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Industry level analysis of tourism-economic growth in the United States

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A B S T R A C T

We investigate the relationship between economic growth and six tourism-related sub-industries (accommodation, air transportation, shopping, food and beverage, other transportation, and recreation and entertainment) in the United States in 1998–2017. Except for the lodging and the food and beverage sectors, no long-run relationship exists between other tourism sub-industries and economic growth. We uncover a unidirectional Granger causality from economic growth to each of the sub-industries. Causality is also found between the tourism industries but predominantly from industries providing local offerings (food, entertainment, shopping) to those delivering cross-destination goods and services. Our results suggest that tourism investment could be successful in the long-run even during periods of economic stagnation. In the short-run, however, tourism sectors could benefit from economic growth and tourism-related investment should take a cue from the general economy. Additionally, tourism-related investment and marketing efforts in the U.S. may wish to focus on the food, shopping, and leisure sectors.

1. Introduction

The United States is an important player in the global tourism industry, attracting millions of international visitors per year. Tourists are drawn to the U.S. for historic sites, national parks and monuments, amusement and theme parks, other recreational and entertainment attractions, as well as culinary, business, health and shopping options. One feature that makes the U.S. a preferred destination for many international tourists is the quality of its tourism goods and services. In 2015, the World Economic Forum constructed the Tourism and Travel Competitiveness Index, a comprehensive index that measures the quality of tourism supply in each destination country. The U.S. performed strongly in the infrastructure and natural and cultural resources components of the index, particularly with air transportation and tourist service infrastructure, world heritage sites, as well as cultural, entertainment, and sports attractions (World Economic Forum, 2015). Of the 114 countries considered in the index, the U.S. is ranked first in the Americas and fourth globally after Spain, France, and Germany.

Tourism is currently the most significant service sector within the U.S. economy. In 2017, international and domestic tourists together spent over $1035.7 billion direct travel expenses in the U.S., resulting in $165 billion total tax revenues and an additional $2.4 trillion indirect and induced expenses (US Travel Association, 2018b). In total, the tourism sector created approximately $84 billion surpluses in 2016 (US Travel Association, 2017), making it the few industries producing positive trade balance for the U.S. economy. The tourism industry is also among the largest employers within the U.S., generating nearly 7 million indirect and induced jobs in addition to the 8.8 million people directly employed by the industry (US Travel Association, 2018b).

Many studies have investigated the relationship between tourism and economic growth, often finding inconsistent and sometimes even conflicting results. One strand of literature argues for tourism-led economic growth hypothesis and that the government should engage in tourism development to foster the economic development, while other studies report evidence that the causality runs either from economic growth to tourism or bi-directionally between the two variables. The reasons behind these inconsistencies are multifaceted, with researchers often pointing to the differences in the country considered, the sample period examined, and the empirical methods employed in the analyses.

Mill and Morrison (2002) and Tang and Jang (2009) argue that the treatment of all tourism-related businesses as a homogenous industry might also account for the inconsistent results found in previous studies. When measuring the performance of the tourism industry, most of the existing studies have used either the overall receipt or the number of patrons to the industry without differentiating between various categories of activities within the sector. Unlike other industries that offer goods with similar characteristics and quality, the tourism industry consists of many sub-industries each providing customers with distinct services such as lodging, dining, transportation, entertainment, etc. These sub-industries may perform differently even under the same

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economic environment due to the nature of their businesses and likewise may have different relationships with the overall economic growth.

Chen (2007) is the first to empirically examine the tourism-economic growth nexus at the sub-industry level by investigating the relationship between the stock prices of tourism firms (hotels, airlines, and travel agents) and economic development in Taiwan and China. They find that the interactions between the stock performance and GDP vary substantially across firms, suggesting the possible existence of differential causal patterns between GDP and individual tourism sub-industries. Tang and Jang (2009) extend the study of Chen (2007) by examining the relationship between aggregate sales revenue from four tourism-related industries (airline, casino, hotel, and restaurant) and the economic growth in the U.S. Although the relationship between tourism and GDP is consistent among the four sub-industries in the short-run, they found that the results differ in the long-run—while the airline industry co-moves with GDP, none of the other three industries have a long-run relationship with the economic growth.

