On the nexus between globalization, tourism, economic growth and biocapacity: evidence from top tourism destination

Festus Fatai Adedoyin

Department of Computing and Informatics, Bournemouth University, United Kingdom

Email: fadedoyin@bournemouth.ac.uk

Uju Violet Alola

Department of Tourism Guidance, Istanbul Gelisim University, Istanbul, Turkey

South Ural State University, Economics and Management, Chelyabinsk, Russia

uvalola@gelisim.edu.tr

Festus Victor Bekun[1]

Faculty of Economics Administrative and Social sciences,

Department of International Logistics and Transportation

Istanbul Gelisim University, Istanbul, Turkey

Email: fbekun@gelisim.edu.tr

[1] Corresponding author: Festus victor Bekun
Email: fbekun@gelisim.edu.tr

Abstract

Several studies have investigated the relationship between tourism, consumption of energy, globalization, and ecological footprint. However, the role of biocapacity alongside tourism development in environmental sustainability is yet to be documented in the extant literature. No doubt, the biocapacity of a country, its level of tourist's arrival as well as globalization all contribute immensely to ecological footprint. Consequently, this study looks at long-run and causality connections with a special focus on bio-capacity. The study uses the Pooled Mean Group- Autoregressive distributed lag model (PMG-ARDL) methodology to test the causality relationship during 2016 international tourists' receipt from world tourism organization data files for 10 tourism destinations. Empirical result based on the panel PMG-ARDL confirms the Environmental Kuznets curve (EKC) hypothesis for the 10 tourism destinations countries investigated. Furthermore, the Panel ARDL estimator was used to estimate the short-run and long-run relationship simultaneously between biocapacity, tourist arrivals, GDP per capita, globalization, and ecological footprints. While the Dumitrescu and Hurlin panel causality test was used to establish causality relationships among the highlighted variables. The trade-off between economic growth and environmental quality suggests that tourist arrival dampens environmental quality. In addition, the study finds that growing biocapacity affects ecological footprints negatively. Furthermore, an increase in tourism-related activities, globalization, and economic production has the potential to damage the quality of the environment. To this end, given the study results, there is a need to pursue green tourism which can reduce environmental degradation and destruction of land caused by multiple tourism-related transportation and construction of tourist facilities respectively in the top ten tourist destination countries.

Keywords: Tourist arrival; sustainable development; bio-capacity; economic growth ecological footprints; globalization

1. Introduction

Tourism and economic growth move concurrently, especially in tourist destinations. International tourism (tourist arrivals and receipts) continues to direct the pace of the global economy, especially since the advanced and emerging economies are both benefits of this rise from tourism income as highlighted by the World Tourism Organization (UNWTO) (UNWTO, 2019). The trickle-down theory explains the phenomenon that tourism expansion leads to economic growth that eventually but gradually elevates countries Gross Domestic Product (GDP). The impact of tourism inflow to countries for leisure increases geometrically from 50% in the year 2000 to 56% in 2018 according to the World Tourism Organization (UNWTO)report of 2019. Tourism inflow is seen from the creation of employment, infrastructure development, and stimulation of other sectors directly and indirectly. The industry witnessed 9-year conservatively sustained growth (UNWTO, 2018). Also, for 7 years in a row, the growth has increased faster than merchandise exports, leading to trade deficits in several countries of the world, adding a total of 79 % in domestic value, job creation and export revenue. Also, in 2016, the expected tourist arrival increased by more than 1.2 billion as earlier projected (OECD 2018).

Furthermore, in 2018, according to the report of World Travel and Tourism, the tourism sector contributed 319 million jobs (WTTC, 2019). The World Tourism Organization (UNWTO) in 2018 predicted international tourist arrival of 2019 which grew by 4% in the first half of the year 2019. The growth was evident in most of the continents. For instance, the Middle East witnessed the highest tourist arrival of 8% plus, followed by Asia and the Pacific +6%, 4% plus from the European region, Africans +3% and Americans by 2% plus. Given verdict by sub-regions, the Caribbean witnessed the highest growth of 11 % plus, the North Africa by +9%, while plus 7% was seen in North-East Asia.

Importantly, the tourism-led growth fortunes have not come without several problems where keen attention should be paid in value rather than in volume. For instance, the last decades' study on the tourism-economic development nexus has further provided insight into the environmental consequences of the development in tourism sectors. As much as economic development has been investigated from the perspective of the Environmental Kuznets Curve (EKC), so is the EKC from the tourism development perspective. Another greater concern is the impact of tourism development on economic growth especially when there is a flock or concentration of tourists to a particular destination, thus causing over-tourism (Mass Tourism). Take for instance the mass tourism, the case of the Great Wall of

China, which puts enormous stress on the destination land that indirectly leads to soil erosion that gradually destroys the environmental resources and other parts of the ecosystem.

Although, Brida et al., (2008) found a significant impact of tourism and the economy for the case of Colombia over the investigated period. However, several emphases have been made on the positive impact of tourism, economic growth, and development (Adedoyin & Bekun,2020; Tecel et al.,2020; Akadiri et al. 2017; Albalate & Bel, 2010). Also, another study has linked economic growth and environmental sustainability in Asian countries using a nonlinear autoregressive distributed lag approach, however, the result shows that the economic growth pattern in the country is environmentally unsustainable (Shahbaz et al. 2021). Additionally, several recent pieces of literature highlight the relevance of tourism inflow to the economy either directly or indirectly (Ozcan et al., 2021; Alola et al. 2019, Akadiri, Alola, Cop, & Adewale Alola, 2019, Akadiri & Alola, 2017). According to the World tourism organization, the USA and European Union states are the largest tourist destination countries followed by China which is the third-largest inbound tourist destination. The view of Xue, Chang and Chi-Wei (2018) and the data from the National Bureau of Statistics shows that China receives 133.82 million dollars as tourist revenues increase the country's foreign exchange earnings by 113.65 billion dollars, thus contributing enormously to the country's GDP and increasing CO_2 emission.

Interestingly, as tourism is increasing, energy consumption is also increasing (fossil fuels) contributing to the emission of CO_2 (Nathaniel 2021c; Balsalobre-Lorente et al., 2020; Ballie et al. 2019; Gossling & Peeters, 2015). This is evident in transportation, accommodation, and other tourist activities directly or indirectly. Moreover, several studies highlight the long-run relationships that exist between economic growth and CO_2. For instance, the study of Eluwole et al. (2020), investigates 10 tourists' destinations and came up with a conclusion that in the long run, that the impact of tourism asserts a negative effect on carbon emission. Accordingly, (Kocak, Ulucak & Ulucak, 2020) a significant difference exists between developed and developing countries relationship in tourism inflow and CO_2. Cai et al. (2020), made a huge contribution by suggesting a practical approach to the reduction of CO_2 emissions. Production and consumption of energy should be measured and improve and develop clean energy power generation. On the other hand, the reduction of the use of energy will reduce CO_2 emissions (Kocak & Ulucak, 2019). Although, Saint Akadiri et al. (2019), opined a negative impact of tourism arrivals on CO_2 in a long run. Applying a CO_2 emissions reduction strategy that is wildly acceptable to measure the sustainability of the environment (Kocak, Ulucak & Ulucak, 2020; Eluwole et al. 2020; Etokakpan et al et al.,2019; Balli et al. et al. 2019), is highly encouraged.

