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Research Article

An Investigation into the Role of Tourism Growth, Conventional Energy Consumption and Real Income on Ecological Footprint Nexus in France

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Abstract. Previously documented studies in the literature on how tourism leads to economic growth in the form of tourism-led growth hypotheses (TLGH) has been investigated. This study presents a new perspective on the growth of tourism by considering its impact on conventional energy consumption, real income level, and emission via the channel of globalization. Sequences of econometric tests were conducted to validate the hypothesized claims between tourism development and growth impact on conventional energy consumption and pollution proxy by ecological footprints, globalization GDP per capita, biocapacity, and tourists for the case of France. Empirical evidence from the Granger causality test presents a uni-directional causality from ecological footprints to GDP per capita and from biocapacity to ecological footprints. The correlation matrix shows interrelation amongst series with biocapacity significantly correlating with ecological footprints with tourist's arrival having a positive correlation with ecological footprints and a negative one with biocapacity. GPD per capita was found to positively affect the ecological footprints and have a negative correlation with biocapacity and a significant relationship with tourists' arrivals. Additionally, globalization exerts a positive impact on ecological footprints, and its effect on biocapacity was found to be negative although globalization's effect on tourists' arrivals and per capita GDP is significant. The ARDL estimation indicated biocapacity as a neutral agent for ecological footprints, tourist arrivals having a negative impact on ecological footprints, and globalization significantly affecting ecological footprints. From these findings, it is evident that tourism growth has a significant impact on energy consumption and pollution. Policy recommendations were also provided in this study accordingly.

Keywords: Biocapacity, Tourists Arrivals, Globalization, energy consumption, Tourism growth, Ecological footprints

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1. Introduction

The linkage between tourism growths, the demand for energy, and the simultaneous emission of pollutants, that destroys the environment will persistently be one of the strategic agenda for sustainable tourism. The consequence of these tourism activities on the consumption of energy has detrimental effects on the environment. Thus, the influence of tourism growth on the use of conventional energy requires adequate attention in the tourism milieu. In the search to accomplish the aim of our current study, it is worth mention that a handful of researchers have found evidence on the effect of sustainable tourism development on energy consumption. Sustainable tourism is frequently associated with energy demand (Berrittella, Bigano, Roson & Tol, 2006; Sghaier, Guizani, Jabeur, & Nurunnabi, 2019).

Tourism is and will remain one of the major and most demanding economic sectors in the globe, as it deals with humans, with their endless and variable needs and wants; it's standing in the worldwide economy is indisputable. Based on the above consideration tourism activities encourages exports and embodies remarkable environmental cultural, and heritage value and also give rise to employment, (Nepal Irsyad & Nepal, 2019). The global tourism and travel industry have been faced with a tremendous increase in tourist activities in recent years. Notwithstanding the geopolitical tension and reasonable economic development that the emerging and advanced economies are faced with, the tourism and travel industry remains at its peak in performance across the globe (Fahimi & Akadiri, 2018). The area has been claimed to be responsible for a huge share of the Gross Domestic Product (GDP) of the world, (WTTC, 2008). The tourism and travel industry is anticipated to have about 4% growth every year. This is a remarkable rate when related to the predictable growing rate in the manufacturing, financial, and transportation sectors, (WTTC, 2015). Because of the beneficial effect of tourism activities, tourism is considered as the ultimate cause of foreign currency incomes in many tourist destinations worldwide (Fahimi *et al.,* 2018), thus, the case of France is not an exception. The tourism and travel segment has been given principal concern by the governments of these foreign economies (Louca, 2006), According to estimate, this industry contributes more than 9% of share to international GDP, which is in the neighbourhood of 7 trillion USD. Furthermore, it has reduced world-wide

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unemployment by creating occupations and opportunities for jobless people and other individuals in tourist centers (Koens & Wood, 2017),

The world's largest service sector which is the tourism industry directly employs about 292 million people globally which can be estimated to one out of 10 created jobs on the world and is responsible for an about 10.2% of worldwide GDP with an estimated figure of around US$7.6 trillion (WTTC 2017). The growth of the economy is a key element when it comes to the analysis of macroeconomic activities. This, therefore, confirms that the authentic facilitators of growth that is tourism development is critical for the invention of active strategic tools that will support economic growth in the long-run. Hypothetically, tourism activities and the use of energy are important players in the stimulation of economic growth, thus their examination is crucial. Furthermore, the consequences of tourism development on energy consumption also lead to the production of gases that pollute the atmosphere thus making this another call for environmental concern. However, prevailing observed literature revealed that the influences of tourism and energy use on the advancement of the economy remain a dilemma (Tang& Abosedra, 2014). The inflow of tourists into a country, though will stimulate economic growth will further impact an increase in energy consumption and pollution. Though the tourism industry accounts for great economic, environmental, and social benefits, there are great costs attached to their activities (Read, 2013). Based on the above statement, a rise in tourism destination activities is likely to follow rising calls for energy and environmental pollution as a result of the emission of pollutant gases such as CO_2 emission

