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Do tourism, economic complexity and globalization affect economic growth? New empirical evidence in the context of TALC theory and accounting for cross sectional dependence

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Abstract

This paper investigates the Tourism Led Growth (TLG) relationship, incorporating the law of economic returns and the Tourism Area Life Cycle (TALC) theory, along with economic complexity and globalization. To measure tourism accurately, principal components analysis is employed, integrating five tourism-specific variables for 127 countries spanning the period from 1995 to 2020. The empirical analysis utilizes advanced panel dynamic models that account for cross-sectional dependence, yielding robust evidence of a nonlinear TLG relationship. Our findings reveal an inverted U-shaped curve characterizing the TLG relationship in both the short and long run, highlighting distinct impacts of tourism specialization in each time frame. Specifically, higher levels of tourism specialization in the short run can lead to diminishing returns to scale in the long run. Furthermore, our analysis demonstrates that cultural globalization positively facilitates the TLG relationship, while economic complexity exerts a negative influence on the impact of tourism on economic growth.

Keywords: panel cointegration; panel cross sectional dependence; tourism-led-growth, Tourism Area Life Cycle
JEL Classification Codes: C21, C23, C32, C33, E13, L83, O11, P48

1. Introduction

Tourism has become a pivotal driver of national economies, playing a crucial role in jobs creation and contributing significantly to global GDP. Prior to the COVID-19 pandemic, it accounted for a substantial portion of newly generated employment worldwide, amounting to 334 million jobs, which constituted a quarter of all jobs created. Additionally, the tourism sector's economic impact reached up to 10.4% of the global GDP, equivalent to 8.44 trillion US dollars (WTTC 2021).

The concept of "Tourism Led Growth Hypothesis" (TLG), as initially suggested by Balaguer and Cantavella-Jordá (2002) draws inspiration from the export-led-growth hypothesis (ELG)

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as well as the trade principle of comparative advantage introduced by Ricardo (1891). TLG posits that a country specializing in a particular sector with a comparative advantage, namely tourism, can enhance its production efficiency and its total welfare through international trade, by exporting tourism products and services. However, it is worth noting that the majority of the TLG literature overlooks the axiom of constant returns to scale, that poses as a fundamental tenet of the Ricardian theory.

Existing studies within the TLG framework often adopt a comprehensive approach that assumes constant returns to scale, utilizing the Cobb-Douglas function, and establishing a linear relation connecting tourism and economic growth. However, evident non-linear investigations within the TLG framework, as explored by Pablo-Romero (2013) and Castro-Nuño et al., (2013), lack a coherent connection and interpretation of economic theory. Furthermore, a limited number of studies (Adamou 2009; De Vita 2017) have revealed decreasing returns to scale in the context of tourism specialization and its effect on economic growth. Moreover, insufficient attention has been provided to examining the dynamics of tourism specialization and its interconnectedness with economic growth. One notable theory that has not yet adequately examined within the TLG framework is the Theory of Tourism Areas Life Cycle (TALC), originally derived from economic geography as proposed by Butler (TALC; Butler, 1980) and popularized by Potter and Wattsy (2011). TALC posits that tourism destinations undergo a five-stage evolution process, namely exploration, involvement, development, consolidation, and post-stagnation, as evidenced by studies conducted by Balsalobre et. al (2020;2018), proposing that the benefit of tourism varies over time. This theory suggests that the benefits derived from tourism vary over time, with increasing returns observed in the early stages, constant returns during the maturity phase, and eventual decline in the post-stagnation stages, as noted by Zuo and Huang (2018). However, during the post-stagnation phase, the implementation of new technologies within the tourism sector (e.g environmental-friendly infrastructure) and effective resource allocation can stimulate a new cycle of tourism-driven development. The TALC theory offers a solid theoretical framework to explain the diverse empirical findings concerning the actual effect of tourism on economic growth.

Considering the existing gaps within the literature, our study examines the short-term as well as the long-term TLG relation with respect to the fundamental law of returns in economic theory and the TALC. To provide new empirical evidence, we utilize a panel dataset comprising of 127 countries in various stages of economic and tourism development. Additionally, we employ a novel measure of tourism specialization. Our findings indicate that both in the short and the long run, tourism specialization exhibits diminishing returns to scale, given the influence of globalization and economic complexity on this relationship. Ultimately, our study contributes to identifying the optimal level of tourism specialization that can foster economic growth both in the short run as well as the long run.

The subsequent sections of this paper are presented as following: Section 2 briefly provides an overview of the existing literature, while Sections 3 and 4 outline the data sources and methodology employed in our analysis. Sections 5 and 6 present our results and concluding remarks, accompanied by policy suggestions.

2. Literature review

A vast amount of theoretical and empirical approaches has endeavored to unravel the complex relation connecting tourism and economic growth. Theoretical investigations can be broadly classified into four key approaches; the "short-run" perspective (Cooper et al., 2008), the "long-run" perspective (Pérez-Montiel et al., 2021); the input-output model or general equilibrium approach (Blake, 2006; Copeland, 1991; Dwyer 2004, 2006; Sinclair, 2010); and the approach employing exogenous (Romer, 1987) or endogenous (Lucas, 1988) growth models (Candela & Cellini, 1997; Hazari, 1995; Lanza, A. & Pigliaru, 2000; Lanza & Pigliaru, 1995; Lozano, 2008). While all theoretical approaches concur, that tourism provides the potential to stimulate economic growth, there are divergent perspectives on the underlying growth mechanisms and the ultimate impact of tourism on the growth of an economy.

