The asymmetric impact of air transport on economic growth in Spain: fresh evidence from the tourism-led growth hypothesis

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ABSTRACT

The tourism sector has emerged as an essential driver for economic growth strategies during the last decades. An asymmetric long-run effect of air transport on economic growth is validated assuming a process of social globalization in Spain between 1970 and 2015. To achieve the study's objective, the recent asymmetric autoregressive distributed lag methodology framework advanced by Shin, Yu, and Greenwood-Nimmo (2014) is applied. For determining the causality direction, this methodology is applied in conjunction with the non-parametric causality test proposed by Diks and Panchenko (2006). The current study also accounts for the effects of renewable energy use and urbanization process over economic growth. Empirical results showed that air transport, urbanization process and social globalization exert positive and significant implications over economic growth, while renewable energy use reduces economic growth, as consequence of an energy mix sustained by fossil sources. Based on these outcomes several policy recommendations were offered in the concluding section.

KEYWORDS

- Air transport
- renewable energy use
- social globalization
- tourism development
- economic growth
- cointegration analysis

1. Introduction

During the last decades, tourism has been a leading sector and engine of economic growth and development in both developing and developed economies (Akadiri, Akadiri, & Alola, 2019). This is because the increases in movement of tourists give a signal of development across the globe and this era of development has witnessed many ways through, which tourism can influence the economic activity of a country. This paper offers fresh evidence on the impact of air transport as a proxy for tourism on economic growth in Spain. Air transport is one of the major drivers of tourist movement and Spain is one of the top 10 destination earning most from activities in the tourism industry (WTTC, 2017 **[Q1]**). Tourism contributes about 15% to gross domestic product (GDP) through several direct and indirect tourism activities (WTTC, 2017). Over the past few decades, Spain has been one of the most popular destinations for international tourists across the globe. Therefore, tourism is regarded as the third major contributor to the growth of the national economy of Spain after the industrial and the banking sectors contributing about 10% to 11% of GDP and also generating a substantial rate of employment. In 2018, Spain was regarded as the second most visited nation globally with a patronage of over 80 million tourists from different parts of the world (INE, 2019). This antecedence has drawn the attention of scholars recently to investigate the demand/determinant of tourism-led growth hypothesis (TLGH).

Nevertheless, whether and how the expansion of the tourism industry affects the growth of the Spanish economy has been a subject of debate. In fact, according to World Bank's development indicator database, a comparison of economic growth in Spain with the UK, Italy, Germany and France reveals that Spain grows the least in terms of its GDP per capita, with over 10 years (between 2005 and 2015) of no real change in economic growth (World Bank, 2019 **[Q2]**).

Thus, as an engine of economic growth in this globalized era, tourism has evolved around not only the movement of capital and labour for pleasure and business alone but also as stimulation for more investment in infrastructural development, human capital, urbanization of the destinations and employment generation. Unquestionably, there is hardly an argument on whether or not, tourism is an important driver of the global economy, and is the fastest and largest contributor to international trade. However, despite the importance of the industry, there is no consensus as to the strength, direction and other potential variables that mediate the causal link between contributions of the tourism industry and the growth of the economy. In fact, while most empirical evidence suggests that the tourism-led growth assumptions holds (Jalil, Mahmood, & Idrees, 2013; Seghir, Mostéfa, Abbes, & Zakarya, 2015; Katircioglu, 2009; Katirciogğlu, 2014 **[Q3]**; Tugcu, 2014; Shahzad, Shahbaz, Ferrer, & Kumar, 2017; Perles-Ribes, Ramón-Rodríguez, Rubia, & Moreno-Izquierdo, 2017; Etokakpan, Bekun, & Abubakar, 2019; Aratuo & Etienne, 2019), with different impacts in the short run as well as in the long run, only few studies exists on the strength of the relationship (Antonakakis, Dragouni, & Filis, 2015; Santamaria & Filis, 2019), and the intervening role of other variables, such as social globalization and urbanization.

Additionally, the reason for accounting for these 'contemporary' variables is not far-fetched. On one hand, the share of urban population (urbanization) is important for tourism policy in Spain, since the number of people who live in areas regarded as 'urban' per 100 of the total people has consistently increased in the last five decades. In fact, between 1970 (66%) and 2015 (79.6%), the urban population has grown notably due to the rapid development of urban areas across the globe. This growth represents a significant shift from rural to urban-composition effect, which is not unconnected to shifts from a farming-based economy to mass industry, innovation and service (World Bank ~~Database~~, 2019 **[Q4]**). In fact, urban areas have a higher and better set up to achieve the positive goals of social and environmental issues than rural regions. Urban areas generate more employment opportunities as well as training and medical services, among others.

The increasing patronage of Spain as one of the major destinations for international tourists has been directed towards the movement to continuous globalization. Thus, for social globalization, on the other hand, the free flow of information through the internet, social media, popular books, TV series and films are drivers and can serve as a key motivation for travel and tourism (Dwyer, 2015).

The growing demand for tourism in Spain has impacted the changing direction of development of the global economy in terms of entrepreneurship, investments, innovations, civilization, cultural and political development. As such, access to different forms of transport, development in renewable energy, amongst others appear as important factors in the TLGH. In fact, an examination of data from World Bank's development indicator database (2019), shows that increase in international tourist arrivals can be traced to the growth in air transport, which has witnessed an upward trend since 2010 after the global financial crisis (for example, an 18% increase between 2015 and 2017). Similarly, there's been a sharp increase in renewable energy use in Spain up to double (100% increase) in 2010 from its 2005 levels. This has implications on tourism activities as well as the environment (Balsalobre-Lorente, Shahbaz, Roubaud, & Farhani, 2018) and growth prospects, and is worth a revisit in order to strengthen existing knowledge on tourism-growth nexus in Spain.

Furthermore, past studies on the tourism-growth nexus in Spain have not established the relationship in line with the effects of urbanization, air transport demand and social globalization. A close analysis for Spain, near to the current study is that of Perles-Ribes et al. (2017). Their study presented empirical evidence for the TLGH (TLGH) considering some evolving events, and to check for the strength of the tourism-growth nexus. However, the current study differs substantially from existing studies. Thus, the main aim of this study is to investigate the dynamic effect of air transport on economic growth assuming a process of social globalization in Spain. The role of urbanization and social globalization are considered in the model to avoid potential omitted variable bias and to further account for tourism impacts on economic growth and consequently offer fresh evidence on the impact of air transport as a proxy of tourism on economic growth in Spain. The present study also sidesteps for omitted variables bias by the addition of other variables, which the previous study failed to address. The empirical results validate TLGH through a nonlinear autoregressive distributed lag (N-ARDL) estimation methodology.

The paper is organized in the following manner. The next section is a stylized review of the related study. Section 3 presents the data and methodological route applied in the study. Empirical results interpretation is offered in Section 4. The conclusion is rendered in Section 5.