This study seeks to revisit the inquiry of Tang and Jang's (2009) sub-industry level analysis by investigating the relationship between economic growth and the real outputs of six major tourism-related industries in the U.S., including food and beverage, recreation and entertainment, air transportation, shopping, accommodations, and other transportation-related commodities. We test the long-run relationship between real GDP and the performances of the six sub-industries using the bounds test of Pesaran, Shin, and Smith (2001), and the causality between each pair of variables using the Toda and Yamamoto (1995) Granger causality test from 1998 to 2017. These two methods are also used to explore the long- and short-run relationships among the six tourism-related sub-industries.

We find that GDP co-moves with the lodging and the food and beverage industries in the long-run, but does not cointegrate with the other four sub-industries. Within the tourism sector, we find that except between other transportation and the air transportation industries, no long-run relationship exists between the remaining pairs of industries. For the short-run, we uncover a unidirectional causality from GDP to each of the six tourism industries. We also observe a meshwork of unidirectional causal interrelationships between the tourism-related sub-industries. Taken together, the performances of the food and beverages, recreation and entertainment, and shopping industries precede those of the accommodation, air, and other transportation industries.

Our paper complements previous sub-industry level analyses of the tourism-economic growth nexus, an area that remains under-investigated. While our results overall agree with the economic-driven tourism growth hypothesis found in previous studies for the U.S., we find that industries providing local offerings (e.g., food and beverage, recreation and entertainment, and shopping) are the leading sub-industries within the tourism sector, perhaps because tourists expenditures on these industries are more sensitive to changes in income and the underlying economic activities than those of industries providing cross-destination offerings. Marketing efforts to promote tourism growth may wish to take a cue from, and perhaps even focus on these sub-industries since their performances anticipate the outputs of other sub-industries. Additionally, we find that the performance of the airline industry tends to lag other sectors, perhaps because of the longer planning horizons of trips involving air transportation than trips to nearby destinations that do not require air travel. Investment decisions in the airline sector should, therefore, consider the performance of other sub-industries in addition to the general economy.

The remainder of the paper is structured as follows. Section two provides a brief review of the tourism-economic growth literature. Sections three and four describe the data and empirical methods used for the analysis, respectively. Results are presented in section five, and the last section concludes the paper.

2. A brief review of the literature

An extensive literature has investigated the relationship between tourism and economic growth for various countries, often finding the relationship to vary depending on the specific country examined, the time periods considered, and the methods employed. One strand of literature argues for tourism-led economic growth (TLEG) hypothesis that views tourism as a strategic factor for long-term domestic economic growth, generating direct, indirect, or induced effects on other productive sectors (Tugcu, 2014). The TLEG hypothesis has found a wide support in empirical studies, including Balaguer and Cantavella-Jorda (2002) who reported a unidirectional causality from tourism to economic growth in Spain, Brida, Lanzilotta, Lionetti, and Risso (2010) who found a positive effect of tourism expenditure on GDP per capita in Uruguay, and Dritsakis (2012) that confirmed the beneficial impact of tourism on GDP in seven Mediterranean countries. Similar results are found in Lanza, Temple, and Urga (2003) for 13 OECD (Organization for Economic Co-operation and Development) countries, Durbarry (2004) for Mauritius, Gunduz and Hatemi-J (2005) for Turkey, Proença and Soukiazis (2008) for several southern European countries, Brida and Risso (2010) for South Africa, Belloumi (2010) for Tunisia, and Katircioğlu (2010) for Singapore, among others. In fact, of the 87 empirical studies reviewed, Pablo-Romero and Molina (2013) reported that 55 studies found evidence in support of the TLEG hypothesis.

Contrary to the TLEG hypothesis, the second stream of literature asserts that economic fluctuations are the driving force behind the tourism sector, which is often referred to as the economic-driven tourism growth (EDTG) hypothesis. The reasoning underpinning the EDTG assertion is that resource availability, infrastructure development, and political stability create an ambient economic climate that promotes tourism activities. For instance, using the Engle and Granger two-stage approach and bivariate vector autoregressive model, Oh (2005) found that while no cointegration (i.e., long-run equilibrium) exists between tourism and economic growth, economic growth Granger-causes tourism in South Korea but not vice versa in the short-run. Empirical analyses by Lee and Chien (2008), Payne and Mervar (2010), and Odhiambo (2011) provide further evidence in support of the EDTG hypothesis in various other countries.