The leisure industry deals with services alongside tangibles that encourage travellers to stay on spot away from their regular environment for up to one consecutive year for business, leisure alongside other activities. This industry is one of the most rapidly emergent industries in the world as it creates imported exchange and employment prospects in international countries. It is also one of the most noticeable financial and social occurrences. At the end of the 19th century, the World Travel and Tourism Council (WTTC) predicted that few companies in the telecommunications, information technology and tourism industries would take over many other companies in sectors other than the tourism. Despite various internal and global wars, political upheavals, fears, infections, epidemics, energy emergencies and financial problems on several continents, worldwide tourism volume reached about 1.3 billion of dollars in 2014 compared to almost 1.6 million of dollars in 1970. As most tourism companies routinely use energy from oil products or indirectly from coal, gas or fuel energy (Parramati *et al.,* 2017), tourists can negatively affect the climate in the form of carbon and international carbon dioxide (CO_2) emissions, for example, conferring to the UNWTO (2007), 5% of global CO_2 emissions, predominantly for transportation, housing, and other travel-related movements, were responsible for vacationers' actions (Jones & Munday, 2007).

Researches have been directed towards specific countries or across countries with the use of several methodologies, nevertheless, it is still not clear whether tourism development could affect energy consumption in tourist destinations or not (see Katircioglu 2014a). Thus, the present study aims to investigate tourism development effects on conventional energy consumption and pollution of the environment. The increase in the inflow of tourists or tourism development in a country like France will result in increased use of energy and thus simultaneous pollution of the environment. This resonates the intuition that the use of energy following a rise tourism activity in the tourism sector is unquestionable, and the escalation in energy consumption as a result of the increase of tourists' activities can have a negative impact on t quality of the environment as a result of emission of atmospheric pollutants such as CO_2 emission. Environmental degeneration is sure to arise due to the development of tourist activities, such as the building of hotels and other tourism facilities to the disadvantage of green spaces, following further consumption of energy (Sghaier *et al*., 2019).

It is noteworthy to consider that the interrelationships between tourism and the natural environment are precarious in framing active sustainable tourism development policies (Napal *et al.,* 2019). Nevertheless, empirical studies have demonstrated that these relationships are narrow in the tourism existing literature (Shakouri Yazdi & Ghorchebigi, 2017). The link between tourism and energy use is also less explored in extant tourism literature despite increasing cognizance of environment-related issues associated to tourism activities (Nepal *et al*., 2019; Becken *et al.,* 2003). Another contribution to this study is the investigation of the above relationship on a country such as France which is the number one tourist destination in Europe and the world

Moreover, some studies have investigated the impact of tourism and other variables, such as tourism and political instability in MENA, (Tang & Abosedra, 2014; Tecel *et al.,*2020; Adedoyin & Bekun,2020; Balsalobre-Lorente *et al*.,2020) tourism on post economic growth, in Microstates (Fahimi, *et al*., 2018). Furthermore, investigations have been confirmed on tourism and energy consumption in different parts of the world such as; tourism on CO_2 emission in Cyprus (Katircioglu, *et al.,* 2020), tourism and energy consumption in Tukey (Gokmenoglu & Eren, 2020), and Pakistan (Liu *et al.,* 2019). But an inclusive model that examines the impact of tourism development on energy consumption and pollution around the center of Europe; France as the case of this study, which is considered the number one and most beautiful destination for tourists worldwide requires more investigation (French Travel, 2020). Referring to several previous publications, a study by Ozdan, Bekun and Nazlioglu (2021) also showed that transnational tourism is a facilitator for energy depletion and economic progression, leading to polluting emissions. The association between tourism and energy consumption is still being given little attention in the up to date literature (Apergis & Payne, 2012; Amelung and Nicholls 2014; Katirciog˘lu 2014; Isik *et al*.,2017; Dogan *et al*.,2017; Dogan & Aslan, 2017).

A hand full of studies tried to examining temporal link between tourism and economic evolution. (Ozcan, Bekun, and Nazlioglu, 2021; Etokakpan *et al.,* 2019; Bekun, Adedoyin, Etokakpan & Gyamfi, 2021). Tourism's economic contribution to world-wide economic expansion cannot be underestimated. Nonetheless, the intercontinental influx of vacationers, coal, worldwide economy and investment trade, reports a negative control on environmental dilapidation (i.e. the subsequent impact of carbon dioxide emissions). The tons of carbon releases from the world with the inclusion of evolving countries such as China, India, Russia, Indonesia and Turkey, was about 3.9 metric tons in the early 90s, followed by a decline in 2010. Since then, carbon emissions have continued to rise until 2018.