2. Literature review

A systematic sequential analysis of past empirical studies on what we know about the tourism-growth nexus showed that most studies confirmed the tourism-growth linkage (Pablo-Romero & Molina, 2013). In their review, nearly 64% of past studies found a one-to-one tourism-growth linkage, 19% discovered a one-to-one relationship, 10% revealed a unidirectional causality from growth to tourism. While less than 5% found no causality. Also, it is noteworthy that the authors gathered their results based on various push and pull factors like the nation's level of concentration in tourism and much attention is given to the choice of model stipulations and econometric models as sources of deriving the results. This is to provide evidence for the variance in the submissions of different scholars and policymakers about the tourism-led hypothesis.

In the same vein, Brida, Cortes-Jimenez, and Pulina (2016) conducted a review on the tourism-growth nexus, based on the main empirical implications that have been suggested so far in the literature. The authors reviewed 100 related research papers and found that most of the studies suggest that overall, economic growth is driven by international tourism, though there are some exceptions. In modelling tourism-growth nexus, the bulk of studies in the literature adopt a bi-variate framework (Brida et al., 2016, 2019~~08~~ **[Q5]**) in a linear setting. However, from an economic view, it is known that most macroeconomic indicators exhibit nonlinear traits given the wave of economic uncertainty, shocks and business cycles. The already established tourism-induced growth hypothesis underlines there could be nonlinear relationships between variables. Thus, considering only linear relations the study would be flawed with model bias. This would lead to spurious policy recommendations. The present study extends empirical literature on tourism modelling applying a N-ARDL technique that admits the analysis of the potential asymmetric impact of air transport over economic growth, both in the long and short-run. The N-ARDL methodology is appropriate for the understanding of nonlinear dynamics between tourism and economic growth, in order to sketch policy recommendations (Meo et al., 2018). Thus, this study aims to fill this gap by modelling the connexion between air transportation and economic growth based on nonlinearity and account for the impact of other covariates on economic growth.

Additionally, due to increased earnings from tourism development, many governments have sought to invest more in tourism infrastructures with the motive of growing their economies. This increasing attention has led to a recurrent examination of the association among the travel industry, economic growth and other factors in the literature. However, there are mixed estimations by researchers on the TLGH. A review of past empirical studies has justified the existence of inconsistencies as regards the tourism-growth nexus owing to the variation in methodology, data used, country or economic and geographical region of study, as well as econometrics model employed.

For instance, based on country-specific analysis for Malaysia, Tang and Tan (2013) tested the rationality of TLGH in alignment to 12 selected tourism market and reaffirmed the validity of the hypothesis in 8 markets out of the 12 examined in the study. Nepal, Indra al Irsyad, and Nepal (2019) also employed an econometric model based on autoregressive distributed lag model (ARDL) and Granger Causality test to assess both short and long-run linkages amongst tourist arrivals, per capita output, CO_2 emissions, energy consumption and gross capital formation using Nepal as the focus of study. It was discovered that there exists a bidirectional causal link between tourists' arrival and gross capital formation though tourism is negatively affected by the increasing CO_2 emission.

Jalil et al. (2013) also examined the tourism-growth nexus in Pakistan and affirmed a positive and one-way causal relationship from international tourism to economic growth. In the case of Turkey, Katircioglu (2009) also tested for the validity of the TLGH, and found a distinctive result from the previous studies on Turkish economy as it was found that no cointegration exists in the tourism-growth nexus, which disenabled the author to further the process of finding the causality effect.

Additionally, Shahzad et al. (2017) investigated the validity of TLGH in 10 most visited tourists' destinations in the world and found a direct link in the tourism-growth nexus, though there are variations in the level of the relationships across the countries. Chou (2013) also used causal analysis to assess whether a link exists in the tourism-growth nexus for 10 transitional nations. The study showed several relationships across countries; an independent relationship in the case of Bulgaria, Romania and Slovenia; for Slovakia, Cyprus and Latvia, the TLGH holds; for Poland and Czech Republic, reverse relationships were found; and in the case of Estonia and Hungary, a feedback TLGH also holds. Seghir et al. (2015) also examined whether a causal link holds for the tourism-growth nexus in 49 countries, utilizing both cointegration and Granger causality analysis. The study found a two-way direction of causality for the nexus.

A survey of prior studies reveals that several studies that have adopted air transport (AT) as a proxy for tourism and investigate its linkage to economic growth, although most studies reveal differing forms and direction of causality. Marazzo, Scherre, and Fernandes (2010) analysed the case of Brazil and found that the growth in the number of air transport (AT)[1] passengers cointegrates with the growth of the economy. Their study showed that a strong positive AT demand-growth nexus owing to the positive changes in GDP. Similarly, Hu, Xiao, Deng, Xiao, and Wang (2015) showed that a long-run and robust two-way causal link exists in AT-growth nexus, but only a short-run one-way causality exists and runs from AT to economic growth. For the OECD, Küçükönal and Sedefoğlu (2017) also found a one-way causal linkage in the short run, which runs from GDP, employment and tourism to air transport. Baker, Merkert, and Kamruzzaman (2015) also found a significant bidirectional relationship implying that airports have an impact on the growth of the Australian economy, and that the economy also directly impacts air transport. Saidi and Hammami (2017) showed that bidirectional causality occurs between environmental degradation and growth of the economy and a one-way causal link from transport to environmental degradation.

Further evidence also exists to support the presence of a long-run link in the AT-growth nexus. For instance, the study by Hakim and Merkert (2016) showed that in South Asia, there exists a long-run one-way causality from GDP to air passenger traffic. In the same vein, Van De Vijver, Derudder, and Witlox (2014) examined the causal relationship between trade and air passenger travel through the use of diverse Time-Series Cross-Section (TSCS) Granger causality evaluation in some areas in Asia-Pacific. Their study revealed four major findings on the causal relationship, first, independent patterns of relationship; second, bidirectional link between air traffic and trade and lastly, the existence of bidirectional causal link across the different pairs of countries employed in the study.