A third hypothesis, termed the feedback or reciprocal hypothesis, argues that there exists a bi-directional feedback relationship between tourism and economic growth. For instance, Dritsakis (2004) found that tourism, economic growth, and real exchange rates are cointegrated and that a bi-directional causal relationship exists between tourism and economic growth in Greece in 1960–2000. The reciprocal relationship between tourism and economic growth was also obtained for Taiwan by Kim, Chen, and Jang (2006) and Lee and Chien (2008), for Malaysia by Tang (2011), and for Spain by Perles-Ribes, Ramón-Rodríguez, Rubia, and Moreno-Izquierdo (2017). On the contrary, some researchers have found evidence in support of a fourth hypothesis that no causality exists between tourism and economic growth (e.g., Katircioglu, 2009).

In the present study, we seek to revisit the tourism-economic growth nexus in the U.S., using sub-industry level data that disaggregate the tourism sector into several related industries. Despite the substantial number of papers on the tourism-economic growth relationship, most of the existing work focuses only on the overall performance of the tourism sector (as measured by the overall receipts or total visits), without accounting for the heterogeneous nature of different sub-industries. The two sub-industry level analyses, i.e., Chen (2007) and Tang and Jang (2009), suggest the possible presence of a non-uniform relationship between economic growth and tourism sub-industries. Here, we expand the four categories used in Tang and Jang (2009) to six sub-industries, the performances of which are more clearly defined and accurately measured. Methodologically, we employ the improved cointegration and causality tests that avoid certain drawbacks of the conventional methods. The data and methods used in the analysis allow us to more accurately gauge, as well as providing an updated assessment of, the linkage between economic growth and the performance of tourism-related sub-industries in the U.S.

3. Data

To measure the performance of tourism-related sub-industries, Tang and Jang (2009) calculated the aggregated sales revenues of individual public-traded firms in the same industry according to the North American Industry Classification System. Since firms in the tourism industry often operate businesses in many different countries, the aggregate sales revenue of these multinational companies may fail to reflect the tourism activities in the U.S. Additionally, a significant portion of the firms in the industry are privately owned, the exclusion of which may create large downward bias when measuring the overall performance of each sub-industry using data derived from publically-traded firms. Tang and Jang (2009) also acknowledged that the aggregate sales data may incorporate non-tourism revenues for each sub-industry, further complicating the empirical analysis.

In this paper, we instead use the real tourism output of each sub-industry, comprising of all domestically produced goods and services sold to travelers, as a proxy for their performance. We obtain the quarterly real tourism output estimates from the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce and the National Travel and Tourism Office for the period of Quarter 1,1998-Quarter 3, 2017. According to the BEA, the real tourism output is calculated by adjusting the estimated total direct tourism output for each industry by chain-type price indexes, yielding the seasonally- and inflation-adjusted annual rates for each quarter (Bureau of Economic Analysis, 2017).[1]

Unlike Tang and Jang (2009) who examined the performance of four tourism-related industries—airline, casino, hotel, and restaurants, we expand the scope of the analysis to six major tourism-related sectors—food and beverage (Food), recreation and entertainment (Rec), air transportation (Air), shopping (Shop), travelers' accommodations (Lodging), and other transportation-related commodities (OthTpt), as defined by the BEA's Travel and Tourism Satellite Account. The industries considered in the present paper are more expansive, and the detailed economic activities included in each category are more clearly defined than in Tang and Jang (2009). The accommodation, for example, includes hotels, motels, and all other forms of lodging used by tourists. The recreation and entertainment industry involves activities travelers engaged in during their leisure time, including gambling, amusement parks and arcades, museums, historical site, skating rinks, ski lifts, day camps, sporting goods, etc. The food and beverage sector includes activities occurred in restaurants and other food and beverage spots. Besides air transportation, we also consider all other tourism-related transportation within the U.S., such as rail, water transport, intercity bus, local bus, taxi, car rental, travel arrangement and reservation services, gasoline, etc. For the shopping sector, the BEA defined it as “all personal consumption expenditures for nondurable commodities except gasoline” made by tourists during their trips,[2] including cosmetics, clothing, footwear, and other purchases.[3]

Receipts from tourist spending in the six industries during the sample period are plotted in panel A of Fig. 1. The sector with the highest receipts is other transportation-related commodities, followed by accommodation services and air transportation. The category with the lowest receipts is recreation and entertainment. Tourist expenditures in all six industries suffered a decline in 2001–2003 and 2009–2011, possibly reflecting the macroeconomic and political shocks occurred during these periods. The September 2001 terrorist attack hit the tourism industry particularly hard, with many individuals and groups canceled vacation plans after the attack and changed their subsequent travel decisions. This sharp decline can be seen in Fig. 1 panel A, where the loss in revenues was particularly pronounced in the accommodation and air transportation industries during this period. The financial crisis that started in the second half of 2008 also adversely affected the tourism industry, as the U.S. economy suffered the largest recession in the past half a century and the world economic growth stagnated. During this period, the revenues of all six sub-industries declined.