In this effect, the present study deviates from the conventional approach to employ a comprehensive and robust empirical technique on variables such as the total ecological footprint real gross domestic product per capita, international tourist arrivals, biocapacity, and globalization in a panel of 10 highest tourist destination country over the period of 1977-2018. Although recent studies have investigated tourism and other variables (Katiricioglu, Gokmenoglu & Eren, 2018) finding out that tourism development exerts a negative influence on ecological footprints. In the same line, Shahzad et al. (2017), ascertained a positive relationship between tourism and economic growth in a study using ten tourist destinations with a quantile-on-quantile approach.

The objective of the current research is robust in that it provides empirical outcome and contribute significantly to existing literature. A comprehensive multivariate model was used for panel study of the top 10 tourist destination countries comprising both developed and developing economics. Choosing the 10-tourist destination cut across the continent will be a great representation and thereby making the result good for generalization. The study uses tourism arrivals as a proxy for tourism relative to previous literature that adopts the use of tourism receipt or tourism expenditure. The motivation for the use of international tourism arrival stems from the fact that international tourism arrival is a broader measure that captures more dynamics in the tourism industry both in its physical impact and income basis generated aspects of tourism. On the other hand, tourism receipt only reflects wealth impact (Akadiri et al.,2019, Ozcan et al.,2021). Furthermore, existing studies applied carbon dioxide, however, the present study will apply ecological footprint (EFP) which encompasses several natural habitats to the study model and brings novelty to the growth-tourism and environment for the top tourism destination. Previous studies are conducted for small island states (Akadiri et al.,2019) and single country-specific cases. The current study focuses on top tourism-dependent countries to make policy prescriptions in terms of environmental sustainability with the perspective of total ecological footprint and biocapacity without compromise for the bloc economic trajectory.

The remainder of this study proceeds with a review of related literature in section 2. Subsequently, the data and methodological sequences are presented in section 3 while empirical results are rendered in section 4. Finally, the concluding remarks and policy guidance for the bloc are documented in section 5 accordingly.

2. Review of related literature

2.1 Biocapacity, Economic Growth, Tourist Arrivals in the top destinations

Over the last three decades, a large number of studies have investigated the determinants of environmental pollution across the countries of the world (Adedoyin et al., 2020b, 2020a; Udi et al., 2020; Ahmad et al. 2021). As shown in table 1a in the appendix, a summary of the various literature in this study is shown. According to Zaman et al (2016) economic growth, tourism, health, and investment are responsible for carbon emissions which in turn affect the quality of the environment in high-income OECD, non-OECD, EU, East Asia, and Pacific countries. Also, (Ahmad et al. 2021) employed the augmented mean group method and Dumitrescu Hurlin causality to examine the long and short-run connection in economic development and environmental emission among the 31 Chinese provinces, their result found a simultaneous growth link as urban concentration is rising; economic development is increasing both in short and long-run levels of development. Urban concentration shows a U-shaped connection with nonrenewable energy use intensity and environmental emissions index. Similarly, the study by Akadiri et al (2019a) on the Turkish economy from 1970 to 2016, with ARDL-VECM and concluded that tourism and real income (real GDP) were important determinants of CO_2 emissions and consequently the natural environment.

Among the related studies that made use of causality analysis, the work of Akadiri et al (2018) used a panel non-causality approach and identified a causal relationship from GDP per capita and tourism to CO_2 emissions in 16 developing Island countries. Interestingly, apart from confirming the adverse impact of GDP and tourism on the environment, the study also found that carbon emissions induce tourism and economic growth for two countries in the study-Bahamas and Papua New Guinea. This means that carbon emissions have predictive power on tourism and growth in the two countries- a phenomenon is known as the demand flowing hypothesis. The quest to decarbonate the environment has ushered in several policies including a carbon tax. The revenue generated from the carbon tax will be tailored towards energy innovation. The study of (Cheng et al. 2021) examined the impact of the carbon tax and energy innovation using Quantile-on-Quantile Regression over a period of 29 years in various sectors of the Swedish economy. Interestingly, the findings show that both ways (carbon tax and energy innovation) will not be effective in the long run. On the other hand, the study of Zafer et al (2021), investigated the effect of biomass energy and environmental quality. The study incorporated several variables for a study like energy consumption, technology innovation and education on environmental quality. The findings review that biomass energy use together with technological innovation has a reduction on environmental quality, while economic growth accounts for a massive rise in carbon emission whereas financial development and education causes a reduction in carbon emissions.

The reciprocal relationship between tourism and environmental degradation has been documented in studies carried out in other countries around the world. In a study involving 34 high-income countries from Asia, Europe and America, a reciprocal relationship between emissions and tourism were identified in 12 of the countries (Khan et al, 2019).

Some authors believe that the adverse effect of tourism on the environment is not properly accounted for, hence, they found more efficient ways of accounting for the adverse effect of tourism on the ecological quality to pave the way for effective mitigation of this phenomenon. For instance, Tang et al (2014) used a bottom-up approach to calculate the components of the tourism industry and the collective impact on the environment. They found that tourist transportation contributed to 80% of tourism carbon emissions in china while tourist activities and tourist accommodation constituted the rest. In another study, Cadarso et al (2016) carried out a study on the calculation of carbon footprints in Spain and found that tourism contributes up to 40% of the carbon footprints in the country. The study also included the role of tourism investments which made a significant increase in the contribution of tourism to the total carbon footprints in Spain. In the same line, Sun et al (2016) submitted that the depleting carbon efficiency in Taiwan is due to tourism-related air travel and poor mitigation rules in the country. The study which adopted an environmentally extended input-output model and data tourism-related data covering the period 2001-2011 called for serious government intervention to arrest the worsening environmental conditions caused by tourism-related transportation in the country.

Further insights on the impact of GDP on environmental quality are available in the literature. Churchill et al (2018) investigated the Environmental Kuznets Curve (EKC) for 20 OECD countries for the period 1870-2014. Overall, the panel data analysis showed the presence of the EKC in the focus countries which shows a U-shaped relationship between economic growth and environmental quality. On the other hand, Wu et al (2017) studied BRIC countries for the period 1992-2013. With the use of panel co-integration analysis, the study did not find the presence of EKC in the focus countries, however, they concluded that an increase in economic growth and renewable energy consumption is responsible for environmental degradation in the BRIC countries. The study further suggested that BRIC countries increase their energy efficiency to reduce emissions and their harmful effects on the environment. Similarly, a study by Jorgensen and Clark (2011) for 65 countries over the period 1960 to 2003 confirms that rising levels of economic growth led to environmental degradation. Going further Meng et al (2016) linked high levels of economic activities to Ecosystem Service Deficit (ESD) using the Ecosystem Footprints Service Model for China for the period 2000-2014.