The applied literature is extensive, comprising numerous studies that attempt to synthesize the existing body of literature (Ahmad, 2020; Brida, 2016; Comerio & Strozzi, 2019; Gwenhure, 2017; Li et al., 2018). However, the evidence regarding the impact of tourism on economic growth remains inconclusive, primarily due to the absence of comparability and heterogeneity in terms of sample data (panel, cross-sectional, time series), frequency, time span, geographical characteristics, and methodology (Ahmad, 2020). Within the empirical literature exploring the TLG relationship, two major topics are prominent. The first investigates the causal direction linking tourism and economic growth, while the second focuses on modeling the tourism and growth equation. The causality literature (Ahmad, 2020) suggests four types of causality: uni-directional causality (tourism-led-growth and growth-led-tourism), bi-directional causal relation (mutual feedback between tourism activity and growth), and neutrality (absence of feedback). The findings from studies employing either time series and panel data analysis on causality are mixed, with approximately the 35–40% of the studies supporting the tourism-led-growth (TLG) causality direction, while the remaining percentage falls into the other categories (Ahmad et al., 2020).

Regarding the tourism-led growth equation, there are two main approaches: the demand equation approach and the supply equation approach (Brida et al., 2016). The demand equation framework suggests a Keynesian demand equation where the tourism variable is treated as an exogenous influence. However, this approach is static and predominantly focuses on the short-run perspective (Figini & Vici, 2010). The production function approach employs Balassa's extended version of Solow's economic growth model (Balassa, 1978; Solow, 1956) and considers standard factors such as physical capital and labor, with tourism acting as a non-standard factor. Lanza and Pigliaru (2000) extend the production function within a two-sector (tourism-manufacturing) Lucas-type (Lucas, 1988) model, incorporating natural resources as an additional production factor. They conclude that economies specialized in tourism utilize natural resources to bridge their technological gap and achieve higher growth rate.

The empirical literature on the TLG relationship commonly utilizes tourism receipts and tourism arrivals as the main variables of interest. However, alternative approaches (C. L. Chang et al., 2012; Deng, Ma, & Cao, 2014; Po & Huang, 2008) propose tourism specialization as a more appropriate measure to approximate the tourism sector activity. This can be defined either by the ratio of tourism receipts-to-GDP or by tourism arrivals per resident population of the destination country (Bojanic & Lo, 2016; C. L. Chang et al., 2012; Cherif, 2009). Nevertheless, these alternative measures yield different economic implications, and it remains unclear which approach produces more plausible results. Another method for assessing tourism specialization involves employing variable reduction techniques, such as weighted averaging (WEF, 2021) and principal component analysis (Norusis, 1993; Wold et al., 1987) , to construct a tourism specialization index using multiple tourism-specific variables. For instance, De La VIina et al.(1994) developed a tourism activity index using four variables for the San Antonio region, while Zaman et al. (2016) and (Ali et al., 2021) constructed tourism indices using annual panel multi-country data. However, these approaches lack to suggest a general concise framework to a representative tourism index. In our study, we propose the computation of a tourism activity index that incorporates important tourism-related variables, describing the actual impact of tourism sector on economic growth.

Our analysis integrates the TLG framework with the law of returns and TALC theory. While the tourism specialization level evolves over time during the different stages of the TALC, the relation connecting tourism and economic growth also changes accordingly (Arslanturk et al., 2011). This relationship exhibits a non-linear and dynamic trajectory; as tourism specialization increases, economic growth initially increases, reaching a maximum, and then it decreases after surpassing a threshold of tourism specialization. Zuo & Huang (2018) provide a more comprehensive overview of the theoretical framework. Empirical investigations that examine the TLG within this framework are summarized in the studies by Adamou & Clerides (2009) Zuo & Huang (2018), Chang et al.(2011), Po & Huang (2008), De Vita & Kyaw (2017), Deng et al.(2014). The estimated threshold of each approach is presented at Table 1.

Nevertheless, the turning point varies, depending on selection of the tourism variable, the definition of tourism sector (domestic vs international), and the type of data (country specific vs cross-country analysis). Moreover, the existing literature doesn't consider the short-run or long-run properties and dynamics of the TLG curve.

Furthermore, an important aspect related to the TLG is the consideration of economies of scale and scope associated to the tourism sector (Andriotis, 2002; Croes, 2006; Weng & Wang, 2004). Understanding the role of globalization is crucial in studying economies of scale and scope, as it enhances international trade and facilitates exports (Dreher, 2006; Wahab & Cooper, 2005). Moreover, Ali et al., (2021) reported connection between cultural globalization and tourism. Additionally, a recent approach in economic literature to examine economies of scale and scope is through the concept of economic complexity (Hausmann, 2012; Hidalgo, 2009) which indicates the level of ubiquity and diversity of an economy's export basket. The effect of economic complexity on economic growth is contingent upon the specific variables incorporated in the model, resulting in either positive (Hausmann et al., 2019) or negative impacts (Canh & Thanh, 2022). A key question arises as to how economic complexity might influence the relationship between tourism and economic growth, considering that tourism could be considered as a less complex sector compared to other economic sectors.

