole (2019) argue that sustainable tourism remains an elusive goal if gender continues to be treated as an additional aspect within sustainable tourism development or if it is used as a veneer to silence feminist voices.

2.4. Tourism's multidimensional impact on sustainable development

Tourism's influence extends far beyond direct economic metrics, affecting various aspects of sustainable development through complex pathways. For instance, the relationship between tourism and health indicators, such as infant mortality, maternal mortality, and immunization rates, can be explained through several mechanisms.

One mechanism is healthcare infrastructure. Tourism revenue often leads to improved healthcare facilities and services, potentially reducing infant and maternal mortality rates (Pratt, 2015). Another mechanism is public health campaigns. Increased tourism can result in better funding for public health initiatives, including immunization programs (Novelli, 2015). Additionally, health education and awareness play a role, as interaction with tourists can lead to greater health awareness and adoption of preventive health practices (Dimoska, 2006).

Similarly, tourism's impact on social indicators like teenage motherhood rates and suicide mortality can be understood through various factors. Economic opportunities generated by tourism can create jobs and reduce economic pressures that may contribute to social issues

(Ashley et al., 2007). Cultural exchange is another factor, as exposure to different cultures can influence social norms and behaviors (Reisinger and Dimanche, 2020). Moreover, tourism revenue may be directed towards improving mental health support systems, which in turn can have an effect on suicide mortality rates (Filep and Pearce, 2014).

These examples illustrate the complex relationships between tourism and various sustainable development indicators, justifying their inclusion in our comprehensive analysis.

2.5. A final assessment

It is imperative to acknowledge that the economy is intrinsically linked to society, serving its needs, while society, in turn, relies on the environment (Baumgartner and Korhonen, 2010). Overlooking the "society within a biosphere" perspective in the mainstream economic understanding hinders sustainable development as it perceives the environment and society merely as exploitable resources (Özgür et al., 2021). An analysis of sustainable tourism should encompass this holistic view.

The literature on sustainable tourism underscores the necessity of reevaluating certain aspects from a critical standpoint to align with sustainability goals. The concept of tourism sustainability lacks clarity and often diverges from the principles of sustainable development. Policies in the tourism industry frequently maintain a narrow focus on economic growth (Saarinen, 2015; Sharpley, 2020). This fixation on sustaining tourism without considering a balanced relationship with other economic sectors results in competition for shared resources.

The evaluation of environmental performance in energy-consuming sectors is crucial for sustainable development. Xue et al. (2022) employ a novel data envelopment analysis approach to assess the environmental performance, which can provide valuable insights into optimizing resource use and reducing emissions.

Additionally, the COVID-19 pandemic has underscored the need for a green economic recovery. Taghizadeh-Hesary et al. (2022) highlight various strategies to achieve green economic recovery while mitigating greenhouse gases, emphasizing the integration of environmental and economic policies.

Chien et al. (2022) explore the impact of external debt on sustainable economic growth, revealing critical insights into how fiscal policies can support or hinder sustainable development, especially in the context of post-pandemic recovery. Moreover, Baloch (2023) examines the dynamics of commodity prices, particularly oil and gold, during the COVID-19 pandemic, offering insights into the economic volatility and its implications for sustainable development.

For a deeper analysis of environmental degradation in developing countries, Sabbar (2023) provides an econometric analysis of the causes of environmental degradation, identifying key factors that need to be addressed to achieve sustainability goals. Furthermore, Ghaffar and Sardar (2023) analyze the climate vulnerability of different regions and the effectiveness of transitioning to renewable energy, highlighting the critical role of energy policy in mitigating climate risks.

To conclude, transforming profit-driven businesses is also crucial to attain sustainability goals, as current economic models often hinder sustainable tourism agendas. This shift involves a reorientation from an economy-centric focus to one that prioritizes society and governance reforms to regulate economic growth in ways that safeguard the essential elements of a good society, including equity, sustainability, and social justice (Özgür et al., 2021).

3. Data and methods

3.1. Data

In this paper we use cross-country panel data at the national level. While we recognize the importance of regional-level analysis in tourism studies, as highlighted by Calero and Turner (2020), Alcalá-Ordóñez et al. (2024), and Yenisehirlioglu et al. (2020), our study deliberately adopts a national-level approach. This choice allows us to examine broad trends across a diverse set of countries and contribute to the global discourse on tourism and sustainable development. Our macro-level analysis complements regional studies by providing insights into cross-country patterns and relationships that may not be apparent at the subnational level.

We employ a unique dataset that covers a wide range of sustainable development indicators for 160 economies from 1995 to 2019. The whole list of 160 countries is provided in the appendix. Our dataset includes health-related indicators, economic metrics, environmental measures, educational data, and social variables, allowing us to explore the diverse facets of sustainable development. The health-related indicators in our dataset encompass critical measures such as life expectancy, infant mortality rate, neonatal mortality rate, mortality under age five, maternal mortality, access to basic sanitation, safe drinking water, and immunization coverage against various diseases. These indicators reflect the well-being of populations and are essential components of sustainable development. Economic variables are also crucial in assessing sustainable development. Our dataset includes real GDP per capita, multiple poverty headcount ratios, poverty gap series, and access to electricity. These economic metrics shed light on the economic prosperity and poverty alleviation aspects of sustainable development. The environmental dimension of sustainable development is captured through indicators such as CO2 emissions per capita, CO2 emissions per 2010 GDP, CO2 emissions per 2011 PPP GDP, air pollution levels, and mortality attributed to air pollution. These indicators provide insights into the environmental impact of tourism and its potential implications for sustainability. Education is a fundamental component of sustainable development. Our educational variables group comprises indicators such as tertiary and secondary schooling ratios, adult literacy rates, and lower and upper secondary educational attainment. These metrics reflect the progress and accessibility of education, which is essential for individual and societal development. Lastly, the social dimension of sustainable development is explored through indicators such as teenage motherhood rates, suicide mortality rates, legal rights indices, gender-specific adult literacy rates, female labor force participation, and a gender equality index. These variables reflect societal well-being, equity, and gender equality, which are critical aspects of sustainable development. As can be seen from this extensive list of variables, we aim to be as comprehensive as possible, however, there are certain various other measures of sustainable development (such as waste emissions for environmental quality), however, our choice of these variables was largely motivated from data availability. Our selection of first-level indicators, while directly related to 9 SDGs, indirectly addresses aspects of the remaining goals. For instance, our economic indicators relate to SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible Consumption and Production). Social indicators touch upon SDG 16 (Peace, Justice and Strong Institutions) and SDG 17 (Partnerships for the Goals). Environmental indicators are relevant to SDG 6 (Clean Water and Sanitation) and SDG 7 (Affordable and Clean Energy). This comprehensive approach allows us to capture the multifaceted nature of sustainable development and its complex relationship with tourism. The validity of our chosen indicators extends beyond their relation to SDGs. Each indicator was selected based on its relevance to tourism impacts, data availability across our sample countries, and its established use in sustainable development literature (e.g., Özgür et al., 2021; Elgin et al., 2022). While no set of indicators can perfectly capture all aspects of sustainable development, our selection provides a robust framework for analyzing tourism's diverse impacts.