Given the highlighted literature, this present study including biocapacity as a determinant of environmental quality is very few in the literature. Among the few is Danish et al (2019) who carried out a study in Pakistan for the period 1971-2014. With the help of a dynamic ARDL, they found that an increase in economic growth and biocapacity worsens ecological footprints. Based on the analysis of ecological security in the Beijing-Tianjin-Heibin region for the period 1995-2010 Chu et al (2017) submit that decreasing biocapacity leads to improvement of the ecological footprints in the region. More recently, some studies have examined the relationship between biocapacity, ecological footprints and energy consumption (Nathaniel et al 2021; Sharma, Sinha & Kautish, 2021). The biocapacity and ecological footprints crisis point to the insufficiency of available resources for economic production and the drive to meet specific economic development goals across the globe.

It, therefore, means that countries with sufficient biocapacity will be able to maintain a cleaner environment while engaging in economic activities. Explored the nexus between ecological footprint and natural resource rent, energy intensity, GDP per capita and two tourism measures such as tourism receipt and international tourism arrival for data covering over three decades with panel analysis such as full modified (CUP-FM) and updated bias-corrected (CUP-BC). The study submitted that ecological footprint has an inverse relationship with urbanization and natural resources while natural resources and increasing urban population can help to reduce environmental degradation in the tourism-dependent countries This study aligns with the finding of Nathaniel and Adedoyin (2020). Nathaniel (2021a) explored the economic growth trajectory for Next-11 countries where the study investigated the well-being of the Next-11 countries and her environmental sustainability using second generational panel techniques. Well-being was captured by composite index-human development index (HDI). The study key finding includes that financial development and biocapacity increase the ecological footprint while the study also reveals that natural resources and globalization reduces environmental degradation over the investigated period. Subsequently, Meo et al (2021) investigated the tourism-energy and growth nexus for developing countries with Pakistan as the focus country. The study considers asymmetry while exploring the relationship between energy consumption, tourism arrival and institutional quality for the case of Pakistan. The NARDL analysis shows an asymmetric relationship between the outlined variables. The mediating role of institutional quality exerts a positive significant t role in the tourism industry given more improvement in institutional apparatus in the country.

2.2 Globalization and Environmental Sustainability

Most of the empirical evidence supports the assertion that globalization plays a significant role in environmental degradation as against environmental sustainability (Ullah et al. 2021). For instance, Akadiri et al (2019b) carried out a study for Italy covering the period 1970-2014 using an ARDL and Toda Yamamoto estimators which results showed a positive significant relationship between globalization and CO_2 emissions in the short run and long run. A study by Khan (2019) for Pakistan confirms the findings of Akadiri et al (2019b). The study which covered the period 1975-2016 and was conducted with a dynamic ARDL found that the economic, social, and political aspects of globalization contribute to environmental pollution in the country. Similarly, Nathaniel (2021b) explored the nexus between economic complexity and ecological footprint in the era of globalization for the Association of Southeast Asian Nations, abbreviated as (ASEAN) countries. The study findings lend support to the study of Akadiri et al. (2019b).

A study of the G20 for the period 2000 to 2014 by Wang et al (2014) with the help of a panel quantile regression confirms that a high level of globalization is associated with worsening environmental quality in the G20 countries. However, the study also shows a declining impact of globalization on environmental quality across quantiles and that greater environmental impact is felt by extremely low and high emission countries among the G20. Baek et al (2009) found that the impact of globalization on environmental quality differs for developed and developing countries. From the study involving 50 countries, panel data analysis reports that while increasing levels of globalization improve environmental quality in developed countries it worsens environmental quality in developing countries. This phenomenon is due to the emission-income hypothesis which submits that economic growth induced by globalization leads to an increase in environmental quality through an increase in emissions until it crosses a certain threshold after which further growth will lead to a decrease in emissions and consequently the improvement of the environment. Also interesting is the finding that, while there is unidirectional causality from growth-proxy for globalization to S02 emissions in developed countries, there is uni-directional causality from S02 to growth in developing countries except for China.

Globalization comes with both adverse and beneficial effects on the environmental quality in Africa as shown by the work of Acheampong et al (2019) on 46 sub-Saharan African countries. The study used two indicators for globalization namely Foreign Direct Investments (FDI) and trade openness, and with the help of panel spatial analysis, it was found that while an increase in FDI improves environmental quality by a reduction in carbon emissions, a rise in openness leads to environmental degradation in

Africa by spurring a rise in carbon emissions. The study suggests increased use of renewable energy and regulation of non-sustainable production activities to mitigate environmental damage. Comparatively, You and Lv (2018) differ in the globalization environmental nexus. In their study of 83 countries over the period 1975 to 2013 they found an overlapping negative significant relationship between globalization and environmental quality, hence, the conclusion that high levels of globalization improve the quality of the environment among the 83 countries in the study. The study further inferred that being surrounded by a globalized country has a positive impact on the environmental quality of a country.

3. Data, Model and Methods

This paper examines the causal linkage between International Tourist Arrivals, Bio-Capacity, Globalization and Ecological Footprint: Evidence from Top 10 Tourism Destinations like France, United States, Spain, China, Italy, United Kingdom, Germany, Mexico, Thailand, Turkey period. Hence our Tourism model includes bio-capacity, globalization, and ecological footprints. Methods like panel pooled Mean Group- Autoregressive Autoregressive distributed lag model (PMG-ARDL) were adopted. The empirical model is given as:

$$\mathrm{TEFP} = f(\mathrm{BIO}, \mathrm{TOU}, \mathrm{GLO}, \mathrm{GDP}, \mathrm{GDP2}) \quad (1)$$

$$\mathrm{In\,TEFP}_{it} = \alpha_0 + \alpha_1 \mathrm{InBIO}_{it} + \alpha_2 \mathrm{InTOU}_{it} + \alpha_3 \mathrm{InGLO}_{it} + \alpha_4 \mathrm{InGDP}_{it} + \alpha_5 \mathrm{InGDP2}_{it} + e_{it} \quad (2)$$

Where TEFP represents Ecological footprints, BIO represents biocapacity, TOU represents tourists' arrivals, GLO represents globalization and GDP represents real Gross domestic product subscripts e_{it} refers to the error term; i represent each country while t represents the time. The choice of variables follows several empirical studies in the literature. For example, the development of the tourism sector in many countries is considered paramount to determining the quality of ecological footprint (Katircioglu et al., 2018; Kongbuamai et al., 2020). Also, studies have examined the relationship between biocapacity, ecological footprints and energy consumption (Nathaniel et al 2021; Sharma, Sinha & Kautish, 2021). The biocapacity and ecological footprints crisis point to the insufficiency of available resources for economic production and the drive to meet specific economic development goals across the globe.