Table 1. Estimated thresholds in the TLG literature.

	Turning Point		Tourism variable composition	
Study	***Tourism Arrivals***	***Tourism receipts***	***Domestic Tourism***	***International tourism***
Zuo - Huang (2018)	303.47%	8.25%, 18.33%	+	+
Adamou - Clerides (2009)	282.35%	20.8%	–	+
Chang et. al (2009)	–	14.97%, 17.50%	+	+
Po - Huang (2008)	–	4.0488%, 4.7337%	–	+
Zhao -Mao (2013)	–	5.5%, 13.5%, 15.3%	–	+
Deng,et.al (2014)	–	1.80%, 2.04%	–	+
De Vita - Kyaw (2016b)	–	10.7%	–	+*

Notes: + available, – not available; * only for countries with high level of financial absorptive capacity

3. Data

As a specific measure for the tourism sector, we construct the Tourism Activity Index. The Tourism Activity Index is formulated through the application of Principal Component Analysis (PCA), whereby a weighted index is derived from five distinct variables that are specifically associated with the advancement of a country's tourism sector. The first variable integrated into the index is the metric of tourism arrivals, which serves as an indicator of the actual level of tourism activity within the sector. The second variable incorporates the extent of investment allocated to the Travel & Tourism (T&T) sector, represented as a percentage of the real Gross Domestic Product (GDP), thus providing an approximation of the potential for growth and development within the tourism sector.

The third variable encompasses the total tourism contribution, expressed as a percentage of the real GDP, and takes into account the influence that tourism exerts on the overall economic framework. The fourth variable represents the direct contribution of the T&T sector to employment, measured as a percentage of the total employment figure, and serves to assess the impact of the tourism industry on income generation. Lastly, the fifth variable gauges the extent of government expenditure allocated to the T&T sector, presented as a percentage of the real GDP, thus acting as a policy indicator that facilitates the fostering of tourism development.

The data source for Tourism arrivals is derived from the World Bank database (World Bank, 2021), while the remaining variables utilized in the analysis are obtained from the World Travel & Tourism Council(WTTC, 2021). The PCA results for the Tourism Activity Index can be found in Table 2, providing an overview of the weighted variables and their contributions to the overall index.

Table 2. Principal Components Analysis; Tourism Activity Index.

Principal component analysis for tourism index					
Panel A: Eigenvalues of the observed matrix					
Eigenvalues: (Sum = 5, Average = 3)					
Number	*Value*	*Difference*	*Proportion*	*Cumulative value*	*Cumulative proportion*
1	1.67330	0.217224	0.3347	1.6733	0.3347
2	1.45607	0.457608	0.2912	3.12937	0.6259
3	1.00847	0.483039	0.1997	4.137835	0.8256
4	0.51543	0.158689	0.1031	4.653261	0.9287
5	0.35674	-	0.0713	5.000000	1
Panel B: Eigenvectors (loadings)					
Variable	*PC1*	*PC2*	*PC3*	*PC4*	*PC5*
cip	0.6549	0.2307	-0.0041	0.3558	-0.6255
govp	-0.3399	0.6111	-0.1366	0.6577	0.2445
tc2ep	-0.048	0.0926	0.9905	0.0853	0.026
tc2gp	-0.1541	0.7054	-0.0115	-0.6391	-0.2646
arr	0.6554	0.2591	0.0031	-0.1584	0.6916
Panel C: Observed correlation					
	cip	*govp*	*tc2ep*	*tc2gp*	*arr*
cip	1				
govp	-0.1006	1			
tc2ep	-0.0157	0.0057	1		
tc2gp	0.01	0.4772	0.0656	1	
arr	0.6218	-0.1361	-0.0152	0.084	1

Note: ***cip*** indicates Capital investment in T& T as % of total exports**,** ***govp*** indicates Government spending in T& T services as % of GDP, ***tc2ep*** T& T total contribution to employment as % share of total employment, ***tc2gp*** indicates T& T total contribution to GDP,% of GDP**,*arr*** indicates number of tourists' arrival

Table 2, Panel A presents the eigenvalues of the five factors extracted from the data. The highest eigenvalue is 1.673 for the first factor, followed by 1.456 for the second factor, 1.008 for the third factor, 0.515 for the fourth factor, and the lowest eigenvalue of 0.356 for the fifth factor. The first and second eigenvectors account for similar proportions of variation, specifically 33.47% and 29.12% respectively. The third and fourth factors explain 19.97% and 10.31% of the total variation respectively, while the remaining factor contributes 7.13% of the overall variation. In Panel B, Table 2 displays the loadings of the eigenvectors, representing the weights assigned to each principal component factor (PC1, PC2, PC3, PC4, and PC5). Lastly, Panel C of Table 2 presents the observed correlations among the tourism-related variables. The majority of variable pairs exhibit positive correlations, indicating a tendency for these variables to move together towards the same direction. However, there are a few exceptions, such as the negative correlations between government spending and investment, investment and tourism contribution to employment, and tourism arrivals and government spending on tourism.