Moreover, we also use two tourism-related variables. These are tourist arrivals as a percentage of population and tourism revenue as a percentage of total exports. We also recognize the implications from the overall literature (see for example, Song et al., 2010; Peng et al., 2015; and finally, Roselló-Nadal and He, 2020) that these two different measures of tourism may lead to different results. However, as will be seen in

Table 1
Summary statistics for the complete dataset.

Name of Variables	Average	Standard Deviation	Minimum	Maximum
Inbound Tourist Arrivals, % Population)	3.25	12.49	0.00012	167.37
Revenue from Tourism, (% Exports)	16.92	18.96	0.001	101.26
Openness, % GDP (Open)	52.09	53.11	1.40	269.15
Growth, %	3.98	6.50	9.90	21.52
Government Expenditures, % GDP	19.39	10.44	3.87	58.10
Health Related Variables				
Average Lifespan, in years	64.83	11.65	18.90	84.29
Rate of Infant Deaths, per 1000 live births	53.44	47.45	1.71	267.54
Rate of Neonatal Deaths, per 1000 live births	24.57	19.69	0.92	106.11
Child Mortality Rate, per 1000 live births	80.40	80.88	2.22	442.00
Maternal Deaths, per 100,000 live births	246.56	358.71	3.0	2900.00
Percentage of Population with Access to Basic Sanitation	71.06	30.79	3.15	100.00
Percentage of Population with Access to Safe Drinking Water	764.48	26.46	3.91	10.00
Percentage of Population with Access to Basic Drinking Water	84.20	19.03	16.50	100.00
DPT Immunization Rate, Percentage of Children Aged 12–23 Months	84.52	17.03	6.00	99.00
Hepatitis B Immunization Rate, Percentage of One-Year-Old Children	84.38	18.82	1.00	99.00
Educational Variables				
Percentage of Gross Enrollment in Tertiary Education	26.89	23.70	0.00	142.90
Percentage of Gross Enrollment in Secondary Education	69.58	34.15	0.00	163.93
Literacy Rate among Adults, Percentage of Individuals Aged 15 and Above	82.82	21.48	8.69	99.97
Educational Attainment in Lower Secondary, Percentage Aged Above 25	59.75	28.51	0.60	100.00
Educational Attainment in Upper Secondary, Percentage Aged Above 25	50.56	25.68	0.37	96.31
Percentage of Children Not Enrolled in Primary School, Ages 6-12	15.29	17.60	0.00	89.95
Economic Variables				
Per-Capita Gross Domestic Product, Adjusted for Purchasing Power Parity	13.58	20.71	0.16	238.59
Index of Economic Inequality (Gini Index)	39.36	9.51	21.00	65.80
Poverty Headcount at $5.50 Threshold	36.19	32.82	0.00	100.00
Poverty Headcount at $5.50 Threshold	22.15	26.44	0.00	98.50
Poverty Headcount at $1.90 Threshold	11.65	18.52	0.00	94.10
Poverty Gap at $5.50 Threshold	17.98	20.31	0.00	100.00
Poverty Gap at $3.20 Threshold	9.63	13.95	0.00	77.10
Poverty Gap at $1.90 Threshold	4.52	8.34	0.00	63.60
Percentage of Population with Access to Electricity	80.90	34.24	0.01	100.00
Environmental Variables				
Carbon Dioxide Emissions per Capita	4.55	7.98	0.02	100.70
Carbon Dioxide Emissions per 2010 GDP, in kg per 2010 USD	0.52	0.51	0.02	6.10
Carbon Dioxide Emissions per 2011 PPP GDP	0.28	0.21	0.005	1.76
Ambient Air Pollution, Micrograms per Cubic Meter	29.26	17.82	5.89	100.78
Mortality due to Air Pollution, per 100,000 Population	87.48	73.85	7.00	324.010
Social Variables				
Percentage of Teenage Mothers, Ages 15-19	19.60	10.74	2.10	50.60
Mortality Due to Suicide, per 100,000 Population	10.29	7.51	0.70	52.60
Index of Legal Rights, Ranging from 0 to 12	4.92	2.70	0.00	12.00
Literacy Rate among Females, Percentage of Adult Females	0.90	0.12	0.36	1.12
Female Labor Force Participation Rate, ILO Estimate,	51.13	16.03	6.08	90.78
Percentage Female Labor Force Participation Rate, National Estimate, Percentage	46.30	15.48	1.93	94.40
Composite Index for Gender Equality, Ranging from 0 to **6**	3.47	0.66	1.50	5.00

the result section, qualitatively, our results are overall similar and not very susceptible to using either index.

Finally, in some regressions we also use three control variables, namely trade openness (the ratio of the sum of exports and imports to GDP), GDP growth (%) and government spending (as % GDP). We have obtained all these series from the World Development Indicators (WDI) of the World Bank. Table 1 presents descriptive summary statistics of all variables used in the empirical analysis.

3.2. Methodology

Prior to commencing the regression analyses, we administered the Fisher and IPS unit root tests to evaluate the long-term time-series properties of the variables in our dataset. These specific panel unit root tests were chosen due to the considerable imbalance in our dataset's structure. The results of these tests revealed that the majority of series, including the two tourism-related variables, exhibit stationarity at their levels. However, it was observed that GDP per capita and CO2 emissions per capita are non-stationary, and in particular, they exhibit first-order integration.

Our econometric analysis necessitated the utilization of various econometric methods, as our annual cross-country panel dataset exhibits substantial imbalances across most (if not all) variables. Additionally, some of the measures we employ are only available for a limited number of years. To commence the analysis, we present a series of regression analyses in Table 2 involving an index representing sustainable development. This index was formulated by incorporating variables consistently exhibiting significance across multiple estimations, as detailed in the Appendix section, particularly in Tables A.1 and A.2. In these regressions reported in Tables A.1 and A.2 we used panel fixed-effects with or without auto-regressive errors and OLS, whenever dictated by the data.

From the 37 sustainable development indicators listed in Table 1, the following indicators have been utilized in constructing this index: life expectancy, infant mortality, immunization rates, per capita GDP, poverty incidence, gap indices (based on a daily income threshold of

Table 2
Cross-sectional OLS regressions of the sustainable development index.

Independent Variables	PCA Index	PCA Index	PCA Index	PCA Index	PCA Index	PCA Index
Tourist Arrivals	−0.54*** (0.18)	−0.40** (0.17)	−1.04*** (0.38)			
Interaction with GDP per capita	0.05** (0.02)	0.04** (0.02)	0.04** (0.02)	0.04** (0.02)	0.04** (0.02)	0.04** (0.02)
Tourism Revenue (% GDP)				−0.11** (0.05)	−0.12** (0.06)	−0.10** (0.05)
Growth		0.09 (0.09)	0.06 (0.09)		0.05 (0.05)	0.08 (0.09)
Gov. Sp.		0.23* (0.13)	0.24* (0.13)		0.14* (0.08)	0.15** (0.08)
Openness			−0.03 (0.04)			0.01 (0.07)
GDP-cap			0.02** (0.01)			0.02** (0.01)
Observations/Countries	160	159	155	158	155	155
R-squared	0.21	0.24	0.33	0.19	0.21	0.27

Robust standard errors are specified within parentheses. The symbols *, **, *** signify confidence levels of 10, 5, and 1%, respectively.