Panel A of Fig. 1 also illustrates that while the real output from each sub-industry follows a similar trend, they do behave somewhat differently from time to time. For instance, until 1999 the air transportation industry was the third-largest recipient of tourist expenditure after the other transportation and accommodation sectors. However, the air transportation sector's output plummeted to its lowest in 2002, below the outputs of all other industries except recreation and entertainment. It then regained its share in the following few years. Unlike all other industries whose outputs increased in 2013–2014, the expenditures on the food and beverage sector declined during this period. The dissimilarities in how each sub-industry performed during the sample period suggest that they may play diverse roles in the overall economic development, and that economic shocks may affect them differently.

Following the previous literature, we measure the economic growth in the U.S. by its real gross domestic product (GDP), again obtained from the BEA. As can be seen in Fig. 1 panel B, the real GDP has been trending upwards with a few exceptions, most noticeably between the 2008–2009 financial crisis. Comparing the two panels in Fig. 1, while both tourist receipts and GDP increased significantly over the sample period, tourist receipts appear to be more volatile than the GDP.

4. Econometric methods

We employ the autoregressive distributed lag (ARDL) bounds test proposed by Pesaran et al. (2001) to check for the presence of a long-run relationship (i.e., cointegration) between economic growth and the six tourism-related industries, and the Toda-Yamamoto (TY) augmented Granger causality test (Toda & Yamamoto, 1995) to determine the direction of causality between the two variables. Compared to the Engle and Granger error correction method and the Johansen maximum likelihood test commonly used in the literature, the bounds test performs well when the sample is relatively small, and is applicable irrespective of the order of the integration of the variables considered (Pesaran et al., 2001). Equation (1) shows the bounds test for two variables, with each variable in turn as the dependent variable:

$$\Delta Y_{1t} = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{1t-i} + \sum_{j=1}^{q} \theta_j \Delta Y_{2t-j} + \eta_1 Y_{1t-1} + \eta_2 Y_{2t-1} + e_t \quad (1)$$

where Y_1 and Y_2 are the variables under consideration, p and q are lag lengths of Y_1 and Y_2, $\beta_i's$ and θ_{sj} represent the short-run coefficients, and η_1 and η_2 denotes the long-run coefficients. The ARDL model in equation (1) can be used to derive the long-run relationship between Y_1 and Y_2 by rewriting the model in its error-correction form. Additionally, the F-test for the joint significance of the long-run coefficients (i.e., $H_O: \eta_1 = \eta_2 = 0$) can be used to determine whether there exists a long run relationship between Y_1 and Y_2. Pesaran et al. (2001) calculated two sets of critical values of the test statistic: lower and upper values that assume regressors are I(0) and I(1), respectively. The null hypothesis of no cointegration is rejected if the F statistic exceeds the upper critical

[1] For details of the data, see https://www.bea.gov/newsreleases/industry/tourism/tourbackground.htm.

[2] See https://www.bea.gov/scb/pdf/2015/06%20June/0615_travel_and_tourism_satellite_account.pdf.

[3] Though we divide the tourism sector into six sub-industries, each sub-industry still includes a rather diverse set of business activities. This is particularly true for the recreation and entertainment sector, which includes a wide range of activities with different seasonality and business nature. However, we do not have access to more disaggregated data, preventing us from dividing the tourism sector into sub-industries each consisting of homogenous activities. Regardless, by using the six sub-industries as defined by the BEA, our analysis still accounts for some of the heterogeneity not considered in previous studies.