The selection of eigenvectors in our analysis follows the Kaiser (1960) criterion, where we choose eigenvectors associated with eigenvalues greater than one. These selected eigenvectors are utilized to generate the Tourism Activity Index by calculating the weighted sum of the factor loadings, with the relative proportional variation serving as the weighting factor. Subsequently, we rescale the index to a range of 1-100 and transform into natural logarithm. This index captures the variability of the component variables that describe the dynamics of the tourism sector. The Tourism Activity Index serves as an indicator of tourism specialization, with higher values indicating a greater degree of specialization of an economy in tourism. Additionally, we compute the squared logarithm of the tourism index, following the approach of Adamou & Cleridis (2009), in order to generate a Kuznets-type variable.

In our study, we utilize the Real Gross Domestic Product per Capita as a long-term indicator of economic growth measured in constant 2010 prices denominated in United States dollars. The data for Real GDP per Capita are sourced from the World Bank World Development Indicators (World Bank, 2021). Furthermore, we incorporate the Economic Complexity Index (ECI; Hausmann 2014) ,which is obtained from The Growth Lab at Harvard University, (2020) database. The ECI is rescaled to a 1-100 scale and converted into natural logarithm. Additionally, we include the cultural Globalization Index (KOF) *de facto* (Dreher, 2006) to capture the cultural dimension of globalization strongly connected to tourism(Ali et al., 2021). The data for the Globalization Index are obtained from the ETH Zurich KOF institute (Gygli et al., 2019).Table 3 provides an overview of the variables used in the dataset. The variable "*gdppc*" represents the logarithm of GDP per capita, "*tour*" represents the logarithm of the Tourism Activity Index, "*toursq*" represents the square of the logarithm of the Tourism Activity Index, "*eci*" represents the logarithm of the Economic Complexity Index, and "*kof*" represents the logarithm of the cultural Globalization de facto Index.

Table 3. Analysis variables.

Symbol	**Variables**	**Type**	**Unit of measurement**	**source**
gdppc	logarithm of Gross Domestic Product per capita	DV	log euros	WDI
tour	logarithm of Tourism Activity Index	IV	index	WDI& WTTC
toursq	squared logarithm of Tourism Activity Index	IV	index	WDI& WTTC
kof	logarithm of Cultural Globalization Index,*de facto*	IV	index	KOF Zurich
eci	logarithm of Economic Complexity Index	IV	index	Harvard Atlas

The dataset employed in this analysis pertains to a panel data set consisting of 127 countries observed over the period of 1995-2020. The panel sample comprises a total of 3,302 observations. Descriptive statistics for the variables utilized in the analysis are presented in Table 4.

Table 4. Descriptive statistics of the variables.

Variable	**Mean**	**Median**	**Std. Dev**	**Min**	**Max**	**Obs**
gdppc	*8.623*	*8.579*	*1.454*	*5.212*	*11.431*	*3,302*
tour	*2.041*	*1.969*	*0.685*	*0.001*	*4.605*	*3,302*
toursq	*4.636*	*3.878*	*3.196*	*0.000*	*21.208*	*3,302*
eci	*3.865*	*3.891*	*0.376*	*0.000*	*4.605*	*3,302*
kof	*3.697*	*3.891*	*0.750*	*0.661*	*4.578*	*3,302*

4. Methodology

This study aims to investigate the relationship between tourism-led growth by constructing the Tourism Activity Index and incorporating globalization and economic complexity. A significant portion of the existing literature on tourism-led growth (TLG) explores the possibility of a non-linear relationship, often characterized by an N-shaped pattern, by incorporating square and cubic terms of the tourism proxy variable. However, it is important to note that cubic equations have the potential to yield infinite values (either positive or negative), which can pose challenges in terms of interpretation and estimation. As a result, our approach in this study concentrates on examining the quadratic relationship between tourism variables and economic growth. Additionally, it should be noted that the time span of the available data is limited (26 years), which restricts our ability to accurately estimate and analyze the dynamics of an N-shaped relationship over time.

The general form of our model can be specified as follows:

$$gdppc_{it} = f(tour_{it}, toursq_{it}, eci_{it}, kof_{it})$$

The econometric model describing the long-run relationship is the following:

$$gdppc_{it} = a_0 + a_1 tour_{it} + a_2 toursq_{it} + a_3 eci_{it} + a_4 kof_{it} + \varepsilon_{it}$$

where a_1 , a_3 and a_4 are the long - run elasticities of tourism, economic complexity and cultural globalization respectively, a_0 is a constant term and ε_{it} is the error term. The a_2 term represents the *"Kuznets – type* parameter as in (Adamou & Clerides, 2009) which captures the effect of an additional increase of tourism specialization on income. Given the respective literature findings we assume that in the long-run the TLG follows an inverted U - shaped relationship, with the turning point/threshold to be calculated by the ratio

$$\frac{\partial gdppc_{it}}{\partial tour_{it}} = 0 \xrightarrow{yields} T = -\frac{a_1}{2a_2}.$$

According to the empirical literature (Ali et al., 2021; Dreher, 2006; Hausmann & Hidalgo, 2014; Zuo & Huang, 2018) we expect the signs of the parameters as in Table 5.

Table 5. Expected signs of the variables of the long-run equation.