Therefore, the current research aims to explore the influence of tourism development in France's economy on her energy consumption and environmental pollution. The objectives of the present study are first, to investigate the impact of tourist arrival increase on energy consumption and secondly, the influence of tourism expansion on environmental pollution in the number one world's tourist destination; France. This country was chosen as the study preference because it considered by the UNWTO, as the number one tourist destination in the world in recent years with a significant 89.4 Million tourists in 2018 followed by Spain with 82.8 Million in

the same year. It is no doubt that France is the world's most populated tourist destination with at least 89 million tourists from all over the world. France has one of the most fascinating and amazing cities on the globe. It is full of galleries that captivate the heart and soul, glamorous buildings, chic cafes, etc. Talking about beauty, France has no rival on the planet earth (French Travel, 2020). The incessant influx of international tourist across the world comes with it implications on economic growth as highlighted by the TLGH especially for tourism destination like France our study focus. However, there is also spill over effect on environmental quality (Katircioglu, 2014; Ozcan *et al*., 2021). Tourism activities is usually accompanied with energy consumption mostly from fossil -fuel sources, which in turn dampens the quality of the environment. Thus, there is a triangle nexus between economic expansion, tourism, and environmental degradation (ecological footprint). The Plausible intuition between the connect of the variable is tied to the influx of tourist comes with increase demand for energy consumption via tourism activities which translate into more emission given that the energy sources are not renewable, and all these connections are linked via globalization. This preposition aligns with the Environmental Kuznets Curve (EKC) phenomena that highlights the trade-off between economic growth and environmental degradation. In essence it means there is a connection between tourism and environmental quality i.e., tourism-induced environmental degradation (Adedoyin *et al,* 2020). Our study model leverages on an augmented EKC-environment (liner version) using tourism and GDP growth as determinant for environmental quality for the case of France a high-tourism destination.

The leisure industry is one of the foremost factors financially inducing the universal economy. It has the potential to positively impact economies of scale in significant multiples, either directly or indirectly in other sectors of the economy. (Balsalobre-Lorente *et al.,* 2020; Usman *et al*., 2020; Etokakpan *et al.,* 2019). However, previous research from Mbaiwa (2003) established that the destruction of tourism ecosystems subsidizes elevation in atmospheric greenhouse releases. And for this reason, environmental policies are needed to create new tourist attractions. These limited functions of tourism are associated with a complex causal relationship in favor of the feedback theory and/or the theory of country growth through tourism (TLG). Saint Akadiri *et al.* (2019) used globalization in modeling involving international tourism (ITOUR). Based on previous research, some researchers have studied and confirmed the impact of tourism on many related environmental and economic factors.

A focus on Singapore, while controlling energy consumption and CO_2, examines the link between tourism development and income levels and aids the tourism-induced EKC theory, using Granger causality analysis (Akadiri *et al.,* 2019). The researchers mentioned above have also identified the negative impact of foreign tourists on CO_2 in relation to tourism-induced EKC for certain island countries, which also reflects a decrease in marginal revenue. A similar pilot study conducted Roudi *et al.* (2019) in minor land mass found an inverse relationship between energy depletion, FDI, and tourism hence confirming the data on pollutant emissions due to tourists' arrivals. Xu and Zhang (2016) defined a reaction association between the urban population and air contaminants in the case of some provinces in Chinese. Similarly, Ma (2015) argues for the positive effects of municipal inhabitants on energy depletion in China.

As an attraction, tourism has significantly subsidised the growth of carbon dioxide contaminants of any tourist nation. Quite a lot of authors have discussed the outcomes of tourism expansion on weather alterations and CO_2 emissions (Gössling *et al.,* 2013; Katircioglu *et al*. 2014)

When many tourists enter the tourist attraction It stimulates economic development and increases energy consumption, thereby increasing carbon emissions (Nie *et al.* 2019; Akalpler and Hove 2019). Subsequently, it has been resolute that the use of tourism-related energy subsidizes high emissions. which negatively affects the environmental quality of countries that heavily depend on proceeds from tourism actions (Adedoyin and Bekun 2020). Zhang and Zhang (2020) studied the link between tourism, financial development and CO_2 emissions in more than 25 provinces of China. According to their findings, a percentage increase in tourism leads to a 0.51% elevation in carbon dioxide emissions, while a percentage rise in energy consumption leads to a 0.12% increase in carbon dioxide emissions. carbon dioxide in China. An increase in real GDP of 1% leads to an increase in CO_2 emissions of 0.55%. Over time, tourism, economic development and energy consumption all contributed to CO_2 emissions. Studies on the relationship between emissions and the tourism sector are increasing rapidly. focusing only on industries with higher incomes Therefore, an increase in energy consumption is expected to have encouraging impact on tourism request. This will denote a direct link between tourism and financial growth.