$1.90), air quality, adult literacy rates, secondary school completion rates, female adult literacy, female labor force participation rate, and the gender equality index. For the PCA analysis we follow the standard methodology of Baxter (1995) and Joliffe (2002). Following standard PCA procedure, the tails of all variables are reduced[1] by 1 % up and down to eliminate the influence of extreme values. After first comparing all inter-variable correlations, we check the normality of all variables and transform any that require it.[2] Normalization and trimming outliers (1 percent) from the data is required because PCA is not scale-invariant. We then adjust all variables to the same scale and index them within a range of 0–100. To do this, we calculate the ratio of the difference between the actual value of a variable and its minimum value to the difference between the maximum and the minimum value and multiply this ratio by 100. We then run the PCA using all the transformed variables. The PCA produces the same number of components as the number of variables used in the analysis. These components are basically linear combinations of the variables. The number of components chosen for the final index should be such that the associated eigenvalue does not go beyond 1. For all statistical analyses, we use STATA version 17. Table A.3 presents the eigenvalues and proportions of the explained variance in the dataset for each component. The table notes present various test results for PCA. The Kaiser-Meyer-Olkin (KMO) index, which compares the correlations between the variables and the partial correlations, is 0.85 is significantly high value, thereby indicating the efficiency of the PCA and adequate sampling. Similarly, Bartlett's test of sphericity is also satisfactory, rejecting the null hypothesis that the observed correlation matrix does not deviate significantly from the identity matrix. Finally, the scale variability is also acceptable, with a Cronbach's alpha value of 0.76. The principal components (eigenvectors) are presented in full in Table A.3 in the appendix.

The final index is calculated using the following formula, where PCAx for x = 1, 2, 3, 4, 5, refers to each principal component:

$$\text{Index} = \left(\frac{0.40}{0.81}\right)\text{PCA1} + \left(\frac{0.14}{0.81}\right)\text{PCA2} + \left(\frac{0.11}{0.81}\right)\text{PCA3} + \left(\frac{0.08}{0.81}\right)\text{PCA4} + \left(\frac{0.08}{0.81}\right)\text{PCA5}$$

Notice that the coefficient of each principal component is equal to the proportion of variation explained individually by each principal component divided by the total cumulative proportion of variation in the whole data explained by all six principal components.

After assembling the comprehensive PCA index, we proceed to analyze its relationship with tourism measures, taking into account their interactions with per capita GDP. Additionally, these regression models include several supplementary control variables. It is essential to note that, owing to the limited dataset size, these analyses are confined to cross-sectional ordinary-least-squares regressions. As mentioned above, these regressions are presented in Table 2.

Furthermore, there is a valid reason to consider the potential endogeneity of the regressors in our analysis, particularly in the case of tourism-related variables, which could be influenced by omitted variable bias. Additionally, sustainable development may be influenced by various factors beyond tourism measures and their interactions with GDP per capita. To address these concerns, we conducted panel-instrumental variable (IV) estimations, introducing additional control variables as depicted in Table 3. In this context, we operate under the assumption that the lagged variables serve as reliable instruments for the regressors' levels and are unrelated to any potential omitted variables or the dependent variable, which is the current level of sustainable development indicators. Specifically, we employ one- or two-period-lagged independent variables as instruments for their respective levels. Since these variables do not exhibit drastic changes from one year to another, lagged values are good instruments[3] for the levels, although they are not correlated with the error term of the current period. The control variables integrated into this analysis encompass the growth of GDP (expressed as a percentage), government spending (as a percentage of GDP), trade openness (defined as the ratio of the sum of exports and imports to GDP), and real GDP per capita. In our main text, when presenting the results of the IV regressions, we also provide information regarding the outcomes of various diagnostic tests, including the under-identification test (utilizing the Kleibergen-Paap rk LM statistic), the weak identification test (Cragg-Donald Wald F statistic), and the over-identification test (Hansen J statistic).

4. Results and discussion

In Table 2, we present the findings from our regression analyses concerning the index we have constructed using Principal Component Analysis (PCA). It's important to note that due to the nature of our analysis, the creation of this index involves amalgamating various variables with differing numbers of observations. This amalgamation significantly reduces the number of observations in the composite index, transforming it into a variable that pertains more to individual countries than a panel dataset. The first three columns of this table showcase regressions involving tourist arrivals as a percentage of the population, while the remaining three columns focus on tourism revenue as a percentage of total exports. As indicated by the results presented here, we observe a negative association between tourism and the sustainable development index. However, this relationship exhibits significant interactions with GDP per capita. Specifically, the negative correlation is less pronounced in countries with higher GDP per capita levels. Moreover, for countries with very high GDP per capita (particularly those surpassing the $30,000 threshold), the correlation even becomes

[1] We also replicated our analysis without dropping the 1-percent tail of the distribution. The results did not change significantly. This additional analysis is available upon request from the corresponding author.

[2] None of the variables satisfy the normality assumption. Therefore, all are transformed.

[3] Our choice of the instruments is also supported by the relevant tests of identification as reported in Table 3.

Table 3
IV-regressions of individual variables with additional controls.

Independent Variables	Life Expectancy	Life Expectancy	Infant Mortality	Infant Mortality	Immunization	GDP-cap	Poverty Head-1.90	Poverty Gap-1.90
Tourist Arrivals	−0.22** (0.10)		0.38** (0.19)		−1.21* (0.64)	90.44*** (22.51)	−10.01* (5.87)	
Tourism Rev. (% Exports)		−0.06** (0.03)		0.40** (0.20)				−30.10** (14.99)
Interaction with GDP per capita	0.03** (0.01)	0.01*** (0.00)	−0.02** (0.01)	−0.09*** (0.03)	0.03*** (0.01)		−0.02** (0.01)	−0.10** (0.05)
Growth	−0.001 (0.03)	−0.65*** (0.21)	0.11 (0.09)	−2.12 (5.1)	16.91*** (2.13)	4004.15*** (357.95)	−5.59** (2.67)	−3.00** (1.23)
Gov. Sp.	0.04 (0.08)	−2.01*** (0.54)	−0.40** (0.20)	−21.14* (11.12)	8.47*** (2.56)	3116.25*** (802.18)	−5.00 (4.32)	−1.10 (2.14)
Openness	−0.12 (0.14)	−0.09 (0.15)	0.02 (0.05)	2.00 (1.50)	1.28 (0.88)	675.99*** (167.32)	−0.11 (1.04)	0.11 (0.55)
GDP-cap	0.003 (0.002)	0.01 (0.02)	−0.02** (0.008)	−0.05 (0.03)	−0.11* (0.06)		−0.32** (0.16)	−0.09 (0.11)
Observations	2873	3991	4001	3240	2794	2757	936	1102
Countries	160	160	159	159	158	145	130	130
J-test	0.25	0.24	0.26	0.23	0.32	0.27	0.30	0.23
Under-id. test (p-value)	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01
Weak-id. test (p-value)	0.01	0.00	0.01	0.01	0.01	0.02	0.00	0.00