Variable	Parameter	Sign of parameter
constant	a_0	+or -
tour	a_1	+
toursq	a_2	-
eci	a_3	+or -
kof	a_4	+

To conduct our analysis, we follow a four-stage procedure. In the first stage, we test for cross-sectional dependence, as its presence could lead to biased estimates (Pesaran, 2004, 2021). We employ various cross-sectional dependence tests, including the Pesaran CD test (2004), the Breusch-Pagan LM test (1980), the Pesaran Scaled LM test (2014) and the Bias-Corrected Scale LM test (Baltagi et al., 2012) to ensure robust estimation. Given the presence of cross-sectional dependence, we proceed to test the stationarity of the variables. For this purpose, we use the CIPS unit root test (Pesaran, 2007) and the PANIC test (Bai & Ng, 2004), considering two alternative factor selection methodologies: the Bai-Ng approach (2002) and the Ahn-Horenstein eigenvalue approach (2013) .

The second stage includes tests for the existence of cointegration between the variables using both conventional as well as second generation panel cointegration techniques. We employ the Pedroni test (2004), the Westerlund test (2005) and the Westerlund bootstrap test (2007) which incorporates the impact of cross-sectional dependence and yields robust critical values.

At the third stage we perform slope heterogeneity tests implementing the Pesaran Yamagata (2008) test and the Blomquist & Westerlund tests controlling for autocorrelation, heteroscedasticity and cross-sectional dependence (Bersvendsen & Ditzen, 2021; Blomquist & Westerlund, 2013, 2016). At the fourth stage, and after establishing cointegrating relationship amongst our variables under cross-sectional dependence and heterogeneity, we estimate the model by using the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL; Chudik et al., 2016; Ditzen, 2018) estimation technique to obtain the long-run as well as the short-run estimates. Moreover, in order to confirm the causal relationship between all possible variable pairs, we also have incorporated the Dumitrescu-Hurlin pair-wise (2012) panel causality test. This test strengthens the validity of the long-run estimates since it accounts for heterogeneity and cross-sectional dependence in panel data series (Langnel et al., 2021).

5. Results

5.1. Cross-sectional dependence test results

It can be hypothesized that all countries in the globe are part of a universal network that assumes economic and social connections related to trade and finance, and therefore, economic channels exist that facilitate the spread of exogenous shocks. In statistical terms, this fact could be observed by the form of cs dependence, a property that leads to biased estimates if not being considered. All the alternative tests, regardless of their different approach assume in the null hypothesis (H_0) of no CS dependence with the alternative (H_1) of CS dependence. The test-results are depicted in Table 6.

Table 6. Cross-Sectional Dependence tests results.

GDP per Capita			**Cultural Globalization Index *de facto* (KOF)**		
Test	*Statistic*	*Prob.*	*Test*	*Statistic*	*Prob.*
Breusch-Pagan LM	134,879.30	0	Breusch-Pagan LM	80,868.29	0
Pesaran scaled LM	1,003.00	0	Pesaran scaled LM	576.03	0
Bias-corrected scaled LM	1,000.46	0	Bias-corrected scaled LM	573.49	0
Pesaran CD	288.83	0	Pesaran CD	210.58	0
Tourism Index			**Economic complexity (eci)**		
Test	*Statistic*	*Prob.*	*Test*	*Statistic*	*Prob.*
Breusch-Pagan LM	56,258.52	0	Breusch-Pagan LM	48,973.62	0
Pesaran scaled LM	381.49	0	Pesaran scaled LM	323.90	0
Bias-corrected scaled LM	378.95	0	Bias-corrected scaled LM	321.36	0
Pesaran CD	114.25	0	Pesaran CD	-1.59	0.11
Tourism Index Squared					
Test	*Statistic*	*Prob.*			
Breusch-Pagan LM	56,258.03	0			
Pesaran scaled LM	381.48	0			
Bias-corrected scaled LM	378.94	0			
Pesaran CD	113.33	0			

Note: Null hypothesis: No cross-section dependence.

All tests for all variables signify the existence of cross-sectional dependence because the majority of the tests reject the null hypothesis.

5.2. Unit root test results

Given the presence of CS dependence, the augmented CS - IPS (CIPS) tests (Pesaran, 2007) as well as the PANIC (Bai & Ng, 2004) tests are performed controlling for series' heterogeneity and CS dependence to get more robust results not captured by 1st generation unit root tests (Phillips & Hansen, 1990). Both tests are performed allowing for a constant, a constant plus a linear trend, in levels and in first differences. The PANIC test assumes at the null hypothesis unit root non-existence, while the CIPS test assumes in the null hypothesis the existence of a unit root. The results of the teste are presented in Table 7.

Both tests indicate that all variables are non-stationary under the existence of CS dependence.

Table 7. Cross-sectional dependence tests results.