Although visiting attractive destinations by tourists has a positive and stable long-term connection with CO_2, it has been found to be an environmentally destructive component. This study was investigated and validated (Katircioglu *et al*. 2014) in Cyprus. With the use of board data between 1995 and 2010, Khan *et al.* (2020) was cited in the work of Ben *et al.* (2015), where he established that tourist entries and energy depletion by tourists' actions, have a negative bearing on Tunisia's environment. They have verified that a continuous, consumption by tourists will have a future reduction effect on carbon dioxide emissions. An assessment of previous literature showed that preceding research on the link between verifiable variables has produced inconsistent results. Therefore, more studies are needed to confirm the recommended link to a sustainable development approach.

The next section presents the data, methods, and model used are explained while section three entails the discussion of results. The study concludes in section four with pertinent policy recommendations.

2. Methods

This study investigates tourism growth's impact on energy consumption and pollution in the case of France. To achieve, this the study leveraged on annual frequency data sourced from 1995-2016 from the world development data base for GDP available at (www.data.worldbank.org) while ecological footprint was sourced from Global footprint network database (https://www.footprintnetwork.org/). The motivation for the choice of the variables draws strength form the United Nations Sustainable Development Goals (UN-SDGs) that highlights pertinent global issues, our study case focuses on UNSDG-8 which outlines sustainable economic growth via tourism channel, climate change action (SGD-13) and responsible consumption (SGD-12). To this end, the methodology adopted by this study is the Autoregressive Distributed Lag (ARDL) cointegration technique. To achieve accuracy of results, Ecological footprint (EFP), Biocapacity (BIOCAP), Tourist Arrivals (ARRIVALS), Globalization (GLOB), and Gross domestic product (GDPC) variables/proxies adopted in the present study. The present draws motivation from carbon-income function and further extends the argument with tourism, energy consumption and globalization. From an empirical

perspective, our study strength gleans insights from (Katircioglu, 2014; Adedoyin & Bekun,2020; Ozcan *et al*.,2021). The measurement model that was used in the present study has Ecological footprints as explained covariate while biocapacity, globalization, real GDP per capita, and tourist arrivals are considered as explanatory variables for the hypothesized study claim over the period under review. The present study functional form is given as:

$$EFP = f(BOCAP, ARRIVALS, GLOBA, GDPC) \quad (1)$$

Where EFP (ecological footprints) as model dependent variable while BOCAP (biocapacity), ARRIVALS (tourists' arrivals), GLOBA (globalization), GDPC (GDP per capita) are considered as explanatory variable for the fitted model as outlined is equation 1.

In terms of the empirical modelling and technique used, the Autoregressive distributed lag model is applied to the specified equation 1. A pre-estimation diagnostic is carried out first before the main estimation is conducted. This includes a summary statistic of the data, as well as a correlation matrix to highlight statistical relationship, direction, and strength of relationship among variables. Furthermore, non-stationarity tests, bounds test, and cointegration tests are carried out to ensure that the modelling conforms to expectation. Following this, the ARDL estimations are conducted as well as the fully modified, Ordinary least squares (OLS), dynamic OLS, and a causality test

3.Result and Discussion

This section renders the preliminary results and subsequently econometrics analysis as well and interpretation accordingly. Empirical results indicate that the present study outlined variables correlate significantly with ecological footprints, this implies that the series may be used to predict the tourism growth of France. Figure 1 reveals the fluctuations of the macroeconomic variables under review. The basic summary of measures of tendencies and dispersions are reported in Table 1, which reveals observable dispersion of each outlined variables from their averages apparent and that none of the variables shows negatively skewed. Table 2 presents the correlation matrix of the study displaying a correlation between the variables under consideration. Correlation analysis shows that biocapacity is positive and significantly correlates with the ecological footprints over the considered period. This is concurrent previous research according to Hassan *et al* (2019) stating that biocapacity also increases the ecological footprint and contributes to environmental degradation. Also, the tourists' arrivals have a positive correlation with the ecological footprints while having a negative impact on biocapacity.