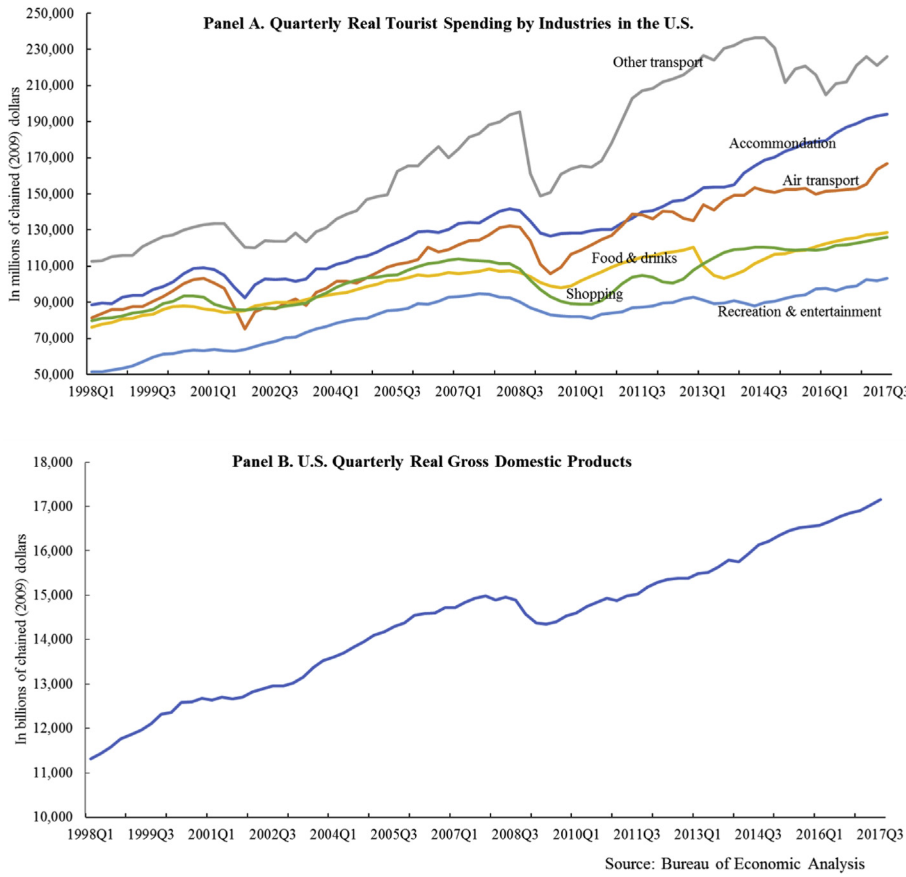

Fig. 1. Quarterly real tourist spending by industries and the real gross domestic products of the United States, seasonally adjusted annual rates, 1998Q1-2017Q3.

value and is accepted if the test statistics falls below the lower critical value. The F-test, however, is inconclusive if the test statistic lies between the lower and upper critical levels.

The sub-industry study by Tang and Jang (2009) uses the conventional Granger (1969) causality test to determine the lead-lag relationship between tourism and economic growth. The test relies on the asymptotic distribution of the test statistic, which may produce spurious results when the variables are non-stationary (Granger & Newbold, 1974). Even in the presence of cointegration, the test cannot be carried out with variables specified in levels (Sims, Stock, & Watson, 1990). Here, we use the Toda and Yamamoto (1995) approach, which is applicable in the possible presence of unit roots and non-cointegration and has been shown to possess a higher statistical power than the original Granger causality test.

The TY Granger causality test is based on an augmented vector autoregression (VAR) model. Three steps are involved in the test. First, we determine the optimal lag length (k) of the VAR model using the appropriate information criteria. In the second step, we select the maximum order of integration ($d_{\max}$) using the appropriate unit root tests. These additional lags are added to the VAR model, as in equation (2) for the bivariate analysis:

$$\begin{bmatrix} Y_{1t} \\ Y_{2t} \end{bmatrix} = \begin{bmatrix} \delta_{10} \\ \delta_{20} \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \delta_{11,\,i} & \delta_{12,\,i} \\ \delta_{21,\,i} & \delta_{22,\,i} \end{bmatrix} * \begin{bmatrix} Y_{1t-i} \\ Y_{2t-i} \end{bmatrix} + \sum_{j=1}^{d_{max}} \begin{bmatrix} \delta_{11,\,k+j} & \delta_{12,\,k+j} \\ \delta_{21,\,k+j} & \delta_{22,\,k+j} \end{bmatrix} * \begin{bmatrix} Y_{1t-k-j} \\ Y_{2t-k-j} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \tag{2}$$

where Y_1 and Y_2 are the two variables defined earlier, k is the optimal lag length selected by information criteria, $d_{\max}$ is the maximum order of integration of the two variables, δ's are the parameters in the VAR system, and ε's are the errors.