PANIC Pooled statistic P-value[1]	**Levels**			
Type of Factor Selection Method	**Bai-Ng**		**Ahn-Horenstein**	
Variable	**constant**	**constant &trend**	**constant**	**constant &trend**
gdppc	0	0	0	0.06
tour	0	0	0	0
toursq	0	0	0	0
kof	0	0	0	0
eci	0	0	0	0
Variable	**Levels**		**First Differences**	
CIPS Test Statistic[2]				
	constant	**constant &trend**	**constant**	**constant &trend**
gdppc	-1.88	-2.08	-2.52***	-2.75***
tour	-1.89	-2.33	-4.70***	-4.78***
toursq	-1.9	-1.52	-2.30***	-2.61***
kof	-1.75	-1.92	-5.27***	-5.39***
eci	-1.76	-2.28	-3.66***	-3.76***

Notes: 1. P-values from Pooled Factors ADF Test, Null Hypothesis no joint Unit root, 2. Null hypothesis unit root * significant at 10%, **significant at 5%, *** significant at 1%.

5.3. Cointegration & causality results

The results in sections 5.1 and 5.2 imply that the variables are non-stationary under the presence of cross-sectional dependence. In order to test for cointegration among the variables, we use the Pedroni test (2004) as well as the Westerlund (2005, 2007) approaches. All tests under the null hypothesis assume no-cointegration. The results are presented in Table 8.

Table 8. Cointegration test results.

Pedroni test for cointegration		
Test	Statistic	P-value
AR parameter: Panel specific		
Modified Phillips-Perron t	**9.624**	0.00
Phillips-Perron t	**4.0139**	0.00
Augmented Dickey-Fuller t	**5.8218**	0.00
AR parameter: Same		
Modified variance ratio	**-11.739**	0.00
Modified Phillips-Perron t	**7.95**	0.00
Phillips-Perron t	**6.7764**	0.00
Augmented Dickey-Fuller t	**8.316**	0.00

Westerlund (2007) Bootstrap test for cointegration			
Statistic	Value	Z-value	Robust p-value
Gt	-2.632	-2.204	0.00
Ga	-0.881	17.761	0.00
Pt	-5.127	17.617	0.00
Pa	-0.348	13.314	0.02
Westerlund (2005) test for cointegration			
Alternative Hypothesis	Variance ratio	Statistic	Robust p-value
Some panels not cointegrated		8.3	0.00
All panels cointegated		3.70	0.00

Note: Null Hypothesis: No cointegration, model with constant & 2 lags, 1,500 simulations

All tests point towards to the existence of a cointegrating relationship among the analysis variables at level at least 5 % of significance. This finding enables to consider a robust long-run relationship. In addition, we use the Dumitrescu-Hurlin test (Dumitrescu, 2012) to test the causal relationship for all possible pairs of the variables under the long-run equation, in the presence of cross-sectional dependence. The results of the test are presented in Table 9.

Table 9. Dumitrescu-Hurlin test results.

Null Hypothesis:	**W-Stat.**	**Zbar-Stat.**	**Prob.**
tour does not homogeneously cause *gdppc*	4.51	3.67	0.00
gdppc does not homogeneously cause *tour*	6.55	10.57	0.00
toursq does not homogeneously cause *gdppc*	4.53	3.71	0.00
gdppc does not homogeneously cause *toursq*	6.67	10.95	0.00
eci does not homogeneously cause *gdppc*	4.85	4.81	0.00
gdppc does not homogeneously cause *eci*	6.06	8.89	0.00
kof does not homogeneously cause *gdppc*	4.09	2.25	0.02
gdppc does not homogeneously cause *kof*	5.04	5.46	0.00
tour does not homogeneously cause *kof*	4.77	4.55	0.00
kof does not homogeneously cause *tour*	4.08	2.20	0.03
toursq does not homogeneously *cause kof*	4.69	4.25	0.00
kof does not homogeneously cause *toursq*	4.10	2.26	0.02
toursq does not homogeneously *cause tour*	5.51	7.05	0.00
tour does not homogeneously cause *toursq*	5.49	6.96	0.00
eci does not homogeneously cause *kof*	5.24	6.12	0.00
kof does not homogeneously cause *eci*	4.44	3.43	0.00
eci does not homogeneously cause *tour*	3.65	0.75	0.45
tour does not homogeneously cause *eci*	4.02	1.99	0.05
eci does not homogeneously cause *tour*	3.73	1.01	0.31
tour does not homogeneously cause *eci*	4.05	2.09	0.04

All tests reveal that there is a bi-directional causality relationship at least at 5% level of significance between all possible variable pairs except for the uni-directional causality caused by the tourism activity index and its square counterpart to the economic complexity index.

5.4. Slope homogeneity tests

We perform the standard Pesaran & Yamagata (2008) slope homogeneity test and the same test controlling for autocorrelation as well as the Blomquist Westerlund (2013,2016) test. Both methodologies are applied controlling for CS dependence in advance (Bersvendsen & Ditzen, 2021). The results of the tests are presented in Table 10.

The results reveal that there is evident heterogeneity under all alternative test specifications.

Table 10. Slope homogeneity test results.