In a bid to further explore the growth led to the impact of air transport, Abate (2016) investigated the impact of liberalizing air transport in Africa. The study found that regions that liberalize experience increase in departure frequency. Furthermore, Smyth, Christodoulou, Dennis, Marwan, and Campbell (2012) investigated the necessity of air transport funding in promoting social inclusion and economic development in Scotland. They discovered that funding the air transport system has significantly increased passenger flows and travel conditions for all passengers, and favoured the increased economic prowess Scottish economy. Rashid Khan et al. (2018) also found different directions of causality as well as no causal relationships amongst the studied variables through diverse transport means. Saidi, Shahbaz, and Akhtar (2018) also examined the effect of transport energy utilization and transport structure on economic development by using information on MENA nations from 2000 to 2016. The causality analysis in the study established a two-way causal linkage between energy consumption and transport as well as between transport infrastructure and economic growth. Furthermore, recently Brida, Lanzilotta, Rodríguez-Collazo, and Zapata-Aguirre (2018) analysed the dynamic relationship between air transportation and economic growth in four South American countries, (Argentina, Brazil, Chile and Uruguay), concluding that relationship between air transport and growth contain an asymmetry behaviour. In line with these results, we have applied an empirical model that explores the asymmetric behaviour of air transport over economic growth in Spain. Brida et al. (2016) found a nonlinear relationship between air transport development and economic growth in the cases of Chile and Uruguay. Husein and Kara (2020) confirmed the existence of an asymmetric or nonlinear cointegration relationship between Puerto Rico's tourism demand and its determinants.

In terms of other variables that affect the TGLH, a number of studies have shown the link between renewable energy use (RNW) and economic growth. The majority of these studies examined the link between the two variables in an attachment to a multivariate framework, which includes variables such as CO2 emission, financial development, import and export and globalization (Le & Nguyen, 2019). For instance, Apergis, Payne, Menyah, and Wolde-Rufael (2010) found a long-run connection between variables while, Tugcu, Ozturk, and Aslan (2012) found a bidirectional causality. Similarly, Bhattacharya, Paramati, Ozturk, and Bhattacharya (2016) showed that renewable energy has a substantial positive effect on growth. Maji and Sulaiman (2019) also investigated the RNW-growth nexus of 15 West African countries using dynamic ordinary least squares (DOLS). They found that RNW decelerates economic growth in these countries based on the poor utilization of wood biomasses in the estimated countries.

To further show causality between renewable energy use and economic growth the variables, Kahia, Aïssa, and Charfeddine (2016) and Huang and Huang (2019) found that there is a long-run relationship, which is a one-way causal link from economic growth to RNW in the short-run and a two-way causality in the long run. Boontome, Therdyothin, and Chontanawat (2017) in the same vein showed that a one-way causality from non-renewable energy consumption to carbon dioxide (CO_2) emissions in the case of Thailand. Troster, Shahbaz, and Uddin (2018) also found a two-way causal connection between changes in RNW and economic growth as well as a one-way causality, which runs from fluctuations in oil prices to economic growth.[2]

However, despite the rich literature on tourism-energy-growth nexus, there is insufficient evidence on whether and/or how this link holds when social globalization and urbanization are considered. The Globalization Index provided by the KOF Swiss Economic Institute gives measures of different aspects of globalization vis-a-viz social, political, economic and financial globalization. According to Salifou and Haq (2017), economic globalization positively drives growth, thereby establishing the TLGH for countries in West Africa. This result also holds for financial globalization in developing countries (Combes, Kinda, Ouedraogo, & Plane, 2019). Additionally, in the case of social globalization, (Marques, Fuinhas, & Marques, 2017) found no short-run impact, while in general globalization drives economic growth in the long run as well as tourism (Javid & Katircioglu, 2017). In summary, although globalization drives both tourism and growth independently, yet, examining this causal link within the framework adopted in this study could provide useful information to both stakeholders and policymakers.

3. Data and empirical strategy

This study uses a Nonlinear AutoRegressive Distributed Lag (N-ARDL) framework (Shin et al., 2014) to explore the long-run effects that air transport (as proxy of tourism), and potential additional determinants, exert over economic growth. Our main hypothesis tries to validate the TLGH for Spain, between 1971 and 2015.

This relationship can be specified as follows.

$$GDP_t = \beta_{GDPPC} GDP_{t-i} + \beta_{AT} AT_{t+i} + \beta_{RNW}(RNW)_{t-i} + \beta_{URB} URB_{t-i} + \beta_{SG} SG_{t-i} + e_t \qquad (1)$$

where the per capita gross domestic product (GDP_t) is determined by its persistence element, (GDP_{t-i}), air transport (passengers) (AT), renewable energy use (RNW), urbanization process, (share urban population) (URB) and social globalization. All variables are expressed in logarithm.

All these explanatory factors are theoretically perceived and often empirically proven to be the determinants of economic growth are also influenced by these factors and their dynamics (Saidi & Hammami, 2017; Saidi et al., 2018; Balsalobre et al. 2019 **[Q6]**).

Assumed that economic growth is influenced by its past values (GDP_{t-i}), we apply the N-ARDL methodology, which it considers the asymmetries and nonlinearities (Pesaran & Shin, 1999; Pesaran, Shin, & Smith, 2001; Shin et al., 2014).

Therefore, the N-ARDL is a suitable framework for investigating the asymmetries and nonlinearities; trying to validate the TLGH in Spain, between 1971 and 2015.

Previously, we can specify the Equation (1) in the following long-run model of economic growth:

$$GDP_t = a_0 + a_1 AT_t^+ + a_2 AT_t^- + a_3 RNW_t + a_4 URB_t + a_5 SG_t + e_t \qquad (2)$$

where GDP_t is the gross domestic product being their determinants specified in Equation (1), where $a = (a_0 - a_5)$ is a co-integrating vector of long-run parameters.

In Equation (2) the AT_t^+ and AT_t^- are partial sums of positive and negative changes in the air transportation, it can be specified as:

$$AT_t^+ = \sum_{i=1}^{t} \Delta AT_i^+ = \sum_{i=1}^{t} \max(\Delta AT_i, 0) \qquad (3)$$

and

$$AT_t^- = \sum_{i=1}^{t} \Delta AT_i^- = \sum_{i=1}^{t} \min(\Delta AT_i, 0) \qquad (4)$$

In the formulation presented above (Equation (2)), the relationship between Air Transport (*AT*) and economic growth (GDP_t) is expected to be positive (a_1), confirming the TLGH, while a_2 captures the association between air transportation and economic growth, while there are reductions in them. As AT is expected to generate co-movement, estimates of a_2 are expected to have positive signs. Furthermore, we also check if the increase in the air transport will result in a higher increase in the economic growth than the decrease in the air transport, which may lead to a decrease in the economic growth. In other words, the positive AT shocks will have a greater impact than the negative AT shocks (i.e. $a_1 > a_2$). Concomitantly, the long-run relationship presented in the Equation (2) is expected to reflect an asymmetric pass through.