The data or this study covers the 2016 period of tourist's arrivals for the top 10 tourism countries highlighted. Data were extracted from World Tourism Organization data files as shown in Table 1.

Additionally, the selection of variables was motivated by the Ecological footprints and the Environmental Kuznets Curve. Furthermore, Table 2 presents the data and the description of the variables under consideration.

Table 1. Countries of focus 2016 International tourism, receipts (current US$)

S/N	Country	International tourism, number of arrivals
1	France	82682000
2	United States	76407000
3	Spain	75315000
4	China	59270000
5	Italy	52372000
6	United Kingdom	35814000
7	Germany	35555000
8	Mexico	35079000
9	Thailand	32530000
10	Turkey	30289000
Source: World Tourism Organization data files		

Table 2. Description of variables and measurement Units

Name of Indicator	**Abbreviation**	**Proxy/Scale of Measurement**	**Source**
Total ecological footprint	TEFP	Area Per Capita	Global Footprint Network (2019)
Real gross domestic product per capita	RGDP	Constant 2010 US$	WDI
International tourist arrivals	TOU	Number of arrivals	WDI
Biocapacity	BIO		WDI
Globalization	GLO	Index	The Swiss Institute of Technology in Zurich

Note. WDI is a connotation for data from World Bank Development Indicator of the World Bank database sourced from https://data.worldbank.org/.

As reiterated above, this study employed a panel mean group autoregressive regressive distributed lag model to capture the short-run and the long-run relationship between the target-dependent and independent variables. Although the ARDL model is capable of capturing short-run and long-run estimation, it is deficient to control the bias prompted by the associative correlation between white noise terms and the mean-differenced predictors, especially with the individual effects panel model. To overcome this bias, we used ARDL in conjunction with PMG developed by Pesaran et al. (1999) to provide challenging and suitable answers to the inappropriateness of dynamic system GMM. Moreover, Pesaran et al. (1999) posited the reliability of PMG estimators and their robustness to lag orders and outliers. Hence, following Sarkodie and Strezov (2018), we developed the model below:

$$\Delta \mathrm{lnTEFP}_{it} = \phi_i \mathrm{ECT} + \sum_{j=0}^{q-1} \Delta X_{it} \beta_{ij} + \sum_{j=1}^{p-1} \psi_{ij} \Delta \mathrm{lnTEFP}_{it-j} + \varepsilon_{it} \quad (3)$$

Where ECT is the error correction term of the model and given in the below equation

$$\mathrm{ECT}_{it} = \mathrm{TEFP}_{it-1} - X_{it}\theta \quad (4)$$

Where Δ represent difference operator, ϕ and θ are coefficients of adjustment (whose product is β *and* ψ after convergence), and long-run coefficient, respectively. ε denote the error term, TEFT is the dependent variable, X denote the vector of predictors (BIO, TOU, GLO, GDP, GDP2) with equal lags order q across each cross-unit i in time t.

4. Results and Discussions

Table 3 reports the descriptive statistics of the variables at the country level and in the group. For the individual countries, The United States of America has the highest Gross Domestic Product while China has the highest Biocapacity and Ecological footprint, France records the highest receipts from tourism while the United Kingdom has the highest globalization index. For group characteristics GDP has the highest mean and median. The correlation matrix shown in table 4 Biocapacity, tourist arrivals, GDP and globalization has a positive correlation with EFP as expected.

Table 3. Summary Statistics

Individual Country Mean (1995 – 2016)					
	EFP ('million)	GDP ('billion)	BIO ('million)	TOU ('million)	GLO
France	323	2490	172	76	84.64
Spain	217	1280	63	53	81.39
United States of America	2790	14000	1100	55	79.41
China	3700	4520	1240	43	58.62
Italy	306	2070	60	41	79.82
Mexico	318	993	148	23	63.47
United Kingdom	337	2310	75	27	87.49
Turkey	207	698	112	22	66.52
Germany	435	3290	138	23	85.60
Thailand	149	292	77	15	66.49
Group Summary Statistics (1995 – 2016)					
Variable	Obs.	Mean	Std. Dev.	Min	Max
EFP ('million)	220	878	1260	114	5260
GDP ('billion)	220	3190	3930	199	16900
BIO ('million)	220	319	431	47	1370
TOU ('million)	220	38	20	7	85
GLO	218	75.34	10.59	45.65	89.35

Table 4. Result of Pearson correlation matrix

	LEFP2	LGDP	LGDP2	LTOU	LBIO	LGLO
LEFP2	1					
LGDP	0.7675*	1				
	0.0000					
LGDP2	0.7668*	0.9997*	1			
	0.0000	0.0000				

LTOU	0.5988*	0.6554*	0.6486*	1		
	0.0000	0.0000	0.0000			
LBIO	0.1393*	0.6651*	0.6739*	0.3135*	1	
	0.0389	0.0000	0.0000	0.0000		
LGLO	0.7949*	0.4082*	0.4016*	0.4703*	-0.3254*	1
	0.0000	0.0000	0.0000	0.0000	0.0000	
***; **; and * connotes a statistical rejection level of normality test statistics at 1%; 5% and 10% significance levels respectively						

Subsequently, in table 5, both Im Pesaran Shin and ADF-Fisher Unit root tests show that all variables are first difference stationary. Three variables are stationary at the level in both tests, hence we conclude that the time series of the variables are integrated of order one, i.e. I(1).

Furthermore, table 6 shows the results of the cointegration tests from the Pedroni co-integration test. The result confirms that there exists among cointegration relationship among LBIOCAP, LGDPC, LARRIVALS, and GLO over our investigated period for the top tourism destination.

Table 5. UNIT ROOT ANALYSIS

TESTS	IPS		FISHER-ADF	
variable	LEVEL	Δ	LEVEL	Δ
LNARRIVALS	0.5014	-2.7086***	20.254	38.195***
LNBIOCAP	-4.0482***	-7.5015***	53.038***	87.089***
LNEFP	0.7014	-3.9855***	16.556	53.759***
LNGDPC	-1.8866**	-2.7636***	32.039**	40.364***
LNGLOBAL	-2.3171**	-4.0092***	34.955**	49.224***

Notes: Δ is the first difference operator for the model with both trend and intercept at the level. Lag length is automatically selected using the Akaike information criterion. ***, ** and * represent a rejection of the null hypothesis of “unit root” at the 1%, 5% and 10% levels of significance respectively.