Table 1
Summary statistics of underlined study variables

Variable	Mean	Standard deviation	Minimum	Maximum
LEFPT	19.5915	0.0486	19.4785	19.6809
LBIOCAP	18.9597	0 .0383	18.8523	19.0159
LARRIVALS	18.1439	0.0908	17.9104	18.2517
LGDPC	28.5402	0.1008	28.3389	28.6628
LGLOB	4.4379	0.0287	4.3739	4.4729

Table 2
Correlation Matrix Results

	LEFPT	LBIOCAP	LARRIV~S	LGDPC	LGLOB
LEFPT	1				
LBIOCAP	0.4894*	1			
	0.0208				
LARRIVALS	0.0094	-0.0393	1		
	0.9671	0.8623			
LGDPC	0.0146	-0.1708	0.9380*	1	
	0.9485	0.4474	0		
LGLOB	0.0147	-0.1006	0.9701*	0.9828*	1
	0.9481	0.656	0	0	

Here: super script ***,**,* represents statistical rejection level 1%,5% and 10% respectively

Table 3
Non-stationarity Test Result

Variable	ADF(Augmented Dickey-Fuller)				PP(Philip-Perron)			
	Level	P-Value	1st diff.	P-Value	Level	P-Value	1st diff.	P-Value
LEFPT	-1.094	0.7173	-6.453***	0.0000	-3.921	0.7501	-6.227	0.0000
LGDPC	-2.749*	0.0659	-2.934**	0.0415	-2.908**	0.0444	-2.903**	0.0450
LGLOB	-2.836*	0.0534	-3.827***	0.0026	-3.360**	0.0124	-3.727***	0.0037
LARRIVALS	-3.406**	0.0108	-3.066**	0.0291	-3.299**	0.0149	-2.858*	0.0504
LBIOCAP	-4.595***	0.0001	-6.866***	0.0000	-4.575***	0.0001	-7.408***	0.0000

Here: super script ***,**,* represents statistical rejection level 1%,5% and 10% respectively

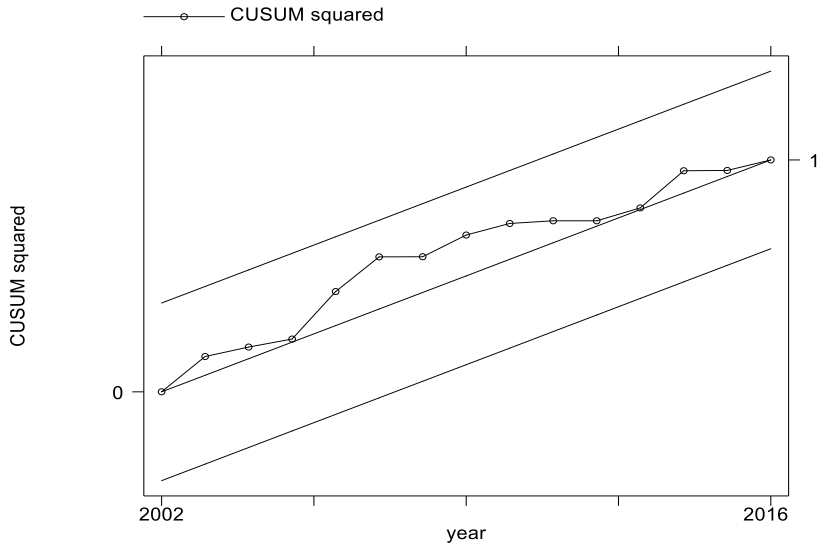


Fig 1. CUSUM Stability test for the fitted model

Table 4a
ARDL Bounds Test to Cointegration

	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Stat	2.985	4.319	3.751	5.331	5.759	7.978	0	0
T-Stat	2.587	-3.694	-2.993	-4.191	-3.874	-5.27	0	0

Table 4b
Johnson cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None	0.894160*	92.28340	60.06141	0.0000
At most 1	0.676563*	47.36686	40.17493	0.0081
At most 2	0.641913**	24.79183	24.27596	0.0430
At most 3	0.119568***	4.252237	12.32090	0.0744
At most 4	0.081735	1.705375	4.129906	0.2251

NOTE: *<0.01, **<0.05, ***<0.10

Supporting findings from Danish *et.al,* (2019) GPD per capita was found to positively affect the ecological footprints having a negative correlation with biocapacity, and its relationship with tourists' arrivals is significant (Table 2). Globalization's effect on ecological footprints as indicated in Table 2 is positive and its effect on biocapacity is negative. Meanwhile, a significant effect of globalization on tourist arrivals and per capita GDP was established in Table 2 and this is in line with findings by Cornel Nicolae *et al.,* (2013) where tourism is found to affect economic activities and GDP. Similarly, Table 3-unit root tests show ecological footprints to be at a level while DPC, GLOB, ARRIVALS, and BIOCAP are the first difference stationary. Subsequently, to investigate the long-run equilibrium relationship of the outlined variables. In Table 4a the Pesaran's ARDL the bounds test of the fitted model shows a cointegration relationship between the dependent and explanatory variables. This is validated as the-T and F-statistics are greater than the required threshold critical value. The long-run equilibrium relationship is reinforced by the Johnsen cointegration results reported in Table 4b with three cointegrating vectors. The long-run regression is reported in Table 5 presents the long and short-run results from the ARDL estimation is motivated on the premise of mixed integration order properties of the series under consideration as outlined by the unit root test. The observed result shows that biocapacity is a neutral agent of the ecological footprints in France.