Independent Variables	**Air pollution**	**Air Pollution**	**Secondary Schooling**	**Secondary Schooling**	**Female Adult Literacy**	**Female to Adult Literacy**	**FLFP (ILO)**	**Gender Equality Index**
Tourist Arrivals	24.44*** (5.00)		8.89** (4.40)		0.09* (0.05)		11.48* (5.99)	
Interaction with GDP per capita	−0.09* (0.05)	−0.14** (0.07)	0.11** (0.05)	0.20*** (0.07)	0.01*** (0.00)	0.01*** (0.00)	0.04** (0.02)	0.05** (0.02)
Tourism Rev. (% Exports		10.10** (5.06)		10.24** (5.11)		0.06** (0.03)		7.11** (3.50)
Growth	4.90** (2.40)	1.60 (4.99)	−0.44 (0.99)	2.01** (1.00)	0.09** (0.04)	0.07* (0.04)	−1.77 (4.22)	0.10 (0.52)
Gov. Sp.	3.00 (2.90)	−3.09 (4.11)	−6.89** (3.54)	−2.00 (1.87)	0.002 (0.07)	−0.07 (0.09)	2.01 (4.44)	0.17 (0.15)
Openness	−1.44** (0.69)	−8.90** (2.11)	−0.22 (0.57)	0.19 (0.49)	−0.01 (0.01)	−0.04*** (0.02)	−0.29 (0.55)	0.03 (0.12)
GDP-cap	−0.14*** (0.04)	−0.15** (0.07)	0.08* (0.04)	0.05* (0.03)	−0.003** (0.002)	0.002*** (0.001)	0.09 (0.12)	0.17*** (0.02)
Observations	970	558	1844	2746	459	551	1797	494
Countries	144	125	137	140	120	122	134	60
J-test	0.29	0.15	0.20	0.19	0.27	0.34	0.36	0.40
Under-id. test (p-value)	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00
Weak-id. test (p-value)	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01

Robust standard errors are specified within parentheses. The symbols *, **, *** signify confidence levels of 10, 5, and 1%, respectively. All variables are elucidated in the text. Additionally, we present the outcomes of the under-identification test (utilizing the Kleibergen-Paap rk LM statistic), weak identification test (Cragg-Donald Wald F statistic), and overidentification tests (Hansen J statistic).

positive. In both sets of regressions, the coefficients for government spending and GDP per capita are also noteworthy. Consequently, a higher level of government expenditure as a percentage of GDP and a greater GDP per capita are both linked to a higher level of the sustainable development index.

To provide a rationale for the selection of variables used in constructing the PCA index, we refer to Tables A.1 and A.2, which can be found in the appendix. These tables present benchmark estimates for all five categories of sustainable development indicators concerning both tourist arrivals and tourism revenue. Moving forward, we introduce another series of instrumental variable (IV) analyses in Table 3, incorporating supplementary control variables. The choice of sustainable development indicators in Table 3 is predicated on the significance of the estimates obtained in Tables A.1 and A.2. Where applicable, this table presents results for both types of tourism measures. Notably, these results robustly reaffirm the outcomes of the prior analyses while also addressing the potential endogeneity of the regressors. It is important to highlight that in all IV estimations, we provide the results of various tests affirming the exogeneity of the instruments employed in the regressions.

Overall, in summary, our analysis of the data reveals intriguing patterns and insights into the relationship between sustainable development and tourism. Notably, we find that this relationship has a significant interaction with GDP per capita, leading to strikingly different outcomes in developed and developing economies. In countries with relatively lower levels of GDP per capita, tourism is associated with mixed impacts on the pillars of sustainable development. Specifically, we find that tourism is linked to lower levels of some specific health-related and environmental sustainability indicators in these countries, particularly for life expectancy, infant mortality and DPT immunization, as well as air pollution. This suggests that, in less developed economies, the influx of tourists may strain healthcare resources and contribute to environmental degradation. Health outcomes may be negatively affected due to increased demand for healthcare services, while the environment may suffer from increased pollution and resource consumption. However, the picture is different in developed countries, where tourism is associated with positive outcomes in these same dimensions of sustainable development. In these nations, the tourism industry may have the capacity to invest in healthcare infrastructure and implement eco-friendly practices, leading to better health and environmental outcomes. Concerning certain economic, educational, and social measures, our analysis reveals a more consistent pattern. Across all countries, tourism implies better outcomes in these dimensions; particularly for GDP per capita, poverty, secondary schooling attainment, female-to-adult literacy ratio, female labor force participation rate

and gender equality index. However, the positive effects are more pronounced as GDP per capita increases. This indicates that tourism can contribute significantly to economic growth, educational attainment, and social well-being, especially in wealthier nations. In less developed countries, while tourism still has positive effects in these dimensions, the impact may be less substantial due to resource constraints and other developmental challenges. Finally, we should also note down that the results of regression when either tourism variable (tourist arrivals vs. tourism revenue) is used, are highly similar, further strengthening our results.

Contrary to generalized results of Destek and Aydın (2022) and Lee and Chen (2021) our findings underscore the importance of tailoring tourism policies to the specific circumstances of each country. Policymakers should recognize that the impacts of tourism on sustainable development vary significantly between developed and developing economies. In less developed nations, policies may need to focus on managing the potential negative consequences of tourism on health and the environment while maximizing its positive economic, educational, and social contributions. This could involve investments in healthcare infrastructure, environmental protection measures, and community development initiatives. In contrast, developed countries can harness tourism as a powerful tool for enhancing sustainable development across multiple dimensions. These nations may benefit from promoting sustainable tourism practices, such as eco-tourism and cultural heritage preservation, to ensure that tourism contributes positively to all aspects of sustainable development.

5. Conclusion

Our comprehensive analysis, based on an original panel dataset of 160 economies for 1995–2019, provides some important insights on the complex relationship between tourism and sustainable development, revealing nuanced patterns that vary significantly with respect to country's economic development phase. Particularly, our findings highlight the pivotal role of GDP per capita in shaping these interactions.

For less developed nations, our research indicates that tourism can have mixed impacts on various dimensions of sustainable development. While it can boost economic growth, improve educational attainment, and enhance social well-being, it may also strain healthcare resources and contribute to environmental degradation. Unlike the generalized conclusions of Destek and Aydın (2022) and Lee and Chen (2021), our findings highlight the importance of customizing tourism policies to fit the specific conditions of each country. Policymakers in these countries should prioritize managing the potential negative consequences of tourism on health and the environment while maximizing its positive contributions. Conversely, in developed countries, tourism emerges as a potent tool for advancing sustainable development across multiple fronts. This is particularly evident in the positive effects on economic growth, educational achievement, and social indicators. To harness these benefits fully, developed nations should focus on promoting sustainable tourism practices, such as eco-tourism and cultural heritage preservation, to ensure tourism's positive impact on all aspects of sustainable development.