Table 6. Pedroni cointegration test

test statistics	statistics	prob*
Panel v-Statistic	-1.398	0.919
Panel rho-Statistic	0.653	0.743
Panel PP-Statistic	-3.753	0.000***
Panel ADF-Statistic	0.050	0.520
Group rho-Statistic	2.860	0.998
Group PP-Statistic	-2.600	0.005***
Group ADF-Statistic	-0.683	0.247

Table 8 reports the regression results, which confirms the EKC for the ten countries in focus (France, United States of America, Spain, China, United Kingdom, Italy, Mexico, Turkey, Germany, and Thailand). Additionally, in Table 7, the results of the Dumitrescu and Hurlin panel causality test are presented. This is to permit an examination of the Granger non-causality from each explanatory variable to total ecological footprints in a heterogeneous panel setting.

Table 7: Causality Analysis

Null Hypothesis	W-Stat.	Zbar-Stat.	Prob.
LARRIVALS ≠>LEFP	7.09472	5.6174	0.0000***
LEFP ≠>LARRIVALS	2.73316	0.4992	0.6176
LBIOCAP ≠>LEFP	4.58166	2.66844	0.0076***
LEFP ≠>LBIOCAP	3.73544	1.6754	0.0939*
LGDPC ≠>LEFP	5.45007	3.6875	0.0002***
LEFP ≠>LGDPC	3.5541	1.4626	0.1436
LGLOBAL ≠>LEFP	5.52944	3.7806	0.0002***
LEFP ≠>LGLOBAL	4.6509	2.7496	0.006***
LBIOCAP ≠>LARRIVALS	2.21417	-0.1097	0.9126
LARRIVALS ≠>LBIOCAP	3.81864	1.7730	0.0762*
LGDPC ≠>LARRIVALS	2.55261	0.2874	0.7738
LARRIVALS ≠>LGDPC	4.28829	2.3241	0.0201**
LGLOBAL ≠>LARRIVALS	4.0676	2.0652	0.0389**

LARRIVALS ≠>LGLOBAL	2.0458	-0.3073	0.7586
LGDPC ≠>LBIOCAP	3.4189	1.3039	0.1922
LBIOCAP ≠>LGDPC	2.73113	0.4969	0.6193
LGLOBAL ≠>LBIOCAP	4.48228	2.5518	0.0107**
LBIOCAP ≠>LGLOBAL	1.15765	-1.3495	0.1772
LGLOBAL ≠>LGDPC	5.21625	3.41311	0.0006***
LGDPC ≠>LGLOBAL	5.83645	4.1409	0.0000***
Note: *** p<0.01, ** p<0.05, * p<0.1 represent statistical rejection level at 1,5 and 10 per cent respectively while symbol "≠>" denotes Granger Causality relationship between highlighted variables with the null hypothesis of no causality.			

Considering the variables in the model, biocapacity is statistically significant in the short and the long run at 5 and 10 % levels respectively. However, while it is negative in the short run with a coefficient of -0.327, it is positive in the long run as can be seen by its coefficient of 0.585. This implies that a 1% increase in biocapacity improves ecological footprints in the short run by 0.32%, while in the long run (future time) a 1% increase in biocapacity worsens ecological footprints by 0.58% in the ten countries. The impact of biocapacity on ecological footprints in the countries of focus is as expected and confirms the study of Danish et al (2019) for the case of Pakistan. Results from table 7 show that there is bi-directional causality between biocapacity and ecological footprints. Apart from providing further supports for the regression results (Table 8), this outcome entails a feedback mechanism between the two variables. Hence, more biocapacity can affect ecological footprints and vice versa.

Consequently, the coefficient for tourist arrivals is not significant in the short run as well as in the long run (Table 8). This means that tourist arrivals in the focus countries have no impact on ecological footprints in the focus countries. Hence, it is other factors that affect ecological footprints in the study countries. However, opposing results are suggested by the causality test, which shows that there is unidirectional causality from tourist arrivals to ecological footprints. This implies that an increase in tourist activities can contribute to environmental degradation as found by Zang (2019) in his study of six South East Asian countries. Furthermore, tourism impacts negatively on the ecological footprints of countries by putting excessive pressure on local land use and as well as local infrastructure. The continuous use of air and road transport by tourist increase air pollution. Also, due to an increase in tourist visits to a country, the construction of tourist sites and facilities destroys soil composition and exposes the land to soil erosion.

In the case of globalization, the regression results (Table 8) suggest a non-significant effect in both the short run and the long run. Similar results have been reported by Akadiri et al. (2018, 2019) for selected tourist destination states, where they found that globalization has no statistically significant impact on environmental degradation and further, submitted that factors environmental pollution was caused by other factors within the countries such as national economic activities rather than outside factors induced by globalization. However, table 7, shows that there is bi-directional causality between globalization and ecological footprints, suggesting that globalization affects ecological footprints and vice versa. This result is consistent with that of You and Lv (2018) for 83 countries and Shahbaz et al (2018) for the Netherlands and Ireland.

GDP per capita is not significant in the short run but it is positive and statistically significant in the long-run coefficient of 8.451. This means that GDP per capita worsens ecological footprints in the long run only. Specifically, a 1% rise in GDP per capita will cause an increase in ecological footprints of 8.45%. Consequently, results from causality tests (table 7) show that there is unidirectional causality from GDP per capita to total ecological footprints, further implying a negative effect on the environment caused by continuous economic growth among the countries in the study. It is against such negative ecological impact that environmental and macroeconomic policymakers are called upon to consider ecological preservation alongside economic development goals. (Alola et al., 2019a, 2019b; Nathaniel et al.,2021).

Table 8. Empirical Results

VARIABLES	MG	DFE	PMG
short-run			
ECT	-0.597***	-0.260***	-0.375***
	(0.132)	(0.0518)	(0.135)
D.lnbiocap	0.433	0.0957	0.327**
	(0.287)	(0.079)	(0.159)
D.lnarrivals	-0.0043	-0.0253	-0.13
	(0.079)	(0.058)	(0.094)
D.lnglobal	0.194	-0.491	-0.060
	(0.422)	(0.345)	(0.404)
D.lngdpc	-24	-3.036	56.51
	(90.5)	(3.743)	(41.48)
D.lngdpsgr	0.434	0.0741	-0.983
	(1.585)	(0.068)	(0.720)
long-run			

lnbiocap	-2.299	0.434	-0.585***
	(1.517)	(0.394)	(0.105)
lnarrivals	-1.288	-0.139	0.0493
	(0.981)	(0.105)	(0.036)
lnglobal	-9.264	-0.246	0.328
	(5.881)	(0.595)	(0.201)
lngdpc	370.0***	2.556	8.451***
	(126.4)	(2.530)	(1.422)
lngdpsgr	-6.439***	-0.0358	-0.148***
	(2.158)	(0.043)	(0.027)
Constant	-1,758*	-12.37	-41.49***
	(905.4)	(9.576)	(14.980)
hausman test	0.000 (1.000)	8.18 (0.140)	0.000 (1.000)
Observations	210		210
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. *** the Hausman test shows PMG is the best model of the three models. should be considered for the analysis.			