This is an implication that biocapacity does not affect ecological footprints this contradicts empirical results presented in Dang *et al* (2013) in a study on China. The plausible explanation to this empirical disparity could be linked to specific country differences, time frames, or data sets employed. Furthermore, a 1% increase in biocapacity will lead to a significant alteration in the ecological footprints in the long run. This, however, implies that biocapacity to France is neutral to promoting pollution. While tourist arrivals, on the other hand, do have a negative impact on the ecological footprints, this contrasts literature and empirical evidence in Dube, (2018). The findings indicate a 1% increase in tourist arrivals has a negative impact on ecological footprints. The reverse will, however, be the case if France put in place environmental policies to support tourism impact on the environment. Similarly, GDP exerts a negative impact on ecological footprint and this conforms to findings from Danish *et al*., (2019). Additionally, Table 6 and 7 are fitted for robustness on DOLS and FMOLS analysis which corroborates the results of the ARDL analysis. For the direction of causality and proper policy prediction and construction, this study conducts the causality analysis. Table 8 presents the Granger causality tests where a unidirectional causality was found to run from long-run ecological footprints to GDP per

capita, this contradicts findings from (see Danish *et al,* 2019; Hassan, 2019) where no causality was found between economic growth and ecological footprints. Besides, the same unidirectional causal relationship exists between biocapacity and ecological footprints, this supports Danish *et al.,* (2019) and Hassan *et.al* (2019) stating that biocapacity also increases the ecological footprint and contributes to environmental degradation. Consequently to ensure that the fitted models are robust and theirs respective coefficient are reliable and suitable for policy construction, model robustness test comprises of Normality test, Breusch-Pagan heteroscedasticity test, Ramsey RESET are presented (see appendix section) while for model stability can be seen in Figure 1.

Table 5
ARDL Analysis.
Dependent variable: Ecological footprint (LEFPT)

Variable	Coefficient	Standard Errors	T-stat
	Long-run		
LBIOCAP	0.405028***	0.097902	4.14
LARRIVALS	-0.25005	0.173602	-1.44
LGLOB	-0.17316	0.721056	-0.24
LGLOB	1.498366***	0.392677	3.82
	Short-run		
D(LECM)	-1.18051***	0.128577	-9.18
D(LBIOCAP)	0.478139***	0.088757	5.39
D(LARRIVALS)	-0.29519	0.198021	-1.49
D(LGLOB)	-0.20442	0.855024	-0.24
D(LGDPC)	1.768836***	0.413132	4.28
Constant	-0.0241***	0.006163	-3.91

Note: *, ** and *** represent significance at 10%, 5% and 1% respectively.

Table 6
DOLS results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
LnBOCAP	4.368032**	0.965779	4.522809	0.0456
LnARRIVALS	-4.770657*	1.667908	-2.860263	0.0036
LnGLOBAL	-4.24416***	9.908597	-4.162462	0.0532
LnGDPC	7.121377**	1.359028	5.240050	0.0345
C	-188.3957**	39.35715	-4.786824	0.0410
R-squared	0.548922	Mean dependent var		1.095105
Adjusted R-squared	0.540300	S.D. dependent var		0.042639
S.E. of regression	0.028910	Sum squared resid		0.001672
Long-run variance	0.000372			