At this point, we frame the Equation (2) into a N-ARDL setting (see, Shin et al., 2014) as follows;

$$\Delta GDP_t = a + \beta_1 GDP_{t-1} + \beta_2 AT_{t-1}^+ + \beta_3 AT_{t-1}^- + \beta_4 RNW_{t-1} + \beta_5 URB_{t-1} + \beta_6 SG_{t-1} + \sum_{i=1}^{j} \emptyset_i \Delta GDP_{t-i}$$
$$+ \sum_{i=0}^{k} (\theta_i^+ \Delta AT_{t-i}^+ + \theta_i^- \Delta ATP_{t-i}^-) + \sum_{i=0}^{l} \gamma_i \Delta RNW_{t-i} + \sum_{i=0}^{m} \delta_i \Delta URB_{t-i} + \sum_{i=0}^{n} \Omega_i \Delta SG_{t-i} + e_t \qquad (5)$$

Being defined all the variables previously, j, k, l, m, n are lag orders, and $a_1 = -\beta_2/\beta_1$; $a_2 = -\beta_3/\beta_1$ are the earlier mentioned long-run impacts of increase/decrease in the air transportation on inflation (Equation (5)).

In Equation (5), the $\sum_{i=0}^{k} \theta_i^+$ measures the short-run impacts of an increase in air transportation on economic growth whereas $\sum_{i=0}^{k} \theta_i^-$ measures the short-run impacts of a decrease in air transportation on economic growth.

The N-ARDL framework will be entailed on the following steps. First of all, we investigate the linearity properties of the variables. This study applies the BDS test (Broock et al., 1996 **[Q7]**) to detect the nonlinearity characteristics of the selected variables. This is to avoid the error of linearity assumption. The results present that all variables are nonlinear. Thus, the use of asymmetric setting like the N-ARDL is suitable to explore nonlinearity as well as structural shift between the outlined variables under consideration.[3] Secondly, we would perform the ADF unit root test with structural break to find the order of integration (Table 1). It is necessary to perform to unit root test to confirm that there is no $I(2)$ variable.[4] **[Q8]** $I(2)$ invalidates the computation of F-statistics to test the cointegration (Ibrahim, 2015). Given that all variables are I(1), we then proceed to apply the bounds testing approach proposed by Pesaran et al. (2001) and Shin et al. (2011 **[Q9]**) to test for the presence of cointegration among selected data series (Table 2). We will perform the Wald F-test with the null hypothesis, $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$. After that we would examine the long and short run asymmetries in the relationship between air transportation and economic growth, we would also discuss the impact of additional explanatory variables included in the model. With specific to the TLGH expectations, we would derive the asymmetric cumulative dynamic multiplier effects of a 1% change in the air transport i.e. AT_{t-1}^{+} and AT_{t-1}^{-} as:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{AT_{t-1}^{+}},\ m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{AT_{t-1}^{-}},\ h = 0, 1, 2 \ldots \tag{6}$$

A point to note here is that as $h \to \infty,\ m_h^+ \to \alpha_1\ and\ m_h^- \to \alpha_2$.

Table 1. ADF test with structural break: Additive & innovative outliers.

Level							
	Variables	ADF test statistic (IO)	*P*-values	Breaking point	ADF test statistic (AO)	*P*-values	Structural break
	LGDP	−4.592323	0.0337	1985	−3.069243	0.6457	1984
	LAT	−4.112719	0.1221	1994	−3.380530	0.4539	1995
	LURB	−8.535964*	< 0.01	1973	−4.392008	0.0578	2014
	LRNW	−4.015319	0.1518	1993	−2.916545	0.7309	1991
	LSG	−2.799458	0.7877	1994	−2.039170	0.9804	1994
1st Difference							
	ΔLGDP	−6.005537*	< 0.01	1995	−4.592095*	0.0337	1979
	ΔLAT	−5.747132*	< 0.01	2007	−5.809720*	< 0.01	2007
	ΔLURB	−6.455630*	< 0.01	1980	−6.118721*	< 0.01	1980
	ΔLRNW	−5.257174*	< 0.01	1979	−5.374439*	< 0.01	1979
	ΔLSG	−9.168830*	< 0.01	1994	−9.383930*	< 0.01	1994

*1% level of significance ** 5% level of significance ***10% level of significance.

Table 2. Bounds test for the nonlinear cointegration.

Dependent variable	F-statistics	Lower-Bound (95%)	Upper-Bound (95%)	Conclusion
LGDP	5	2.39	3.38	Cointegration

*~~1% level of significance ** 5% level of significance ***10% level of significance~~. **[Q10]**

Finally, on the empirical analysis steps, the direction of causality among the outlined variables is detected by the non-parametric causality test advanced by Diks and Panchenko (2006). The Diks and Panchenko (2006) causality test is adopted for its strength over the Hiemstra and Jones (1994 **[Q11]**) test, which is plagued with over-rejection issues in favour of the alternative hypothesis when it is not true. Furthermore, owing to the fact that conventional Granger causality fails to account to nonlinearity and asymmetry informed the choice of the Diks and Panchenko (2006), that ameliorate the shortcomings of both traditional Granger causality and Hiemstra and Jones (1994) test. The choice of the Diks–Panchenko's test is premise on the superiority of the test to render more robust and consistent causality tests results in a non-Granger causality terrane. Also, the test help in the avoidance of the over-rejection drawback of Hiemstra and Jones (1994) test that is observed in the test statistics, which fails to account for possible variation in the conditional distribution that may occur under the null hypothesis when the sample size tends to unit. Thus, to circumvent for the above-mentioned issues the Diks and Panchenko non-parametric non-Granger causality test presents a solution that amends aforementioned setbacks and offers robust and consistent results.

4. Empirical analysis, findings and discussion

To start with, we performed the Unit root test to determine the order of integration of the series. Although in the conduction of N-ARDL some scholars have argued that there is no need for protest. Though there should be no I(2) variables to avoid spurious analysis Ibraim (2015). The chosen approach is ADF Unit root test with the structural break in the data series. Accounting for a structural break is important as in the existence of a structural break, the unit root test, which condones it is prone to be biased towards null of random walk (Ranganathan and Ananthakumar, 2010 **[Q12]**; Nasir et al, 2018). We let the date of the break to be determined endogenously, rather than choosing it exogenously, in simple words we let the data speak. In so doing, we choose the alternate minimize and maximize options to permit for assessment of one-sided alternatives, this produces dissimilar critical values for the final Dickey–Fuller test statistic and tests with greater power than the non-directional alternatives.[5] **[Q13]** The ADF is applied to test for the unit root in the presence of break with both Innovative Outliers (IO) and Additive Outliers (AO).[6] **[Q14]** In order to choose the optimal number of lags for the ADF test, we used the Schwarz Information Criteria (SIC), which is particularly appropriate in the presence of structural break (Asghar and Abid 2007) **[Q15]**. These results are presented in Table 1; -

The results stated that at the level the null of no unit root could not be rejected at (5%) level of statistical significance. However, at the first difference, all the series were found to be stationary i.e. I (1).

Table 2 presents the results of Bounds testing for the nonlinear Cointegration for Spain:

The bound testing showed that the critical values of the F-statistics were greater than upper-bound at 95% level of confidence, indicating strong evidence of Cointegration expectation models (Equation (5)). This implied that there is a long-run relationship between the under-analysis variables and hence, we can proceed with the estimation and further analysis.