5. Conclusion and policy implications

This study links biocapacity, GDP per capita, tourist arrivals and globalization to ecological footprints. This panel study extends the body of knowledge by introducing ecological footprints (which comprises several measures of natural habitat) in the Environmental Kuznets Curve (EKC) framework for the top 10 tourist destinations namely France, the United States of America, Spain, China, United Kingdom, Italy, Mexico, Turkey, Germany, and Thailand over the period 1995 to 2016. The Panel ARDL estimator was used to estimate the short-run and long-run relationship between biocapacity, tourist arrivals, GDP per capita, globalization and Ecological footprints. While the Dumitrescu and Hurlin panel causality test was used to establish causal relationships among the variables.

The study confirms that the Environmental Kuznets Curve (EKC) holds in the ten countries examined., indicating that the addition of more and improved technology innovation will increase the economic growth while decreasing the environmental emission at the same time. This is in line with the study of Ahmad et al. (2021) and Churchill et al (2018) when they find a U shape relationship between the intensity of nonrenewable energy use and emission index. But oppose the study of Wu et al (2017) which poses no EKC hypothesis presence in BRIC countries. Also, the study finds that growing biocapacity affects ecological footprints negatively as Danish et al (2019) also find in their study that development in economic and biocapacity worsens Pakistan's ecological footprint, and Chu et al (2017), whose study confirmed that improvement of ecological improvement resulted from decreasing biocapacity in Beijing-Tianjin-Heibin region. Furthermore, increase in tourism-related activities, globalization, and economic production have the potential to damage the quality of the environment as evidenced from the research conducted by (Nathaniel 2021c) which stated that as tourism increases, consumption of energy also increases, thereby releasing toxic substances that damage the environmental quality.

From a policy perspective, it becomes necessary that attaining environmental sustainability is a commitment to be taken seriously by the individual countries in the study. Such commitment that will ensure a sustainable ecological footprint and cleaner environment can be achieved in several ways. Firstly, governments and organizations are advised to adopt green tourism which can reduce air pollution and destruction of land caused by multiple tourism-related transportation and construction of tourist facilities respectively in the top ten tourist destination countries covered in this study. Secondly, sustainable economic production is desirable to reduce emissions which deplete the quality of the environment in a bid to achieve economic development goals for national economies. Most of the countries analyzed in this study are signatory to the Kyoto Protocol and Paris accord which are committed to reducing the impact of emissions arising from economic activities on the natural habitat. Thirdly, the study has found a link between globalization and high ecological footprints makes it important that sustainable consumption patterns be adopted in the countries under focus to mitigate the environmental damage that arises from economic activities in response to global demand for goods and services. Moreover, the policy should synergize a way to properly manage the biocapacity in the region to have more control on the environmental quality.

References

Acheampong, A. O., Adams, S., & Boateng, E. (2019). Do globalization and renewable energy contribute to carbon emissions mitigation in Sub-Saharan Africa?. Science of The Total Environment, 677, 436-446.

Adedoyin, F. F., & Bekun, F. V. (2020). Modelling the interaction between tourism, energy consumption, pollutant emissions and urbanization: renewed evidence from panel VAR. Environmental Science and Pollution Research, 27(31), 38881-38900.

Adedoyin, F. F., Alola, A. A., & Bekun, F. V. (2020). An assessment of environmental sustainability corridor: The role of economic expansion and research and development in EU countries. Science of the Total Environment, 713, 136726. https://doi.org/10.1016/j.scitotenv.2020.136726

Adedoyin, F. F., Gumede, M. I., Bekun, F. V., Etokakpan, M. U., & Balsalobre-lorente, D. (2020). Modelling coal rent, economic growth and CO2 emissions: Does regulatory quality matter in BRICS economies? Science of the Total Environment, 710, 136284. https://doi.org/10.1016/j.scitotenv.2019.136284

Adedoyin, F.F., Alola, A.A., Bekun, F.V., (2020a). An assessment of environmental sustainability corridor: The role of economic expansion and research and development in EU countries. Sci. Total Environ. 713, 136726. https://doi.org/10.1016/j.scitotenv.2020.136726

Ahmad, M., Ahmed, Z., Yang, X., Hussain, N., & Sinha, A. (2021). Financial development and environmental degradation: Do human capital and institutional quality make a difference?. Gondwana Research.

Ahmad, M., Işık, C., Jabeen, G., Ali, T., Ozturk, I., & Atchike, D. W. (2021). Heterogeneous links among urban concentration, non-renewable energy use intensity, economic development, and environmental emissions across regional development levels. Science of The Total Environment, 765, 144527.

Akadiri, S. S., Akadiri, A. C., & Alola, U. V. (2019). Is there growth impact of tourism? Evidence from selected small island states. Current Issues in Tourism, 22(12), 1480-1498.

Akadiri, S. S., Lasisi, T. T., Uzuner, G., & Akadiri, A. C. (2020). Examining the causal impacts of tourism, globalization, economic growth and carbon emissions in tourism island territories: bootstrap panel Granger causality analysis. Current Issues in Tourism, 23(4), 470-484.

Alola, U. V., Cop, S., & Adewale Alola, A. (2019). The spillover effects of tourism receipts, political risk, real exchange rate, and trade indicators in Turkey. International Journal of Tourism Research.

Baek, J., Cho, Y., & Koo, W. W. (2009). The environmental consequences of globalization: A country-specific time-series analysis. Ecological economics, 68(8-9), 2255-2264.

Balli, E., Sigeze, C., Manga, M., Birdir, S., & Birdir, K. (2019). The relationship between tourism, CO2 emissions and economic growth: a case of Mediterranean countries. Asia Pacific Journal of Tourism Research, 24(3), 219-232.

Balsalobre-Lorente, D., Driha, O. M., Bekun, F. V., & Adedoyin, F. F. (2020). The asymmetric impact of air transport on economic growth in Spain: fresh evidence from the tourism-led growth hypothesis. Current Issues in Tourism, 1-17.

Brida, J. G., Pereyra, J. S., Risso, W. A., Devesa, M. J. S., & Aguirre, S. Z. (2008). The tourism-led growth hypothesis: empirical evidence from Colombia.

Cadarso, M. Á., Gómez, N., López, L. A., & Tobarra, M. Á. (2016). Calculating tourism's carbon footprint: measuring the impact of investments. Journal of cleaner production, 111, 529-537.