NOTE: *<0.01, **<0.05, ***<0.10

Table 7
FMOLS Results

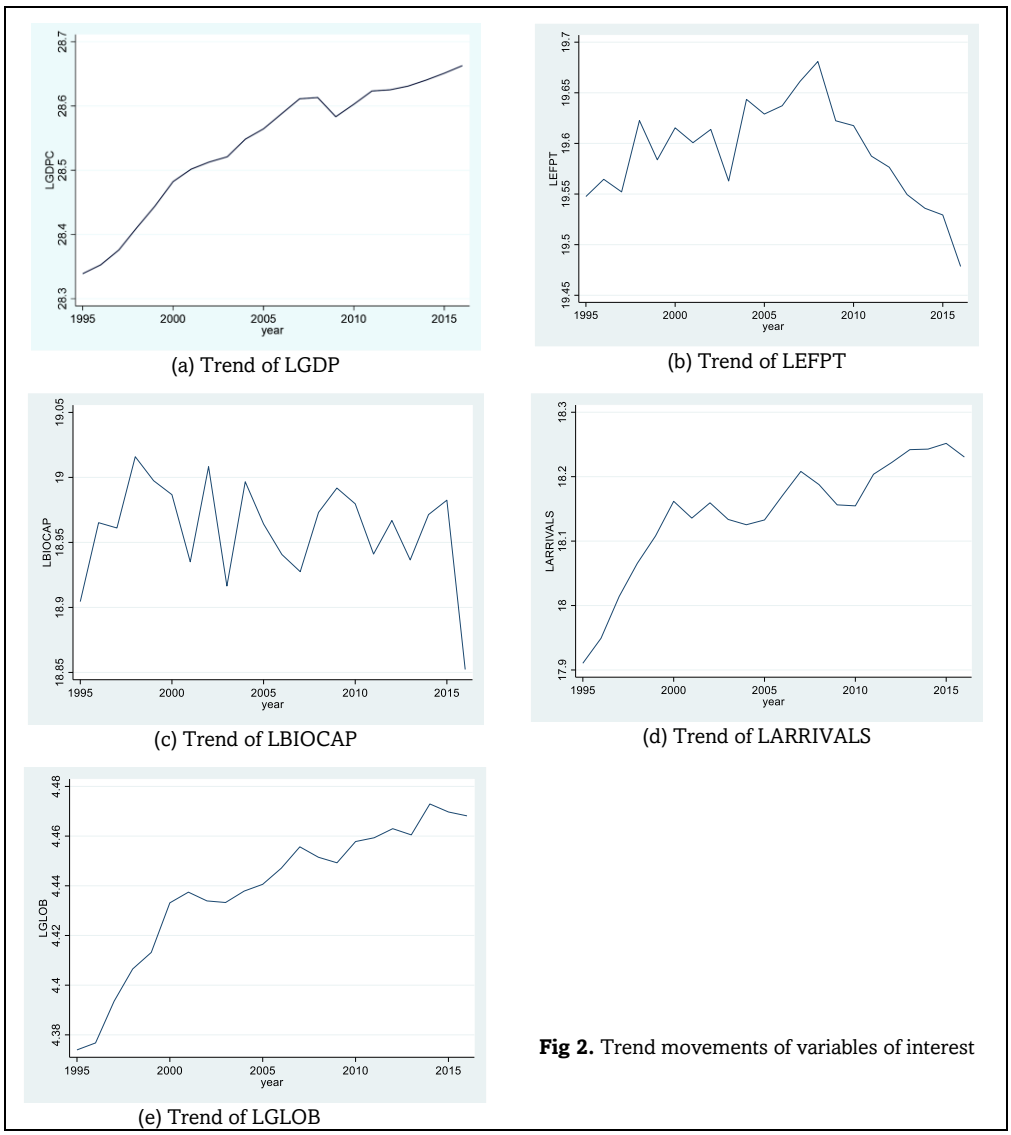
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LnBOCAP	1.005992**	0.404969	2.484118	0.0244
LnARRIVALS	-0.286567***	0.688009	-0.416517	0.0826
LnGLOBAL	-1.519010***	3.848410	-0.394711	0.0983
LnGDPC	0.952697***	0.801282	1.188966	0.0518
C	-33.24332***	16.46703	-2.018781	0.0606
R-squared	0.285467	Mean dependent var		1.087151
Adjusted R-squared	0.106834	S.D. dependent var		0.047679
S.E. of regression	0.045060	Sum squared resid		0.032487
Long-run variance	0.003655			

NOTE: *<0.01, **<0.05, ***<0.10

Table 8
Causality Analysis

Causality Test (H_0)	Statistics	P-value
LEFPT ≠LGDPC	2.85*	0.0969
LGDPC ≠LEFPT	0.13	0.8828
LEFPT ≠LBIOCAP	O.47	0.7088
LBIOCAP ≠LEFPT	2.87*	0.0961
LEFPT ≠ LARRIVALS	0.59	0.5721
LARRIVALS ≠LEFPT	0.79	0.4751
LEFPT ≠LGLOB	0.43	0.7859
LGLOB ≠LEFPT	1.03	0.4623

Note: *, ** and *** represent significance at 10%, 5% and 1% respectively. Where ≠ denotes null hypothesis "does not Granger cause".