Slope heterogeneity tests							
Methodology		**Pesaran -Yamagata**				**Blomqvist-Westerlund**	
type of test		**baseline test**		**Autocorr. Correction**		**hac Correction**	
cs-dependence		Delta	p-value	Delta	p-value	Delta	p-value
without cs	stat.	51.37	0	54.06	0	41.20	0
without cs	adj.stat	58.57	0	61.30	0	46.98	0
with cs	stat.	3.64	0	42.79	0	17.40	0
with cs	adj.stat	6.30	0	49.09	0	30.13	0

note: homogeneity under the null hypothesis

5.5. CS-ARDL estimation results

Given the existence of cross-sectional dependence, non-stationarity, cointegration, bi-directional causality and heterogeneity we estimate the model accounting of these features by applying the cross-sectional autoregressive distributed lag (CS-ARDL) estimation technique. The general form of the equation is the following

$$gdppc_{i,t} = \sum_{l=1}^{p_y} \lambda_{l,i} gdppc_{i,t-l} + \sum_{l=0}^{p_x} \beta_{l,i} x_{i,t-l} + \sum_{l=0}^{p_T} \gamma'_{i,l} \bar{\mathbf{z}}_{t-l} + \sum_{l=0}^{p_{\Delta x}} \delta_{l,i} \Delta(x)_{i,t-l} + e_{i,t}$$

$$\hat{\theta}_{CS-ARDL,i} = \frac{\sum_{l=0}^{p_x} \beta_{l,i}}{1 - \sum_{l=1}^{p_y} \lambda_{l,i}}, x_{i,t-l} = [tour_{i,t-l}, toursq_{i,t-l}, eci_{i,t-l}, kof_{i,t-l}]$$

$$\bar{\mathbf{z}}_{t-l} = [\overline{tour}_{i,t-l}, \overline{toursq}_{i,t-l}, \overline{eci}_{i,t-l}, \overline{kof}_{i,t-l}]$$

Where $\lambda_{l,i}$, are the autoregressive parameters up to lag order p_y, $\beta_{l,i}$ are the long-run estimated parameters of the vector of the independent variables $x_{i,t-l}$ up to lag order p_x $\delta_{l,i}$ are the short-run estimated parameters of the vector of the independent variables $\Delta(x)_{i,t-l}$ up to lag order $p_{\Delta x}$, $\gamma'_{i,l}$ are the nuisance parameters estimated of the vector of the mean group variables $\bar{z}_{t-l}$.

In this model we investigate both the short run and the long run dynamics of the TLG relationship. Furthermore, we estimate the corresponding threshold value for both the short-run as well as the long-run horizon. The estimated parameters are presented in Table 11.

Table 11. CS-ARDL model parameter estimates.

CS-ARDL Estimation					
Depended Variable gdppc					
Equation	Long run			Short run	
Variable	coefficient	p-value	Variable	coefficient	p-value
			constant	0.842	0.62
$tour_{i,t-1}$	4.756***	0.01	$\Delta(tour_{i,t})$	0.542*	0.07
$toursq_{i,t-1}$	-1.315**	0.02	$\Delta(toursq_{i,t})$	-0.128*	0.07
$kof_{i,t-1}$	0.098***	0.00	$\Delta(kof_{i,t})$	0.136***	0.01
$eci_{i,t-1}$	-0.480*	0.09	$\Delta(eci_{i,t})$	-0.034	0.19
$ECT_{i,t-1}$	-0.497***	0.00	$gdppc_{i,t}$	0.503***	0.00
Threshold	Long-run	181%	Threshold	Long-run	212%

Note: *indicates 10% significance, ** indicates 5% significance ***indicates 1% significance (CS ARDL (1,1,1) with 2 lags of mean group variables.

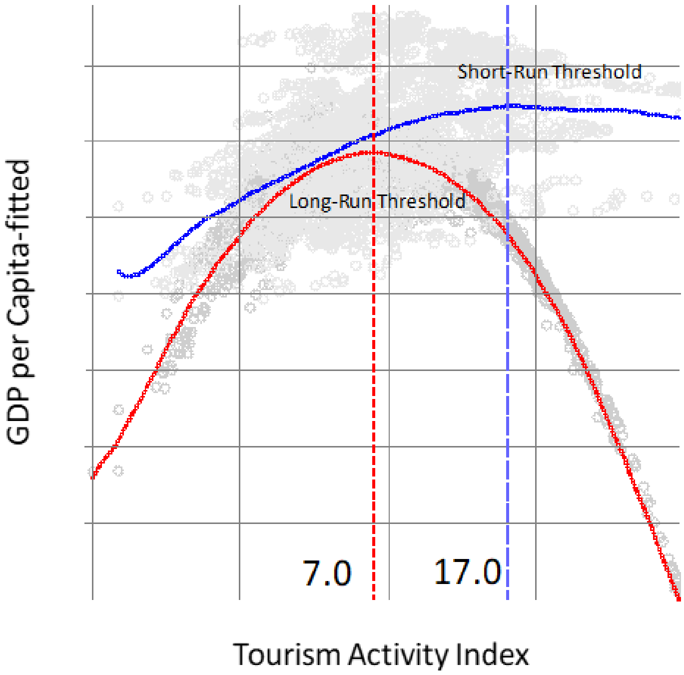
The estimates indicate a valid TLG relationship both in the short as well as the long-run horizon. All parameters are statistically significant at least at 10% level apart from the short-run economic complexity parameter. The speed of adjustment parameter is estimated with value -0.497. The short-run tourism parameter is estimated with value 0.542 and the squared tourism parameter displays negative value 0.145. The globalization parameter displays value of 0.136 and the economic complexity with negative value 0.034. In the long-run the tourism parameter provides value of 4.756 and the respective parameter for the squared tourism variable exhibits negative value as of 1.315. The globalization index parameter is positive with value 0.098 and the economic complexity negative value of 0.480.