Moreover, regarding the discussion and conclusion's focus on the impact of tourism on specific Sustainable Development Goals (SDGs), particularly SDG 8 (Economic Growth), SDG 12 (Sustainable Consumption and Production), and SDG 14 (Life Below Water), we recognize the importance of further emphasizing these aspects. Our findings indeed shed light on the nuanced relationship between tourism and sustainable development, highlighting significant interactions with GDP per capita and varying impacts across developed and developing economies. Specifically, we observe that tourism tends to have mixed effects on health-related and environmental sustainability indicators in less developed nations, while showcasing more consistently positive outcomes in economic, educational, and social dimensions across all countries. Moving forward, we intend to provide a more explicit discussion on how our results align with these specific SDGs, offering insights into the role of tourism in promoting economic growth, sustainable consumption and production patterns, and conservation efforts for marine ecosystems. This additional analysis will enhance the comprehensiveness of our study and contribute to a more nuanced understanding of the implications of tourism for sustainable development goals in the post-2020 context.

Our findings both align and diverge from previous studies. For instance, while Destek and Aydın (2022) and Lee and Chen (2021) provide generalized results on the economic impacts of tourism, our study reveals the nuanced effects that vary with a country's level of development. Our research underscores the importance of GDP per capita, demonstrating that tourism's impact is not monolithic but highly dependent on the socio-economic context. This contrasts with the broader generalizations of prior studies, highlighting the necessity for tailored tourism policies.

For less developed countries, policymakers should focus on mitigating the adverse effects of tourism on health and the environment. This includes investing in healthcare infrastructure to manage increased demand and implementing strict environmental regulations to prevent degradation. Additionally, leveraging tourism for economic and educational benefits should be a priority, potentially through community-based tourism initiatives that ensure local benefits. In contrast, developed countries should promote sustainable tourism practices, such as eco-tourism and cultural heritage conservation, to maximize the positive impacts on economic growth, education, and social well-being.

The practical implications of our findings are significant for various stakeholders. Governments can use this research to develop nuanced, context-specific tourism policies that balance economic benefits with health and environmental sustainability. Tourism industry leaders should focus on sustainable practices that align with national development goals, such as reducing carbon footprints and promoting local cultures. Local communities stand to benefit from tailored tourism strategies that enhance their socio-economic conditions while preserving their environment and cultural heritage.

In light of the unprecedented global challenges posed by the COVID-19 pandemic, it is imperative to reassess the impact of tourism on sustainable development goals. The pandemic has disrupted travel patterns, altered consumer behavior, and strained healthcare systems worldwide, thereby necessitating a reevaluation of existing tourism policies and their alignment with sustainable development objectives. While the full extent of COVID-19's impact on sustainable development goals remains to be seen, preliminary evidence (Nagaj and Zuromskaitė, 2021; Bhatia et al., 2022) suggests significant disruptions in areas such as poverty alleviation, health, education, and environmental conservation. Moving forward, it is essential for policymakers, researchers, and industry stakeholders to adapt strategies to mitigate the adverse effects of the pandemic on sustainable development efforts. This may involve implementing innovative approaches to promote resilience and inclusivity within the tourism sector, fostering community engagement, and prioritizing investments in sustainable infrastructure and destination management practices. By incorporating insights from post-2020 dynamics into future research and policy initiatives, we can enhance our understanding of the evolving relationship between tourism and sustainable development and develop more robust strategies to build back

better in a post-pandemic world.

This comprehensive analysis advances our understanding of the relationship between tourism and sustainable development. It highlights the need for a nuanced and context-specific approach to tourism policy, acknowledging that the effects of tourism vary depending on the economic development stage of a country. By tailoring policies to the unique challenges and opportunities presented by tourism, governments and stakeholders can maximize its benefits while mitigating its drawbacks, ultimately contributing to more sustainable and equitable development paths for nations worldwide. As the global tourism industry continues to evolve, it is essential to consider the multifaceted nature of sustainable development and the diverse impacts of tourism on different aspects of well-being. Future research can build upon this study by investigating further the specific mechanisms through which tourism influences sustainable development and by exploring innovative policy approaches that promote sustainable tourism practices across a broad spectrum of countries. Ultimately, a balanced and holistic approach to tourism development is essential for realizing the full potential of tourism as a driver of sustainable development in the 21st century.

CRediT authorship contribution statement

Ceyhun Elgin: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Adem Yavuz Elveren:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Data availability statement

Data is available upon request from the authors.

Table A.1
Panel Regressions on Tourist Arrivals (% GDP)

	Without Interaction		With Interaction				Est. Method
	Coe.	Std. Err.	Coe.	Std. Err.	Interaction	Std. Err.	
Dependent Variable							
Health Related Variables							
Life Expectancy	−0.16**	(0.08)	−0.41**	(0.19)	0.02**	(0.01)	a
Infant Mortality Rate	1.13*	(0.60)	1.11*	(0.59)	−0.05**	(0.02)	a
Neonatal Mortality Rate	0.29	(0.31)	1.19	(0.54)	−0.06	(0.03)	a
Maternal Mortality	9.90	(9.81)	10.33	(18.79)	−3.74	(1.32)	a
Mortality under 5 years	1.44	(1.79)	2.24	(2.99)	−0.13	(0.12)	a
Access to Basic Sanitation	−0.12	(0.82)	0.03	(0.67)	−0.02	(0.03)	a
Access to Safe Drinking Water	3.21	(2.58)	4.00	(3.90)	0.01	(0.15)	a
Access to Basic Drinking Water	−0.60	(0.59)	−0.45	(0.55)	0.03	(0.03)	a
HIV incidence	−0.03	(0.04)	−0.09	(0.10)	0.01	(0.008)	a
Immunization DPT	−1.28**	0.60	−1.35**	(0.64)	0.04**	(0.02)	a
Immunization HepB3	−10.00	(21.52)	25.20	(37.72)	0.44	(0.49)	a
Economic Variables							
Real GDP Per-Capita (PPP)	66.73***	(32.95)	NA	NA	NA	NA	a
Gini Index	11.44	(12.82)	4.44	(17.01)	0.33	(0.77)	a
Poverty Headcount: 5.50	−22.11	(24.32)	−0.90	(32.11)	−2.27	(1.99)	a
Poverty Headcount: 3.20	0.55	(5.23)	19.32	(25.11)	−1.94	(1.84)	a
Poverty Headcount: 1.90	−9.20**	(4.51)	−9.10**	(4.43)	−0.03***	(0.01)	a
Poverty Gap: 5.50	5.45	(17.15)	26.87	(25.36)	−1.85	(1.25)	a
Poverty Gap: 3.20	16.01	(15.11)	20.11	(19.32)	−1.29	(1.01)	a
Poverty Gap: 1.90	5.74	(9.49)	9.42	(13.73)	−1.06	(0.68)	a
Access to Electricity	0.12	(0.29)	1.66	(2.42)	−0.10	(0.19)	a
Environmental Variables							
CO_2 Emissions Tons Per Capita	−0.48	(0.33)	−3.78	(2.59)	0.03	(0.02)	a
CO_2 Emissions per 2010 GDP	0.23*	(0.12)	0.21	(0.15)	0.0009	(0.007)	a
CO_2 Emissions per 2011 PPP GDP	0.09	(0.10)	0.08	(0.08)	0.01	(0.01)	a
Air Pollution (micrograms)	20.10 ***	(6.65)	21.33**	(5.27)	−0.06**	(0.03)	a
Mortality due to Air Pollution	5.11	(144.32)	NA	NA	NA	NA	c
Educational Variables							
Tertiary Schooling	−3.00	(1.99)	−3.74	(3.92)	0.03	(0.09)	a
Secondary Schooling	6.99**	(3.42)	6.67**	(3.27)	0.10**	(0.05)	a
Adult Literacy	−14.44	(33.42)	−32.11	(32.29)	0.74	(0.89)	b
Ed. Attainment Lower Secondary	−2.11	(9.27)	−62.11	(90.42)	0.34	(1.31)	a
Ed. Attainment Upper Secondary	−12.44	(14.60)	−40.02	(39.01)	0.34	(1.40)	a
Children without Primary School	21.01	(25.44)	4.35	(6.89)	0.20	(0.17)	a
Social Variables							
Teenage Mothers	80.00***	(21.32)	98.40***	(29.11)	−5.90	(4.87)	b
Suicide Mortality	2.00	(19.92)	24.30	(13.19)	−0.39	(0.37)	b
Legal Rights Index	1.99	(4.44)	−1.40	(1.70)	0.07	(0.06)	b
Female to Adult Literacy	0.05**	(0.02)	0.06***	(0.02)	0.01***	(0.00)	b
Female LFPR (ILO)	10.24**	(5.08)	10.06**	(4.99)	0.02**	(0.01)	a
Female LFPR (National)	−14.11	(11.40)	−40.10**	(18.13)	1.52	(0.67)	a
Gender Equality Index	1.32	(1.25)	−3.14	(3.232)	0.44	(0.40)	b