After unit root testing, we come to the estimation of N-ARDL model (Equation (5)).

Table 3 results shows the estimation results showed that in the short run, the lagged values of economic growth GDP_{t-1} had a positive and statistically significant impact on the economic growth.

Table 3. Results of nonlinear (N-ARDL) estimation for Spain (1971–2015).

Variables	Coefficient	Prob.
GDP_{t-1}	0.436055*	(0.0001)
AT^{+}_{t-1}	0.740489*	(0.0003)
AT^{-}_{t-1}	0.811227*	(0.0001)
$LRNW_{t-1}$	−0.201826*	(0.0017)
$LURB_{t-1}$	70.55963*	(0.0000)
LSG_{t-1}	0.274075	(0.8179)
$\Delta LRNW_{t-1}$	−0.144995**	(0.0598)
$\Delta LURB_{t-1}$	−59.26481*	(0.0000)
ΔLSG_{t-1}	4.013367*	(0.0007)
C	−24.06296*	(0.0000)
Long-run estimation		
AT^{+}_{t-1}	1.313052*	(0.0000)
AT^{-}_{t-1}	1.438486*	(0.0012)
$LRNW_{t-1}$	−0.614990*	(0.0000)
$LURB_{t-1}$	20.02823*	(0.0000)
LSG_{t-1}	7.602588*	(0.0009)
C	−42.66898	(0.0000)

R^2	0.995206	
DW	1.568248	
ECT	−0.563945*	(0.0000)
JB test	0.783562	(0.67582)
BG LM test	2.282559	(0.1184)
BPG test	1.14735	(0.3576)
Harvey test	1.713562	(0.1240)
Ramsey REST test	0.8937	(0.3513)
Wald test	44.93583	(0.0000)

*1% level of significance ** 5% level of significance ***10% level of significance, * interpreted as $z_t = z_{t-1} + \Delta z$ whereas the JB is Jarque–Bera test for the error normality. BG is Breusch-Godfrey LM test with two lags for auto-correlation, BPG is Breusch–Pagan–Godfrey Test and White-test was used for heteroskedastic. Note: White heteroskedasticity-consistent standard errors and covariance. Optimal lag selection based on AIC.

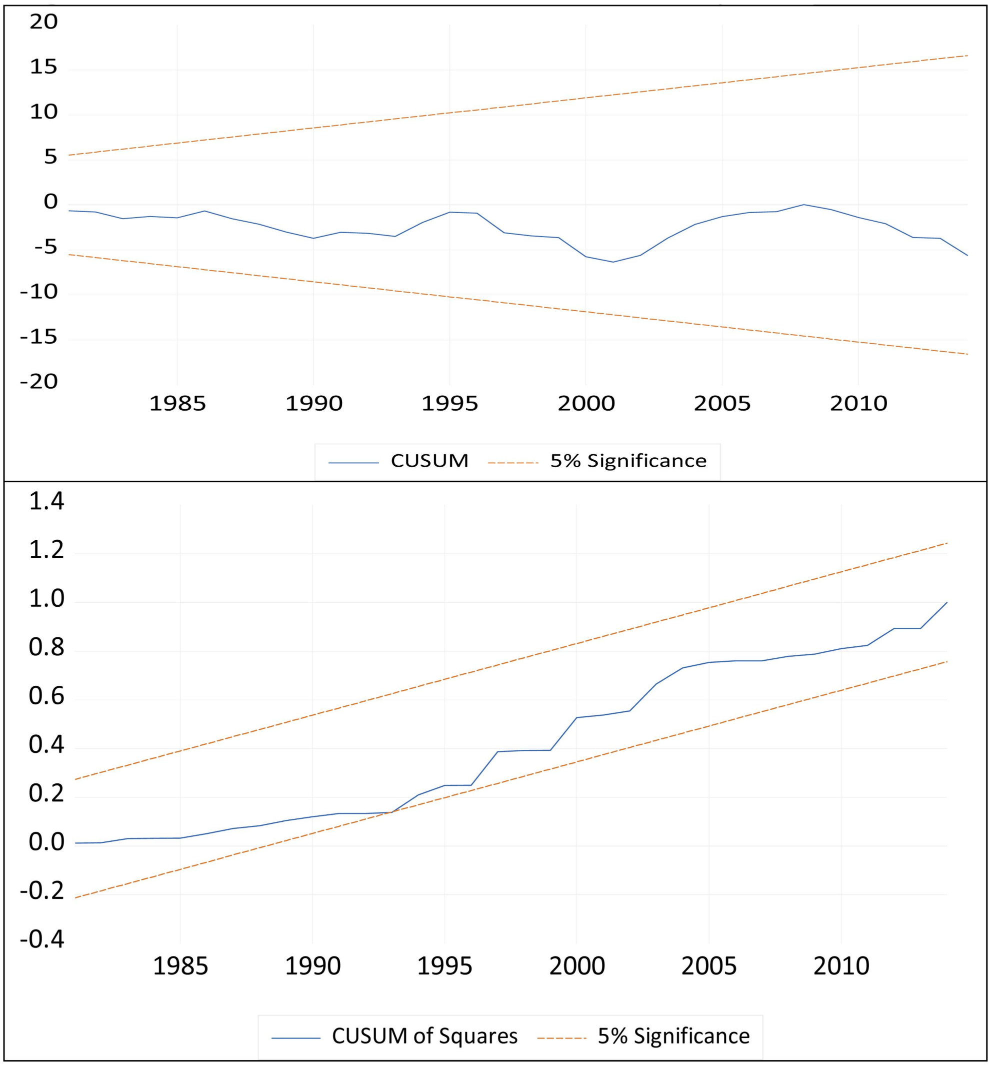
The positive air transportation AT_t^+ has a positive impact on the economic growth while the negative AT_t^+ also had a positive impact on the economic growth in the short run. The positive ΔAT_t^+ were lower in the magnitude than the negative ΔAT_t^-.

The fitted model is free from all diagnostic errors and suitable for policy direction. The negative and significant values of Error Correction Term (ECT) also indicated the stability of the model and adjustment pace in terms of disequilibrium on an annual basis. Lastly, the Ramsey RESET test showed that the null of no misspecification could not be rejected at the statistical level of significance. Concomitantly, the model is correctly specified.

The diagnostic test performed for both sub-periods showed a significant value of ECT. The JB test suggested that the null of normality of errors, no auto-correlation and no misspecifications were not rejected at the statistical level of significance.

To further test the stability of the estimates, we also performed the CUSUM and CUSUMSQ and the results are presented for the full and sub-samples in Figure 1.

Figure 1. CUSUM AND CUSUMS Q Parameters stability test.