We conclude that the TLG relationship is nonlinear both in the short and the long run. The respective parameters in the long run relationship are considerably higher in comparison to the short-run parameters. Cultural globalization contributes positively to the TLG relationship suggesting that for higher levels of globalization the impact of tourism on economic growth is higher. Furthermore, the negative sign of economic complexity parameter implies that the transformation the export basket of an economy to a more complex structure reduces the impact of tourism on economic growth.

To examine the long run and the short run behavior of the TLG relationship and their dynamics we constructed a joint scatter plot of the fitted values of GDP per capita for the short and the long run model to the corresponding tourism index values. The light grey dots represent the data points.

We fit the data using a kernel fit that produces the short-run (blue curve) and the long-run (red curve) TLG curves. We observe that both curves display inverted u-shaped pattern. The short¬-run curve displays less curvature compared to the respective long-run TLG. Furthermore, we observe that both graphs are non-symmetric; the short-run line displays steep slopes at the left counterpart of the graph, while the long-run curve displays steep slopes at its right counterpart. The maximum - threshold of both curves is calculated, where 212% corresponds to tourism index value of 17 for the short-run curve and 181% corresponds to tourism index value 7. These threshold values are lower than the respective tourism arrivals suggested thresholds (Adamou & Clerides, 2009; Zuo & Huang, 2018) and higher than the suggested tourism receipt thresholds (C. Chang, 2014; Deng, Ma, & Shao, 2014; Po & Huang, 2008) Furthermore, our findings imply that GDP per capita responds differently at tourism specialization levels before and after the threshold value. Furthermore, we observe that the short-run maximum corresponds to higher tourism specialization value than to the long-run. When an economy increases its tourism specialization levels in the short-run reaching the maximum, in the long-run displays diminishing returns to scale. Although in the short run tourism benefits an economy at the optimal short-run level, in the long-run the positive impact is reduced because the long-run optimal level is lower than the short-run optimal level.

Figure 1. GDP-tourism scatterplot.



6. Conclusions-policy implications.

This study investigates the relationship between tourism, economic complexity, globalization, and economic growth by integrating the law of economic returns and the Tourism Area Life Cycle (TALC) theory. To approximate the tourism variable, principal components analysis is employed, combining five tourism-specific variables. The empirical results demonstrate that both in the short run and the long run, the tourism-led growth (TLG) relationship follows an inverted U-shaped curve, indicating that tourism specialization initially fosters increasing returns, reaches a maximum, and then gradually declines. These findings provide empirical support for the TALC theory.

Using a comprehensive panel dataset comprising 127 countries, a series of rigorous tests is conducted to establish a robust long-run equation capturing the dynamics between GDP per capita, tourism specialization, squared tourism specialization, cultural globalization index, and economic complexity index. Moreover, causality analysis reveals bi-directional causality between most variable pairs, suggesting feedback effects within the economic growth process, except for the economic complexity and tourism variable pair. To address cross-sectional dependence bias and heterogeneity, the long-run TLG equation is estimated using the CS-ARDL estimation method.

The results suggest the inverse U-shaped curve describing the relationship in both the short run and the long run, thereby validating the TALC and the law of returns theories. The estimated elasticities, which represent the actual effect of tourism specialization on economic growth, are higher in the long run compared to the short run. Additionally, a certain threshold for tourism specialization is identified, namely 181% in the short run and 212% in the long run, beyond which the impact on economic growth turns negative. The tourism specialization levels associated with these thresholds are higher in the short run compared to the long run where we observe lower tourism specialization levels. Cultural globalization positively contributes to the TLG relationship in both the short and the long run, as an increase in the globalization index amplifies the effect of tourism on economic growth. On the other hand, economic complexity exhibits a negative influence on the TLG relationship, as an increase in the complexity of an economy's export basket reduces the impact of tourism on economic growth.

The findings of this study hold valuable implications for policymakers. Firstly, the Tourism Activity Index can serve as a useful policy tool for measuring and determining the level of tourism specialization in an economy. Policymakers can strategically allocate resources by implementing policies that influence tourism specialization through its various components, such as tourism arrivals, the contribution of tourism to GDP, the contribution of tourism to employment, government spending on travel and tourism, and investment in the travel and tourism sector. For example, policymakers can allocate a certain percentage of government spending to support the tourism industry, provide subsidies to incentivize investment in travel and tourism, and implement measures to promote employment in the sector. Furthermore, policies targeting cultural globalization or economic complexity can also be leveraged as effective tools to assess the impact of tourism on economic growth.

The current level of tourism specialization in an economy can indicate its position within the tourism activity life cycle and its potential contribution to economic growth, considering both the short-run and long-run effects. In fact, tourism specialization below the identified threshold values can incentivize resource allocation towards the development of the tourism sector, thereby fostering economic development. However, policymakers should take into account both the short-run and long-run effects of tourism on economic growth. In the short run, the threshold indicating optimal tourism contribution to GDP corresponds to higher levels of tourism specialization compared to the long run, suggesting diminishing returns to scale. By determining the appropriate tourism specialization level, policymakers can influence both the short-run and long-run effects of tourism on an economy's economic growth, aligning with the objectives of their economic policies.

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