Each regression incorporates a constant, alongside country and year dummies. Robust standard errors are presented in parentheses. The symbols *, **, *** signify confidence levels of 1, 5, and 10%, respectively. Refer to Table 1 for the definition of all variables. Estimation methods: a) panel-FE with AR(1), b) Panel-FE, c) OLS.

Table A.2
Panel Regressions of Tourism Revenue (% Exports)

Dependent Variable	Without Interaction		With Interaction				Est. Method
	Coe.	Std. Err.	Coe.	Std. Err.	Interaction	Std. Err.	
Health Related Variables							
Life Expectancy	−0.11**	(0.05)	−0.07**	(0.03)	0.005***	(0.00)	a
Infant Mortality Rate	0.60**	(0.31)	0.46**	(0.23)	−0.06***	(0.02)	a
Neonatal Mortality Rate	0.29	(0.19)	0.44	(0.30)	−0.02	(0.02)	a
Maternal Mortality	−3.40	(7.65)	−0.90	(5.71)	−0.08	(0.35)	a
Mortality under 5 years	3.23	(3.01)	6.03	(3.33)	−0.09	(0.09)	a
Access to Basic Sanitation	0.11	(0.22)	0.24	(0.32)	−0.01	(0.01)	a
Access to Safe Drinking Water	0.42	(0.98)	0.88	(0.84)	−0.02	(0.04)	a
Access to Basic Drinking Water	0.05	(0.19)	0.05	(0.32)	−0.01	(0.01)	a
HIV incidence	−0.03	(0.04)	−0.03	(0.07)	0.01	(0.01)	a
Immunization DPT	−14.44	(22.11)	−10.32	5.56)	0.44	(0.49)	a
Immunization HepB3	−6.59	(9.90)	−13.54	(4.76)	0.30	(0.34)	a
Economic Variables							
Real GDP Per-Capita (PPP)	1.60*	(0.88)	-	-	-	-	a
Gini Index Poverty	−5.90	(4.33)	−6.02	(4.44)	0.50	(0.40)	a
Headcount: 5.50	2.01	(9.95)	10.01	(13.51)	−2.00	(2.13)	a
Poverty Headcount: 3.20	4.44	(7.40)	11.40	(9.92)	−0.72	(1.84)	a
Poverty Headcount: 1.90	4.77	(5.11)	14.07	(18.01)	−0.65	(1.36)	a
Poverty Gap: 5.50	4.07	(4.81)	15.13	(19.44)	−0.98	(1.37)	a
Poverty Gap: 3.20	4.12	(3.37)	13.56	(6.65)	−1.39	(1.01)	a
Poverty Gap: 1.90	−1.88*	(1.00)	−14.29***	(4.83)	−0.06**	(0.03)	a
Access to Electricity	0.19	(0.79)	−0.03	(1.92)	−0.10	(0.20)	a
Environmental Variables							
CO_2 Emissions Tons Per Capita	−1.65	(0.98)	−8.44	(8.11)	0.02	(0.04)	a
CO_2 Emissions per 2010 GDP	0.07	(0.05)	0.08	(0.08)	−0.01	(0.01)	a
CO_2 Emissions per 2011 PPP GDP	0.02	(0.02)	0.03	(0.03)	−0.01	(0.01)	a
Air Pollution (micrograms)	21.33***	(4.40)	10.05**	(5.00)	−0.10**	(0.05)	a
Mortality due to Air Pollution	74.02	(92.18)	-	–	–	–	c
Educational Variables							
Tertiary Schooling	0.89	(1.34)	0.65	(2.59)	0.15	(0.22)	a
Secondary Schooling	5.06**	(2.50)	9.93**	(4.79)	0.13***	(0.04)	a
Adult Literacy	−56.24	(13.04)	−65.74	(10.07)	0.25	(0.25)	b
Ed. Attainment Lower Secondary	5.11	(8.22)	−9.23	(29.43)	0.42	(0.50)	a
Ed. Attainment Upper Secondary	−27.90	(29.44)	−19.35	(17.45)	0.71	(0.62)	a
Children w/o Primary School	7.03	(6.32)	4.44	(3.33)	−0.56	(0.39)	a
Social Variables							
Teenage Mothers	7.10	(6.99)	12.20	(16.13)	−0.30	(1.51)	b
Suicide Mortality	4.40	(4.52)	7.01	(5.99)	−0.10	(0.09)	b
Legal Rights Index	0.44	(1.50)	−0.04	(0.20)	0.02	(0.02)	b
Female to Adult Literacy	0.04*	(0.02)	0.06***	(0.02)	0.02***	(0.01)	b
Female LFPR (ILO)	0.11	(0.08)	−0.45	(0.46)	−0.01	(0.02)	a
Female LFPR (National)	−1.49	(5.87)	−22.19**	(7.56)	0.20	(0.32)	a
Gender Equality Index	2.19**	(0.40)	1.99***	(0.47)	0.04**	(0.02)	b

Each regression incorporates a constant, alongside country and year dummies. Robust standard errors are presented in parentheses. The symbols *, **, *** signify confidence levels of 1, 5, and 10%, respectively. Refer to Table 1 for the definition of all variables. Estimation methods: a) panel-FE with AR(1), b) Panel-FE, c) OLS.