In the last step, we apply the Wald test on the coefficients of the first k lags to determine the causality between the two variables, as in equations (3) and (4):

$$H_0^{Y_{1t}\to Y_{2t}}: \delta_{21,1} = \delta_{21,2} = \ldots = \delta_{21,k} = 0 \tag{3}$$

$$H_0^{Y_{2t}\to Y_{1t}}: \delta_{12,1} = \delta_{12,2} = \ldots = \delta_{12,k} = 0 \tag{4}$$

Under the null, the Wald test statistics will be asymptotically chi-square distributed with k degrees of freedom. A rejection of the null hypothesis in equation (3) implies that the lagged values of Y_1 helps to predict Y_2 and therefore, suggests the existence of a causality running from Y_1 to Y_2. Similarly, a rejection of the null hypothesis in equation (4) suggest that there exists a causality running from Y_2 to Y_1.

In testing for causality, the TY approach accounts for non-stationarity of the variables, thus avoiding the inherent problem of the standard Granger causality test (Wolde-Rufael, 2006). Additionally, level variables are used in the model to reduce the risk of wrongly differencing the data when the data is in fact stationary (Mavrotas & Kelly, 2001). However, it should be noted that as with the traditional Granger causality test, the TY testing results only suggest that whether the lagged values of one variable help predict another variable and hence, do not represent the true "causality" between the two variables, i.e., whether a change in one variable leads to a corresponding change in the other. Despite this shortcoming, the Granger-causality type tests are still useful since they indicate whether one variable provides additional forecasting power of another variable beyond what is already included in its own lagged values. Lastly, it should be noted that if two variables are cointegrated, then there must exist Granger causality in at least one direction (see the Granger-Engle representation theorem in Engle and Granger (1987)). However, in the case of no cointegration causality may or may not exist between the variables under interest.

Table 1
Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) Unit roots test.

Variables	ADF					PP				
	Level		First Difference		Order of integration	Level		First Difference		Order of integration
	C	C & T	C	C & T		C	C & T	C	C & T	
GDP	−1.12	−2.54	−3.98***	−3.98**	I(1)	−1.91	−2.48	−5.64***	−5.73***	I(1)
Lodging	−0.11	−1.89	−5.94***	−6.00***	I(1)	−0.03	−1.93	−6.57***	−6.62***	I(1)
Air	−1.41	−1.78	−8.09***	−8.35***	I(1)	−1.22	−1.50	−8.09***	−8.35***	I(1)
OthTpt	−0.37	−1.50	−3.63***	−3.82**	I(1)	0.49	−0.73	−4.87***	−5.09***	I(1)
Food	−2.55***	−3.59**	−4.25***	−4.22***	I(0)	−1.87	−2.66	−4.85***	−4.82***	I(1)
Rec	−2.57***	−2.54	−2.68***	−2.64	I(0)	−2.26	−2.01	−5.95***	−6.09***	I(1)
Shop	−2.98***	−2.96	−3.63***	−3.60**	I(0)	−1.78	−1.77	−3.43**	−3.40	I(1)

Notes: One, two, and three asteroids denote rejection of the null hypothesis of a unit root at 10% and 5%, and 1%, respectively. "C" = model with a constant only, "C & T" = model with a constant and trend.

5. Empirical results

As with most time series analysis, we convert all variables into their logarithms to reduce non-normality. The first step of our empirical investigation is to analyze the stationarity property of the variables. Even though the ARDL bounds test does not require all variables to be integrated of the same order, it does require that none of the variables is integrated of order two. Additionally, information on the stationarity property of the variables is required to determine the lag lengths of the TY causality test. Here, we employ the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit roots test to determine the stationary property of the variables.

Table 1 presents the unit root test results. The optimal lag length used in each testing equation was selected using the Schwarz Bayesian information criterion (SBC). The ADF test suggests that the outputs of the food and beverage, recreation and entertainment, and shopping sectors are stationary at levels, hence are integrated of order zero, while real GDP, travelers' accommodation, air transportation, and other transportation are first-difference stationary, and are therefore I(1). The results from the PP test, on the other hand, suggest that all the variables are I(1).