Cai, W., Song, X., Zhang, P., Xin, Z., Zhou, Y., Wang, Y., & Wei, W. (2020). Carbon emissions and driving forces of an island economy: A case study of Chongming Island, China. Journal of Cleaner Production, 120028.

Cheng, Y., Sinha, A., Ghosh, V., Sengupta, T., & Luo, H. (2021). Carbon tax and energy innovation at crossroads of carbon neutrality: Designing a sustainable decarbonization policy. Journal of Environmental Management, 294, 112957.

Chu, X., Deng, X., Jin, G., Wang, Z., & Li, Z. (2017). Ecological security assessment based on ecological footprint approach in Beijing-Tianjin-Hebei region, China. Physics and Chemistry of the Earth, Parts A/B/C, 101, 43-51.

Churchill, S. A., Inekwe, J., Ivanovski, K., & Smyth, R. (2018). The environmental Kuznets curve in the OECD: 1870–2014. Energy Economics, 75, 389-399.

Danish, H. S., Baloch, M. A., Mahmood, N., & Zhang, J. W. (2019). Linking economic growth and ecological footprint through human capital and biocapacity. Sustain Cities Soc 47: 101516.

Eluwole, K. K., Saint Akadiri, S., Alola, A. A., & Etokakpan, M. U. (2020). Does the interaction between growth determinants a drive for global environmental sustainability? Evidence from world top 10 pollutant emissions countries. Science of The Total Environment, 705, 135972.

Etokakpan, M. U., Bekun, F. V., & Abubakar, A. M. (2019). Examining the Tourism-Led Growth Hypothesis, Agricultural-Led Growth Hypothesis and Economic Growth in Top Agricultural Producing Economies. European Journal of Tourism Research, 21, 132-137.

Faber, B., & Cecile, G. (2019). Tourism and economic development: Evidence from Mexico's coastline. American Economic Review, 109(6), 2245–2293.

Gössling, S., & Peeters, P. (2015). Assessing tourism's global environmental impact 1900–2050. Journal of Sustainable Tourism, 23(5), 639-659.

Jorgenson, A. K., & Clark, B. (2011). Societies consuming nature: a panel study of the ecological footprints of nations, 1960–2003. Social Science Research, 40(1), 226-244.

Katircioglu, S., Gokmenoglu, K. K., & Eren, B. M. (2018). Testing the role of tourism development in ecological footprint quality: evidence from top 10 tourist destinations. Environmental Science and Pollution Research, 25(33), 33611–33619. https://doi.org/10.1007/s11356-018-3324-0

Khan, M. K., Teng, J. Z., Khan, M. I., & Khan, M. O. (2019). Impact of globalization, economic factors and energy consumption on CO2 emissions in Pakistan. Science of the total environment, 688, 424-436.

Khan, M. T. I., Yaseen, M. R., & Ali, Q. (2019). Nexus between financial development, tourism, renewable energy, and greenhouse gas emission in high-income countries: A continent-wise analysis. Energy Economics, 83, 293-310.

Koçak, E., Ulucak, R., & Ulucak, Z. Ş. (2020). The impact of tourism developments on CO2 emissions: An advanced panel data estimation. Tourism Management Perspectives, 33, 100611.

Kongbuamai, N., Bui, Q., Yousaf, H. M. A. U., & Liu, Y. (2020). The impact of tourism and natural resources on the ecological footprint: a case study of ASEAN countries. Environmental Science and Pollution Research, 27(16), 19251–19264. https://doi.org/10.1007/s11356-020-08582-x

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.

Meo, M., Nathaniel, S., Shaikh, G., & Kumar, A. (2021). Energy consumption, institutional quality and tourist arrival in Pakistan: Is the nexus (a) symmetric amidst structural breaks?. Journal of Public Affairs, 21(2), e2213.

Nathaniel, S. P. (2021a). Ecological footprint and human well-being nexus: accounting for broad-based financial development, globalization, and natural resources in the Next-11 countries. Future Business Journal, 7(1), 1-18.

Nathaniel, S. P. (2021b). Economic complexity versus ecological footprint in the era of globalization: evidence from ASEAN countries. Environmental Science and Pollution Research, 1-11.

Nathaniel, S. P. (2021c). Natural Resources, Urbanisation, Economic Growth and the Ecological Footprint in South Africa: The Moderating Role of Human Capital. Quaestiones Geographicae, 40(2), 63-76.

Nathaniel, S. P., & Adedoyin, F. F. (2020). Tourism development, natural resource abundance, and environmental sustainability: Another look at the ten most visited destinations. Journal of Public Affairs, e2553.

Nathaniel, S. P., Barua, S., & Ahmed, Z. (2021). What drives ecological footprint in top ten tourist destinations? Evidence from advanced panel techniques. Environmental Science and Pollution Research, 1-10.

Ozcan, C. C., Bekun, F. V., & Nazlioglu, S. (2021). Tourism-induced pollutant emissions in Mediterranean countries: Evidence from panel causality analysis. International Social Science Journal, 71(241-242), 261-281.

Saint Akadiri, S., Alkawfi, M. M., Uğural, S., & Akadiri, A. C. (2019). Towards achieving environmental sustainability target in Italy. The role of energy, real income and globalization. Science of The Total Environment, 671, 1293-1301.

Saint Akadiri, S., Alola, A. A., & Akadiri, A. C. (2019). The role of globalization, real income, tourism in environmental sustainability target. Evidence from Turkey. Science of the total environment, 687, 423-432.

Saint Akadiri, S., Lasisi, T. T., Uzuner, G., & Akadiri, A. C. (2019). Examining the impact of globalization in the environmental Kuznets curve hypothesis: the case of tourist destination states. Environmental Science and Pollution Research, 26(12), 12605-12615.

Shahbaz, M., Sharma, R., Sinha, A., & Jiao, Z. (2021). Analyzing nonlinear impact of economic growth drivers on CO2 emissions: Designing an SDG framework for India. Energy Policy, 148, 111965.

Sharma, R., Sinha, A., & Kautish, P. (2021). Does renewable energy consumption reduce ecological footprint? Evidence from eight developing countries of Asia. Journal of Cleaner Production, 285, 124867.

Sun, Y. Y. (2016). Decomposition of tourism greenhouse gas emissions: Revealing the dynamics between tourism economic growth, technological efficiency, and carbon emissions. Tourism Management, 55, 326-336.

Tang, Z., Shang, J., Shi, C., Liu, Z., & Bi, K. (2014). Decoupling indicators of CO2 emissions from the tourism industry in China: 1990–2012. Ecological indicators, 46, 390-397.

Tecel, A., Katircioğlu, S., Taheri, E., & Bekun, F. V. (2020). Causal interactions among tourism, foreign direct investment, domestic credits, and economic growth: evidence from selected Mediterranean countries. Portuguese Economic Journal, 19(3), 195-212.