Table A.3
Eigenvalues in the Principal Component Analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Component 1	5.25	3.41	0.40	0.40
Component 2	1.84	0.41	0.14	0.54
Component 3	1.43	0.40	0.11	0.65
Component 4	1.03	0.03	0.08	0.73
Component 5	1.01	0.30	0.08	0.81
Component 6	0.71	0.17	0.06	0.87

KMO test = 0.85, Bartlett's test of sphericity: approx., Chi-Square = 420.12 Significance = 0.001, Cronbach's alpha = 0.76.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

List of Countries in the Empirical Analysis

Angola, Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Burundi, Belgium, Benin, Burkina Faso, Bangladesh, Bulgaria, Bahrain, Bahamas, Bosnia and Herzegovina, Belarus, Belize, Bolivia, Brazil, Barbados, Brunei, Bhutan, Botswana, Central African Republic, Canada, Switzerland, Chile, China, Côte d'Ivoire, Cameroon, D.R. of the Congo, Republic of Congo, Colombia, Comoros, Cabo Verde, Costa Rica, Cyprus, Czech Republic, Germany, Denmark, Dominican Republic, Algeria, Ecuador, Egypt, Spain, Estonia, Ethiopia, Finland, Fiji, France, Gabon, United Kingdom, Georgia, Ghana, Guinea, Gambia, Guinea-Bissau, Equatorial Guinea, Greece, Guatemala, China, Hong Kong, Honduras, Croatia, Hungary, Indonesia, India, Ireland, Iran, Iceland, Israel, Italy, Jamaica, Jordan, Japan, Kazakhstan, Kenya, Kyrgyzstan, Cambodia, Republic of Korea, Kuwait, Laos, Lebanon, Liberia, Saint Lucia, Sri Lanka, Lesotho, Lithuania, Luxembourg, Latvia, China, Macao, Morocco, Moldova, Madagascar, Maldives, Mexico, North Macedonia, Mali, Malta, Myanmar, Mongolia, Mozambique, Mauritania, Mauritius, Malawi, Malaysia, Montenegro, Namibia, Niger, Nigeria, Nicaragua, Netherlands, Norway, Nepal, New Zealand, Oman, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Paraguay, Qatar, Romania, Russia, Rwanda, Saudi Arabia, Sudan, Senegal, Singapore, Sierra Leone, El Salvador, Suriname, Slovakia, Slovenia, Sweden, Syria, Chad, Togo, Thailand, Tajikistan, Trinidad and Tobago, Tunisia, Turkey, Tanzania, Uganda, Ukraine, Uruguay, United States, Venezuela, Vietnam, Yemen, South Africa, Zambia, Zimbabwe, United Arab Emirates.

Data availability

Data will be made available on request.

References

Adedoyin, Festus Fatai, Erum, Naila, Bekun, Festus Victor, 2022. How does institutional quality moderates the impact of tourism on economic growth? Startling evidence from high earners and tourism-dependent economies. Tourism Econ. 28 (5), 1311–1332. https://doi.org/10.1177/1354816621993627.

Alarcón, Daniela Moreno, Cole, Stroma, 2019. No sustainability for tourism without gender equality. J. Sustain. Tourism 27 (7), 903–919.

Alcalá-Ordóñez, A., Brida, J.G., Cárdenas-García, P.J., Segarra, V., 2024. Tourism and economic development: a panel data analysis for island countries. European Journal of Tourism Research 36, 3615-3615.

Andergassen, R., Candela, G., 2013. Tourism investments, local economic development, and less developed countries. Rev. Dev. Econ. 17 (1), 16–33.

Ashley, C., Mitchell, J., 2009. Tourism and Poverty Reduction Pathways to Prosperity. Routledge, London.

Ashley, C., De Brine, P., Lehr, A., Wilde, H., 2007. The Role of the Tourism Sector in Expanding Economic Opportunity. John F. Kennedy School of Government, Harvard University, Cambridge, MA.

Balaguer, Jacint, Cantavella-Jorda, Manuel, 2002. The long-run impact of tourism on economic growth: evidence from Spain. Appl. Econ. 34 (7), 877–884.

Baloch, Khalil, 2023. Commodity price dynamics and COVID-19: evidence from the oil and gold markets. Climate Economics and Social Impact (CESI) 1 (1), 7–23.

Baumgartner, Rupert J., Korhonen, Jouni, 2010. Strategic thinking for sustainable development. Sustain. Dev. 18 (2), 71–75.

Baxter, M.J., 1995. Standardization and transformation in principal component analysis, with applications to archaeometry. Journal of the Royal Statistical Society Series C (Applied Statistics) 44 (4), 513–527.

Bhatia, Archana, Roy, Bindu, Kumar, Anuj, 2022. A review of tourism sustainability in the era of Covid-19. J. Stat. Manag. Syst. 25 (8), 1871–1888.

Brau, Rinaldo, Lanza, Alessandro, Pigliaru, Francesco, 2007. Growth of small tourism countries: evidence from 1980–2003. Tourism Econ. 13 (4), 603–613.

Brida, Juan Gabriel, Cortes-Jimenez, Isabel, Pulina, Manuela, 2016. Has the tourism-led growth hypothesis been validated? A literature review. Curr. Issues Tourism 19 (5), 394–430.

Brida, Juan Gabriel, Gomez, David Matesanz, Segarra, Veronica, 2020. On the empirical relationship between tourism and economic growth. Tourism Manag. 81. Article 104131.

Calero, Claudio, Turner, Lindsay W., 2020. Regional economic development and tourism: a literature review to highlight future directions for regional tourism research. Tourism Econ. 26 (1), 3–26.

Cárdenas-García, Pablo Juan, Pulido-Fernández, Juan Ignacio, 2019. Tourism as an economic development tool: key factors. Curr. Issues Tourism 22 (17), 2082–2108.

Castro-Nuno, Mercedes, Molina-Toucedo, Jose A., Pablo-Romero, Maria P., 2013. Tourism and GDP: a meta-analysis of panel data studies. J. Trav. Res. 52 (6), 745–758.

Chien, Fengsheng, Chau, Ka Yin, Aldeehani, Talla M., Huy, Pham Quang, Tan, Luc Phan, Mohsin, Muhammad, 2022. Does external debt as a new determinants of fiscal policy influence sustainable economic growth: implications after COVID-19. Econ. Change Restruct. 55, 1717–1737.

Deller, Steven, 2010. Rural poverty, tourism, and spatial heterogeneity. Ann. Tourism Res. 37 (1), 180–205.

Destek, Mehmet Akif, Aydın, Sercan, 2022. An empirical note on tourism and sustainable development nexus. Environ. Sci. Pollut. Control Ser. 29, 34515–34527.

Dimoska, T., 2006. Tourism and least developed countries–A sustainable opportunity to reduce poverty. Economics and Organisation 5 (2), 1–12.

Fayissa, Bichaka, Nsiah, Christian, Tadasse, Badassa, 2008. Impact of tourism on economic growth and development in Africa. Tourism Econ. 14 (4), 807–818.

Figini, Paolo, Laura, Vici, 2010. Tourism and growth in a cross section of countries. Tourism Econ. 16 (4), 789–805.