The CUSUM and CUSUMSQ test for structural change plots of cumulative sum and cumulative sum of squares of recursive residuals. The straight lines describe critical bounds at the 5% level of significance. CUSUM and CUSUMSQ parameter stability tests indicate the stability of estimates. After the stability test, we estimate the multiplier impact of air transport on the economic growth. The results of N-ARDL multiplier analysis are presented in Figure 2.

Figure 2. N-ARDL Multiplier of air transportation and response of economic growth in Spain.

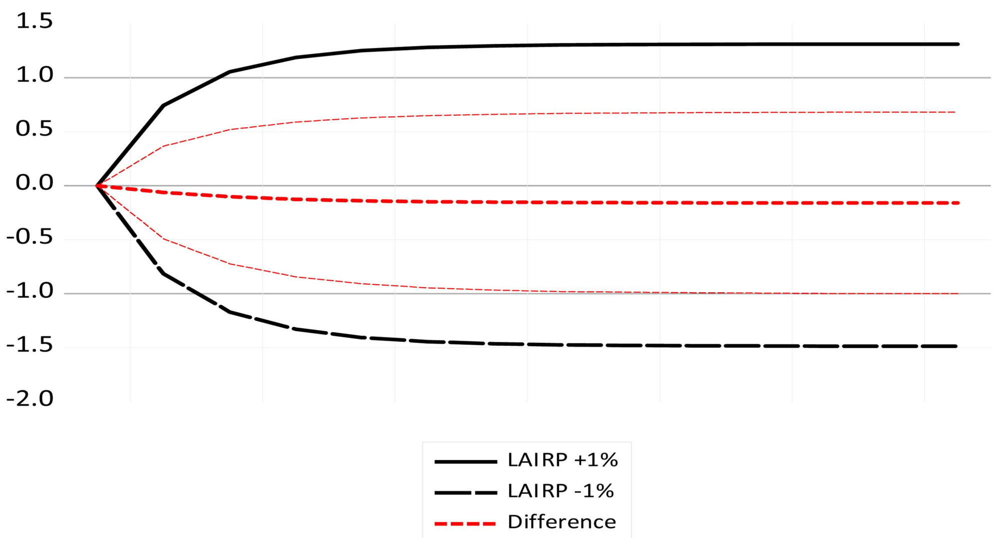


Figure 2 represents the dynamic results of the multiplier test of air transportation on the economic growth for Spain reflects that in response to a 1% increase in the air transportation the economic growth shows a positive response. Similarly, in response to the negative air transportation the economic growth presents a negative response across the annual time horizon.

Finally, our study proposes the non-parametric Diks and Panchenko (2006). This non-parametric causality reduces the bias and lessens the risk of over-rejection of the null hypothesis. The results of the Diks and Panchenko (2006) nonlinear causality test are reported in Table 4. The non-parametric Diks and Panchenko Causality test ameliorate for the pitfalls of conventional Granger causality. Thus, the need for the direction of causality direct flow is pertinent to adequately arm policymaker and stakeholder of direction of the relationship between the outlined variables contemporaneous term and past realization. That is, the predictability power of each variable to another. Table 4 presents insightful results with feedback causality observed from tourism proxy by air transport and economic growth (GDP). This implied that both tourism and GDP are a key predictor of each other. This outcome validates the TLGH and vice versa. This is consistent with the study of Katircioglu (2014). **[Q16]**Furthermore, two-way causality test is seen running from renewable energy consumption and economic expansion. This denoted that renewable energy consumption is a key determinant for economic growth. This is desirable as most nation including the Spanish economy is on the trajectory to decrease fossil fuel energy-based energy consumption. Also, interesting for an industrialized economy like Spain economy globalization is seen as a driver for economic growth as unidirectional causality seen running from globalization to economic growth. This outcome is also validated as the social dimension of globalization triggers urbanization. In addition to the already stated causality analysis, globalization also engenders urbanization as both two-ways and one-way causality from economic growth to urbanization. This is insightful that more urban population with a global effect trigger economic growth in Spain and by extension affect tourism expansion. Further insights into causality can be seen from the schematic in Figures 3–4.

Figure 3. Diks and Panchenko (2006) causality relationship.

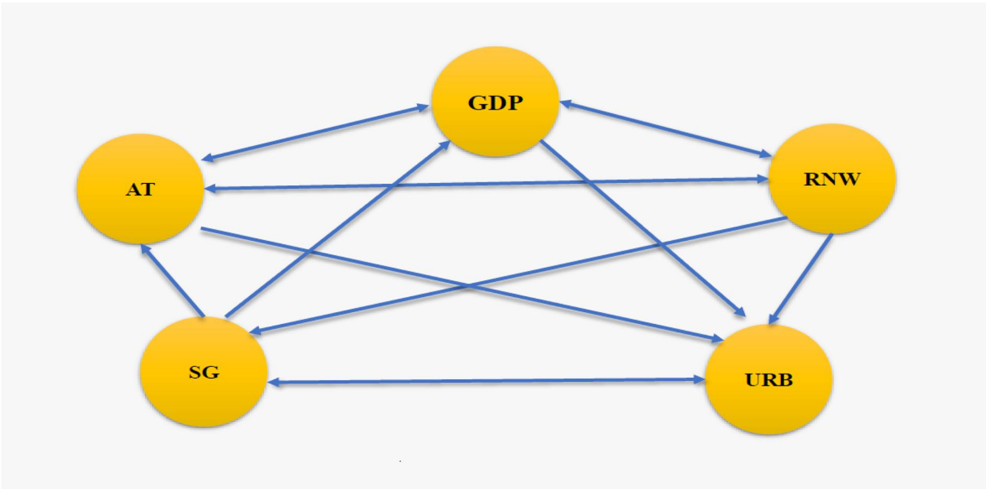


Figure 4. Empirical scheme, based in N-ARDL econometric results.

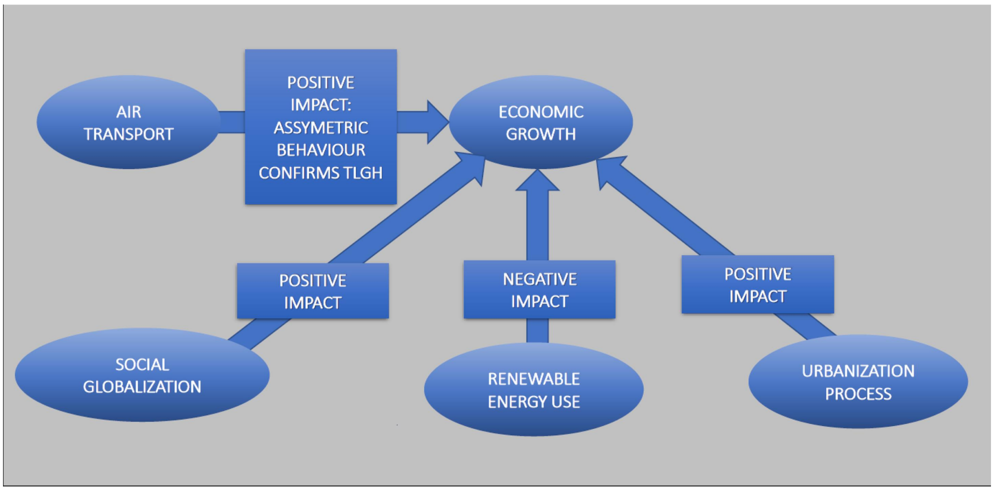


Table 4. Diks and Panchenko (2006) Granger causality test.