(a) Trend of LGDP

(b) Trend of LEFPT

(c) Trend of LBIOCAP

(d) Trend of LARRIVALS

(e) Trend of LGLOB

Fig 2. Trend movements of variables of interest

Figure 2 outlines the trend movements of variables of interest; GDPC, EFPT, BIOCAP, ARRIVALS, GLOB where GDPC is the gross domestic product per capita, EFPT is the ecological footprint, BIOCAP is the biocapacity, and ARRIVALS is the tourist arrivals. These time-series trend plots are part of preliminary analysis to show how the variables fare prior to the modelling before exploration into the series moments as reported in Table 1. Furthermore, Figure 2 outlines the trend movements of variables of interest; GDPC, EFPT, BIOCAP, ARRIVALS, GLOB where GDPC is the gross domestic product per capita, EFPT is the ecological footprint, BIOCAP is the biocapacity, and ARRIVALS is the tourist arrivals. These time-series trend plots are part of preliminary analysis to show how the variables fare prior to the modelling before exploration into the series moments as reported in Table 1. Figure 2(a) one shows the trend of Gross domestic product. As shown from this figure, there are troughs such as in 2007 - 2010 which represents the period of the global financial crisis. However, the rise in GDP has remained consistent over time in terms of recovery. Figure 2(b) shows the trend of ecological footprint, which has fluctuated significantly over time with a notable continuous downward trend since 2008. This is important for our empirical analysis as it shows an interesting fall in environmental degradation when ecological footprint is used as a measure. Figure 2c shows the trend of biocapacity. This has been significantly unstable with several points of peaks and trough over time, while Fig 2(d) shows the trend of tourist arrivals. This volume of tourist arrivals has had shocks which led to a drastic fall but has also picked particularly from the global financial crisis. Finally, Figure 2e shows the movement of globalization over time. As expected, the data shows an upward trend or continuous rise in this series.

6. Conclusion

Previous studies have investigated tourism-led growth hypotheses. However, tourism may not only lead to economic growth, but the growth of tourism or tourist arrivals may affect issues like energy consumption and pollution. This is the motivation that drives the current study to explore the impact of tourism growth on energy consumption and pollution or how energy consumption and pollution are affected by growth in tourism/tourist arrivals.

This study concluded that tourism has a significant impact on energy consumption and pollution in France. Proxied by ecological footprints the study found a unidirectional causality

to run from ecological footprints to GDP and from biocapacity to ecological footprints. This suggests that the level of waste generated into the atmosphere affects the gross domestic product of France and how the capacity of the ecosystem to absorb the carbon dioxide from the atmosphere (biocapacity) affects the ecological footprints. Therefore, certain policy recommendations for France to ensure a positive impact on energy consumption and pollution by putting certain policies in place.

Firstly, since biocapacity is found to have no impact on ecological footprints, this means that there is a need for France to aim towards a renewable resource surplus i.e. by ensuring that the biocapacity of France exceeds its ecological footprints. This implies that it is important to ensure that the amount of renewable resources available in France exceeds the rate at which it is consumed. Also, since tourists' arrivals were found to impact negatively the ecological footprints, it is important to focus on increasing the biocapacity of the country. This will ensure that the positive impact of the economy does not lead to an EF/BC deficit in the country.

Secondly, globalization is found to be important or GDP growth and its impact on ecological footprints were found to be significant. Monitoring the ecological footprint is however important for countries to put in place and encourage renewable energy consumption. Therefore, the increased human activities brought about by globalization will increase the use of renewable resources and inadequate biocapacity may lead to the inability of nature to restore itself. Also, pressure on the environment leads to its degradation which will in the long run affect globalization in itself. It is important to ensure that globalization impacts go into different directions say GDP, imports/exports, and less pressure on the environment to protect the environment and its bounties.

Additionally, the role of tourism on pollution and energy consumption as indicated by the findings in this study cannot be overstated. This is because globalization expands world economies and give room or tourism into countries for whichever reason will mean pressure on the environment and increased demand for energy consumption. This implies that France as developed countries is a center of tourist attraction, hence the need for strong environmental policies that protect the environment from pollution and degradation and encouraging renewable resource consumption to reduce emissions. The impact of tourism growth on pollution and energy consumption should not be detrimental to the environment to ensure sustainability

Conflict of Interest

Authors declare that there is no conflict of interest amongst them

Ethical Statement

The authors hereby declare that, this material is their own original work, which has not been previously published elsewhere, and is not currently being considered for publication elsewhere. Furthermore, this writing reflects the authors' own research and analysis in a truthful and complete manner. This paper properly credits the meaningful contributions of co-authors.

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Appendix

Model diagnostic test results

Lagrange Multiplier Jarque-Bera Normality Test			
Lags (p)	Chi^2	Df	Prob > chi^2
1	10.18233	2	0.00615
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity			
Chi^2 (1)	1.98	Prob > chi^2	0.1596
Ramsey RESET test			
F (3, 22)	0.70	Prob > F	0.5692
Variance inflation factor			
Variable	VIF	1/VIF	
LGDPC	2.11	0.474916	
LARRIVALS	1.93	0.51823	
LGLOB	1.88	0.53114	
LBIOCAP	1.1	0.908989	
Mean VIF	1.7		
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	Df	P-value
Heteroskedasticity	14.39	14	0.4211
Skewness	4.11	4	0.3917
Kurtosis	1.4	1	0.2375
Total	19.89	19	0.4011

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1