Filep, E., Pearce, P., 2014. Tourist Experience and Fulfilment Insights from Positive Psychology. Routledge, New York.

Ghaffar, Abdul, Sardar, Maria, 2023. Different regions' climate vulnerability and the success of transitioning to renewable energy. Climate Economics and Social Impact (CESI) 1 (1), 39–54.

Gössling, Stefan, Peeters, Paul, Hall, C. Michael, Dubois, Ghislain, Ceron, J.P., Lehmann, La Vergne, Scott, Daniel, 2012. Tourism and water use: supply, demand, and security. An international review. Tourism Manag. 33 (1), 1–15.

Gössling, Stefan, Scott, Daniel, Hall, C. Michael, 2018. Global trends in length of stay: implications for destination management and climate change. J. Sustain. Tourism 26 (12), 2087–2101.

Hughes, Emma, Scheyvens, Regina, 2016. Corporate social responsibility in tourism: a development first approach. Tourism Geogr. 18 (5), 469–482.

International Institute for Environment and Development (IIED), 2001. The Future Is Now. Author, London.

Joliffe, Ian T., 2002. In: Principal Component Analysis, second ed. Springer- Verlag, New York, Inc, , New York.

Lee, Chien-Chiang, Mei-Ping, Chen, 2021. Ecological footprint, tourism development, and country risk: international evidence. J. Clean. Prod. 279, 123671.

Li, Kevin X., Jin, Mengjie, Shi, Wenming, 2018. Tourism as an important impetus to promoting economic growth: a critical review. Tourism Manag. Perspect. 26, 135–142.

Lindberg, Kreg, Andersson, Tommy D., Dellaert, Benedict G.C., 2001. Tourism development: assessing social gains and losses. Ann. Tourism Res. 28 (4), 1010–1030.

Markandya, Anil, Taylor, Tim, Pedroso, Suzette, 2005. Tourism and sustainable development: lessons from recent World Bank experience. In: Lanza, Alessandro, Markandya, Anil, Pigliaru, Francesco (Eds.), The Economics of Tourism and Sustainable Development. Edward Elgar, Cheltenham, UK and Northampton, MA, USA, pp. 225–251.

Marsiglio, Simone, 2015. Economic growth and environment: tourism as a trigger for green growth. Tourism Econ. 21 (1), 183–204.

Mohapatra, Subhalaxmi, 2018. Investigating the tourism and economic growth linkage: a panel causality analysis for the saarc countries. Asia Pac. J. Tourism Res. 23 (6), 573–583.

Nagaj, Rafat, Zuromskaitė, Brigita, 2021. Tourism in the era of covid-19 and its impact on the environment. Energies 14 (7). https://doi.org/10.3390/en14072000.

Narayan, Paresh Kumar, Narayan, Seema, Prasad, Biman Chand, 2010. Tourism and economic growth: a panel data analysis for pacific island countries. Tourism Econ. 16 (1), 169–183.

Novelli, M., 2015. Tourism and Development in Sub-saharan Africa: Current Issues and Local Realities. Routledge, New York.

Özgür, Gökçer, Elgin, Ceyhun, Elveren, Adem Yavuz, 2021. Informality as a barrier to sustainable development. Sustain. Dev. 29, 45–65.

Pablo-Romero, Maria del P., Molina, Jose A., 2013. Tourism and economic growth: a review of empirical literature. Tourism Manag. Perspect. 8, 28–41.

Peng, Bo, Song, Haiyan, Crouch, Geoffrey I., Witt, Stephen F., 2015. A meta-analysis of international tourism demand elasticities. J. Trav. Res. 54 (5), 611–633.

Pratt, S., 2015. The economic impact of tourism in SIDS. Ann. Tourism Res. 52, 148–160.

Reisinger, Y., Dimanche, F., 2020. International Tourism: Cultures and Behavior. Routledge, New York.

Rosselló-Nadal, Jaume, He, Jianan, 2020. Tourist arrivals versus tourist expenditures in modelling tourism demand. Tourism Econ. 26 (8), 1311–1326.

Saarinen, Jarkko, 2015. Conflicting limits to growth in sustainable tourism. Curr. Issues Tourism 18 (10), 903–907.

Saarinen, Jarkko, 2020. Tourism and Sustainable Development Goals: Research on Sustainable Tourism Geographies. Routledge, London and New York.

Sabbar, Saad Sabbar, 2023. An econometric analysis of the causes of environmental degradation in developing countries. Climate Economics and Social Impact (CESI) 1 (1), 24–38.

Scheyvens, Regina, Hughes, Emma, 2019. Can tourism help to 'end poverty in all its forms everywhere'? The challenge of tourism addressing SDG1. J. Sustain. Tourism 27 (7), 1061–1079.

Scheyvens, Regina, Momsen, Janet H., 2008. Tourism and poverty reduction: issues for small island states. Tourism Geogr. 10 (1), 22–41.

Scheyvens, Regina, Russell, Matt, 2012. Tourism, land tenure, and poverty alleviation in Fiji. Tourism Geogr. 14 (1), 1–25.

Sharpley, Richard, 2020. Tourism, sustainable development, and the theoretical divide: 20 Years on. J. Sustain. Tourism 28 (11), 1932–1946.

Song, Haiyan, Kim, Jae H., Yang, Shu, 2010. Confidence intervals for tourism demand elasticity. Ann. Tourism Res. 37 (2), 377–396.

Taghizadeh-Hesary, Farhad, Yoshino, Naoyuki, Mohsin, Muhammad, Mirza, Nawazish, 2022. Introduction: ways to achieve green economic recovery and mitigate greenhouse gases in the post-covid-19 era. Climate Change Economics 13 (3), 2203002.

Thomas, Frederic, 2014. Addressing the measurement of tourism in terms of poverty reduction: tourism value chain analysis in Lao PDR and Mali. Int. J. Tourism Res. 16 (4), 368–376.

Torres-Delgado, Anna, López Palomeque, Francesc, 2012. Initiatives in sustainable tourism: the growth and spread of the concept. Tourism Manag. Perspect. 4, 1–10.

UN Women, 2018. Gender Equality in the 2030 Agenda: Gender-Responsive Water and Sanitation Systems. UN Women.

UNWTO, 2015. Tourism and the sustainable development goals. Brochure. Retrieved from. https://www.e-unwto.org/doi/pdf/10.18111/9789284417254.

UNWTO, 2019. In: Tourism Highlights 2019 Edition. UN World Tourism Organization.

WCED (World Commission on Environment and Development), 1987. Our Common Future. Oxford University Press.

Xue, Yangang, Mohsin, Muhammad, Taghizadeh-Hesary, Farhad, Iqbal, Nadeem, 2022. Environmental performance assessment of energy-consuming sectors through novel data envelopment analysis. Front. Energy Res. 9, 713546.

Yenişehirlioğlu, Eemirhan, Taşar, İzzet, Bayat, Tayfur, 2020. Tourism revenue and economic growth relation in Turkey: evidence of symmetrical, asymmetrical and the rolling window regressions. Journal of Economic Cooperation & Development 41 (2), 1–16.