Sample: 1971–2015			
Null hypothesis:	Obs	T-statistic	Prob.
LAIRP does not Granger Cause LGDP	45	1.450***	(0.07358)
LGDP does not Granger Cause LAIRP		1.309***	(0.09534)
LRNW does not Granger Cause LGDP	45	1.516**	(0.06472)

LGDP does not Granger Cause LRNW		1.957*	(0.02516)
LURB does not Granger Cause LGDP	45	0.200,	(0.42060)
LGDP does not Granger Cause LURB		1.256***	(0.10448)
LSG does not Granger Cause LGDP	45	1.427***	(0.07679)
LGDP does not Granger Cause LSG		0.879	(0.18975)
LRNW does not Granger Cause LAIRP	45	1.267***	(0.10266)
LAIRP does not Granger Cause LRNW		1.804**	(0.03559)
LURB does not Granger Cause LAIRP	45	0.732,	(0.23198)
LAIRP does not Granger Cause LURB		1.303***	(0.09625)
LSG does not Granger Cause LAIRP	45	1.358***	(0.08726)
LAIRP does not Granger Cause LSG		1.110	(0.13357)
LURB does not Granger Cause LRNW	45	1.115	(0.13233)
LRNW does not Granger Cause LURB		1.345***	(0.08924)
LSG does not Granger Cause LRNW	45	1.118	(0.13171)
LRNW does not Granger Cause LSG		1.598**	(0.05499)
LSG does not Granger Cause LURB	45	1.256***	(0.10453)
LURB does not Granger Cause LSG		1.576**	(0.05748)

This is insightful for Spanish government administrators that there is a need to strengthen its transportation sector given that the sector in both period trigger economic growth. This is a desirable result given the strategic position of Spain in the community of countries in the European Union (EU) region. This finding aligns with the study of (Hu et al., 2015; Marazzo et al., 2010). The use of renewable sources has a negative impact on economic growth, as a consequence of distribution of energy mix Spain, dominated by fossil sources. This is disturbing, as policymakers need to intensify efforts on her energy mix changes from non-renewable energy sourced-derived economic growth to renewable energy. (Bekun et al., 2019a **[Q17]**; 2019b). This is because of the trade-off of the environmental effect of fossil fuel energy sources, which is characterized by pollutant emission (CO_2). Furthermore, urbanization and social globalization reflect a positive impact, which varied in magnitude and significance over different lags. The long-run estimates for the full period presented in the bottom of Table 3 that the positive air transportation has a positive impact on economic growth while the air transportation also presents a positive impact indicating an asymmetric relationship between the air transportation and economic growth in Spain. Among the other variables, renewable energy shows a negative impact though results significant in the long run. On the other hand, urbanization process and social globalization exert a positive impact on the economic growth.

5. Conclusion

Due to increased earnings from tourism development, many governments have sought to invest more in tourism with the motive of growing their economies. This increasing attention has led to a recurrent investigation of the connection between tourism and economic growth in the tourism literature. It is on this premise that the present study re-investigates the dynamic interaction between tourism and economic growth with a new perspective from the Spanish context. The current study is different from the previous in terms of scope by accommodating for other key growth driver like air transportation, social globalization and urbanization. Furthermore, the present study contributes and complement to the existing literature in terms of methodological front by the application of recently developed N-ARDL methodology proposed by Shin et al. (2014) that account for asymmetry and nonlinearity over the outlined variables.

Empirical investigation traces long-run asymmetry relationship between the variables under review. This implies that there is a strong connection between economic growth and tourism sector in conjunction with the transportation sector of the Spanish economic growth over the investigated period. This study lends support to the finding of Katircioglu (2014) as tourism is seen as a key growth determinant.

It is well documented in the literature that tourism is pivotal to economic growth as air transportation engenders economic growth in a term of dynamic globalized changing world and the need for tourism arrival. However, there is need to apply the brakes on fossil energy sources as the current study observed an inverse relationship between renewable energy and economic growth. Thus, the need for a paradigm shift in energy consumption from tourism sector should be revisited by appropriate strategies from the government officials in Spain. There is an environmental implication(s) for non-renewable induced tourism-growth economy. These consequences are enormous. Consequences range from poor environmental air and health hazard in the long run. Given the highlighted outcomes, pragmatic action step is required that the tourism-induced growth should be green and from cleaner energy basis. Furthermore, the need for policymakers to reinforce tourism infrastructures like more recreational centres, amusement parks and regulations in air transport to warranty the tourism sector attracts more tourist arrival as well increase the promotion of renewable sources, which are cleaner and more eco-system friendly.

In summary, the adoption of linear symmetry modelling can lead to spurious results and misleading policy implications for the Spanish economy. Thus, the use of appropriate N-ARDL methodology offers better and robust conclusions, forecast and policy direction for stakeholders in the related field. Further studies can reinvestigate the theme under review for other top tourism destination and query other co-variates not accommodated for in the present study like role of demographic indicators like democracy or political regime in the TLGH literature.

Notes

1. Air transportation (AT) in this study context refers to the movement of persons, customer's cargo by planes, aircrafts. AT in recent times has evolved to be main/preferred sources of movement given in unique traits of comfort and speed in the transportation sector. This study uses AT as to proxy tourism after studies of (Brida et al., 2018; Husein and Kara, 2020).
2. For brevity, details on other related literature are presented in in appendix section.
3. For brevity, the results of the BDS test can be made available upon request.
4. Even some academics recommend that there is no need for stationary checking for the ARDL method (Ibrahim, 2015), ARDL contains one limitation; when any series in model is stationary at second difference I(2), ARDL cannot be employed, becoming F-statistics value invalid (see Ibrahim, 2015). Therefore, to leave second difference it is recommended to use Dickey–Fuller (ADF) test. Our study applies ADF with structural brake, reported in Table 1.
5. See, Zivot and Andrews (1992), Banerjee et al. (1992) and Vogelsang and Perron (1998).
6. See, Fox (1972) and Tsay (1988).

Disclosure statement

No potential conflict of interest was reported by the author(s **[Q18]**).