Udi, J., Bekun, F.V., Adedoyin, F.F., (2020). Modeling the nexus between coal consumption, FDI inflow and economic expansion: does industrialization matter in South Africa? Environ. Sci. Pollut. Res. https://doi.org/10.1007/s11356-020-07691-x

Ullah, S., Ozturk, I., Majeed, M. T., & Ahmad, W. (2021). Do technological innovations have symmetric or asymmetric effects on environmental quality? Evidence from Pakistan. Journal of Cleaner Production, 316, 128239.

UNTWO Tourism Highlights 2016 Edition (World Tourism Organistaion,2016); http://www.e-unwto.org/doi/pdf/10.18111/9789284418145

Wang, N., Zhu, H., Guo, Y., & Peng, C. (2018). The heterogeneous effect of democracy, political globalization, and urbanization on PM2. 5 concentrations in G20 countries: Evidence from panel quantile regression. Journal of cleaner production, 194, 54-68.

World Tourism Organization (2019). International Tourism Highlights. https://www.e-unwto.org/doi/pdf/10.18111/9789284421152 (Accessed on 2nd January, 2020).

World Travel and Tourism Council. (2017). Travel and Tourism Economic impact 2017 Cuba. https://www.wttc.org/-/media/files/reports/economic-impact-research/archived/countries-2017-old/cuba2017.pdf. (Accessed on 2nd January, 2020)

Wu, L., Liu, S., Liu, D., Fang, Z., & Xu, H. (2015). Modelling and forecasting CO2 emissions in the BRICS (Brazil, Russia, India, China, and South Africa) countries using a novel multi-variable grey model. Energy, 79, 489-495.

Wu, T. P., & Wu, H. C. (2019). The link between tourism activities and economic growth: Evidence from China's provinces. Tourism and Hospitality Research, 19(1), 3-14.

Xue, G. A. O., Chang, H. L., & Chi-Wei, S. U. (2018). Does exchange rate always affect the number of inbound tourists significantly in China? Theoretical & Applied Economics, 25(1).

You, W., & Lv, Z. (2018). Spillover effects of economic globalization on CO2 emissions: a spatial panel approach. Energy Economics, 73, 248-257.

Zafar, M. W., Sinha, A., Ahmed, Z., Qin, Q., & Zaidi, S. A. H. (2021). Effects of biomass energy consumption on environmental quality: the role of education and technology in Asia-Pacific Economic Cooperation countries. Renewable and Sustainable Energy Reviews, 142, 110868.

Zaman, K., Shahbaz, M., Loganathan, N., & Raza, S. A. (2016). Tourism development, energy consumption and Environmental Kuznets Curve: Trivariate analysis in the panel of developed and developing countries. Tourism Management, 54, 275-283.

Appendix 1. Summary of literature

Table 1a. A summary of selected literature on Biocapacity, globalization, tourism, GDP and EF in top destinations

Author(s)	period	variables	country	methodology	Results
Zaman et al 2016	2005-2013	Tourism index, CO_2, GDP, Gross Capital Formation, Health Expenditure	High income OECD, Non-OECD, EU, East Asia and Pacific	Panel data analysis	Tourism induces emissions, energy induces emissions, investment induces emissions.
Sun (2016)	2001-2011	National Carbon footprints, Carbon efficiency	Taiwan	Environmental input-output model	Carbon emissions increase with low carbon efficiency
Tang et al 2014	1990-2012	Tourism-related emissions, tourism transportation, tourism activities, tourism accommodation	China	Bottom-up Approach	Tourism transportation is a major contributor to tourism-related emissions
Cadarso et al 2016	1995-2007	Domestic whole carbon footprint (DWCF), the whole carbon footprint of tourism (WCF)	Spain	Life cycle assessment input-output model	Tourism investments contribute to environmental pollution
Akadiri et al 2020	1995-2014	Tourism, GDP, CO_2, Glob	16 island dev countries	Panel Granger non-causality	Tourism granger causes carbon emissions
Akadiri et al 2019a	1970-2014	CO_2, Tourism, GDP, Glob,	Turkey	ARDL-VECM	An increase in tourist arrivals leads to an increase in CO_2 emissions
Khan et al 2019	1975 -2017	FD, tourism, per cap energy use, Renewable energy, trade	34 high-income countries	Dumitrescu and Hurlin non-causality test	The long-run relationship between tourism and GHG emissions
Danish et al 2019	1971-2014	EF, GDP, Biocap, Human cap,	Pakistan	ARDL	Biocap increases EF
Chu et al 2017	1995-2001	Ecological tension and, ecological occupancy	China	Ecological footprint	EF increased while bio cap decreased

		and, ecological economic coordination and		approach	
Meng et al 2018	2000-2014	ESF, GDP, Income level and population	China	Ecosystem Service Footprint Model	High GDP is linked to Ecosystem Service Deficit (ESD) and vice versa
Jorgesen and Clark (2011)	1960-2003	EF, GDP, Population, military Exp, Arable land and Manufacturing	65 countries	Panel data analysis	GDP has a positive significant relationship with Environmental degradation levels
Churchhill et al (2018)	1965-2014	GDP, trade, population, FD, CO2	20 OECD countries	MG, PMG, AMG	Presence of EKC in 9 countries
Wu et al (2017)	1992-2013	RGDP, CO2, Agric, Renewable energy, Nonrenewable energy.	BRIC	Panel Cointegration analysis	RGDP and REC increase CO_2 emissions NREC and Agric increase CO_2 emissions

Table 1b. A summary of selected literature on Globalization and Environmental sustainability

Author(s)	**period**	**variables**	**country**	**methodology**	**Results**
Khan et al 2019	1971-2016	CO2, Fossil Fuel consp, Trade. GDP, FDI, Financial dev, Innovations, Economic Globalization, urban population, Social glob ind,	Pakistan	Dynamic ARDL	Economic glob, social glob, political glob has a positive effect on CO2 emissions
Akadiri et al 2019b	1970-2014	CO2, energy use, GDP, Glob,	Italy	ARDL, Toda Yamamoto	An increase in Glob leads to an increase in CO2 emissions
Wang et al	Glob, GDP,		G20	Panel quantile	Political glob has a positive impact on PM2.

2018	trade, inflation, democracy, Renew, Urbanisation, fossil, pop, FDI		countries	regression	Democracy has a positive impact on PM2.
You and Lv 2018	1985-2013	CO2, GDP. Glob, Urb, pop, Indus	83 countries	Spatial Panel approach	Glob harms CO2 emissions
Acheampong et al 2019	1985-2015	GDP, renew, trade, regulation, pop, FDI, FD	sub-Saharan countries	Fixed effect/Random effects	
Baek et al 2009	1960-2000	Trade, GDP, CO2	50 countries	VAR	An increase in GDP decreases S02 in dev countries, increase in GDP increase S02 in developing countries