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Appendix

Schematic representation of empirical literature of selected studies

S/N	Author(s)	Variables; Data period and Frequency	Empirical strategy [Unit root testing; and Cointegration method]	Causality analysis and results
1.	Gurgul and Lach (2014)	Y; GFCF; Total Labour force, Average years of schooling over age 25, Government Consumption, Inflation (CPI), FDI (Net inflow), Money and Quasi money; Annual data from 1990–2009	OLS	Globalization → Y
2.	Coulibaly, Erbao, and Mekongcho (2018)	Y; Opportunity entrepreneurship contribution (ENT); Economic globalization (EGI), Physical investment (GCF), National Saving (SAV); Annual data from 2002 to 2013	Arellano–Bond and dynamic system estimation	Globalization → Y
3	Küçükönal and Sedefoğlu (2017)	Air Transport; Y; Employment; Tourism; Annual data from 2000–2013	Granger causality analysis	Short term: Air transport → Y
4	(Meersman & Nazemzadeh, 2017)	Y; Imports and Exports; total length of the road and rail network; The private capital stock; Employment; Annual data from 1980–2012	Granger Causality Test (VAR)	Transport infrastructure → Y
5	(Marazzo et al., 2010)	Gross Domestic Product (GDP) Passenger-kilometre (PAX); Annual data from 1966 to 2006	ADF (Constant and trend); Johansen; Series are cointegrated	Granger Causality Test (VECM) Air Transport demand ↔ Y
6	(Hu et al., 2015)	Y; Air transport passenger throughput; Quarterly data from 2006 to 2012	ADF, Phillips–Perron (First difference); Pedroni and Kao cointegration tests: The series are cointegrated	Bivariate Granger (PVECM); Short term: Domestic air passenger traffic → Y; Long Term: Domestic air passenger traffic ↔ Y
7	(Saidi & Hammami, 2017)	Y; EC; Freight transport; Carbon dioxide emissions; Financial development; Capital stock; Trade openness; Population; Foreign direct investment Urbanization; Annual data from 2000 to 2014	Levin–Lin–Chu (LLC), Im-Pesaran–Shin (IPS) (constant and trend) All series are stationary at first difference	SGMM Freight transportation ↔ Y; Freight transportation + Y → economic degradation

8	(Hakim & Merkert, 2016)	Number of air passenger; Volume of air freight; Y; Annual data from 1973 to 2014	Im-Pesaran–Shin (IPS) – (Constant and Trend); Pedroni/Johansen cointegration test. The series are cointegrated	Granger long-run and Wald short-run causality tests. Short term: No relationship Long term: Air transport → Y
9	Saidi et al. (2018)	Y; Road transport related energy use, Road transport infrastructures, Capital stock; Annual data from 2000 to 2016	Levin–Lin–Chu (LLC), Im-Pesaran–Shin (IPS) – (constant and trend)	Dumitrescu–Hurlin causality analysis (GMM); Transport energy consumption + Transport infrastructure ↔ Y
10	Rashid Khan et al. (2018)	Energy demand; Air transport; Railways transport; Customs and other import duties as % of tax revenue; Y	CIPS panel unit root; Johansen Fisher panel cointegration Analysis; The series are cointegrated	
11	Carfora, Pansini, and Scandurra (2019)	Y; energy consumption, energy prices (CPI); 1971–2015	ADF, Phillips–Perron (PP) – (Constant); Johansen's multivariate maximum likelihood tests; All series are cointegrated	Granger Causality Test (ECM) Y ↔ Energy prices
12	Bhattacharya et al. (2016)	Y; GFCF; RE; Total labour force (LF); Annual from 1991 to 2012	CIPS panel unit root; Panel Pedroni cointegration, All series are cointegrated	Dumitrescu–Hurlin causality (panel FMOLS, DOLS) RE ↔ Y
13	Kahia et al. (2016)	Y; Total renewable and non-renewable electricity consumption, GFCF; Labour force (LF); Annual data from 1980 to 2012	Panel unit root tests; Panel cointegration tests analysis	Panel FMOLS estimates and Granger causality test Short run: Y → RE; RE ↔ NRE Long run: Y ↔ RE
14	Troster et al.(2018)	Oil prices (OP); Industrial Production Index (IPI); EC; Monthly data from July 1989 to July 2016	ADF; Zivot and Andrews test (ZA), ADF Least Squares (ADF-GLS); Johansen linear cointegration test.	Granger causality test RE ↔ Y Oil Price →Y
15	Huang and Huang (2019)	Y; FDI; Per capita Import and Export trade volume; Annual data from 2004 to 2017	ADF test; Phillips–Perron test (PP test) – All the variables are I (1); Bound test cointegration results; ARDL	Individual Energy consumption → Y
16	Boontome et al. (2017)	Y; CO2 emissions per capita (C); renewable energy consumption (REC); Non-renewable energy consumption (NREC); Annual data from 1971–2013	ADF; Phillips–Perron test; All the variables are I (1); Multivariate Johansen cointegration test	Granger causality test (VECM) C → NREC → REC + Y
17	(Tang & Tan, 2013)	Industrial production index; International visitor arrivals; Monthly data from January 1995 to February 2009	ADF; Johansen cointegration test; All series are cointegrated	Recursive Granger Causality test Tourism → Economic growth
18	Nepal et al. (2019)	Y; Tourist arrival GFCF; Energy use, and carbon dioxide emissions (CO2)	ADF; ARDL Bound testing	Granger Causality test (ARDL)

19	(Jalil et al., 2013)	Y; International tourism receipts, Capital stock, Inflation and Trade openness; Annual data 1972–2011	ADF; All variables are either I (0) or I (1); ARDL Bound testing	Granger Causality test (ARDL) Tourism → Economic growth
20	(Tugcu, 2014)	Y; tourism receipts (RCPT) tourism expenditures (EXP); Annual data from 1998 to 2011	Levin–Lin–Chu (LLC), Im-Pesaran–Shin (IPS)	Panel Granger causality test; Tourism receipts ↔ Y in Europe; Tourism expenditures ↔ Y in Asia; No causality found in Africa
21	(Schubert, Brida, & Risso, 2011)	Y of host country; Y of USA; Real Exchange rate; Annual data from 1970–2008	ADF and KPSS; Johansen Cointegration test	Granger Causality test (VECM) tourism demand → Y
22	(Seghir et al., 2015)	Y; Tourism Spending; Annual data from 1988 to 2012	Levin, Lin and Chu (LLC); Breitung t-stat; Im, Pesaran and Shin (IPS) W-stat; MW–ADF Fisher Chi-square; MW–PP Fisher Chi-square; Hadri Z-stat; Heteroscedastic consistent Z-stat; and Panel cointegration test	Panel Granger Causality test Tourism spending ↔ Y

Notes: EG → Economic Growth; ADF → Augmented Dickey–Fuller; GFCF → Gross fixed capital formation; Y → Gross domestic product; EC → Energy consumption.