5.1. The relationship between GDP and tourism-related industries

Since none of the variables are integrated of order 2, we next investigate the long-run relationship between GDP and tourism sectors using the ARDL bounds test (equation (1)). We conduct the pairwise bounds test between GDP and the real output of each tourism-related industry using the latter as the dependent variable. We specify the testing equation in this way because within the same quarter, GDP is more likely to be exogenous to tourism output than the other way around.

Table 2 reports the computed F statistics for the pairwise bounds test between tourism industry performance and GDP. The test statistic falls below the lower bounds when air transportation, other transportation, recreation and entertainment, and shopping are used as the dependent variable, presenting evidence in favour of no cointegration between economic growth and the performance of these sectors. Evidence of cointegration, however, is found when traveler's accommodation and food and beverage are used as the dependent variables, suggesting that these two tourism-related sectors co-move with GDP in the long-run. Our results are in general consistent with the conclusion in Tang and Jang (2009) that the linkage between tourism industries and economic growth in the U.S. is weak in the long-run. Unlike Tang and Jang (2009) who found that the airline industry is the only sector cointegrated with GDP, we instead observe a long-run equilibrium between GDP and accommodation, as well as between GDP and the food and beverage industry.

The weak linkage between tourism sub-industries and the GDP in the long-run suggest that the two may follow rather different long-term paths, at least based on the evidence from our data. Despite its importance, the tourism industry remains a small contributor to the US economy, accounting for 2.7% of total GDP in 2016 (OECD, 2018). Meanwhile, the US economy is highly complexed and diversified, driven by technology innovations, growth in industrial outputs, energy sector expansion, human capital accumulation, rises in domestic and foreign direct investment, as well as many other factors that may only weakly correlate with the tourism sector. The performance of the tourism sector, on the other hand, is highly linked to socio-demographic factors (Zheng & Zhang, 2013), political events (Goodrich, 2002), visa programs (Cheng, 2012), and infrastructure development (Khadaroo & Seetanah, 2007) in addition to income. The lack of cointegration relationship between tourism and GDP in the U.S. may thus in part due to the different sets of variables shaping their long-term performances.

Table 2
Bivariate bounds test of cointegration: Tourism industries and GDP.

Dependent variable	Function	F-Stat	Critical Values		Decision
			Lower	Upper	
Lodging	F(Lodging, GDP)	5.38	4.04	4.78	Cointegration
Air	F(Air, GDP)	4.55	4.94	5.73	No cointegration
OthTpt	F(OthTpt, GDP)	2.50	4.94	5.73	No cointegration
Food	F(Food, GDP)	12.63	6.84	7.84	Cointegration
Rec	F(Rec, GDP)	2.06	4.94	5.73	No cointegration
Shop	F(Shop, GDP)	4.58	4.94	5.73	No cointegration

Notes: H_0—no cointegration between GDP and the tourism sub-sector considered. H_0 is rejected if the F statistics exceeds the upper critical value and is accepted if it falls below the lower CV.

We next investigate the direction of causality between GDP and the performance of each tourism-related industry using the Toda and Yamamoto (1995) test (equation (2)). The optimal lag length for the underlying VAR is selected again by SBC. We then check for residual autocorrelation of the VAR model using the Lagrange-Multiplier test. Additional lags are added to the model until autocorrelation disappears to ensure that the underlying VAR is correctly specified (k lags). Given the maximum order of integration ($d_{\max}$) from Table 1, we estimated a $k + d_{\max}$ order VAR model for GDP and the real output of each tourism-related industry, the results of which are presented in Table 3.

As can be seen, there exists a unidirectional causality from GDP growth to all six tourism-related sectors—the lagged GDP anticipates the real output of tourism-related sub-industries but not vice versa. For the casual patterns we identified, evidence of statistical significance is strongest from GDP to accommodation and from GDP to air transportation, and the weakest from GDP to other transportation. Our results suggest that the performance of tourism-related industries lags the

Table 3
Toda-Yamamoto bivariate Granger causality test between GDP and tourism sub-industries.

Dep var	Ind variable	Lag length	Chi-sq	Prob	Direction of causality
GDP	Lodging	2	3.31	0.191	Unidirectional causality
Lodging	GDP		15.68***	0.000	GDP → Lodging
GDP	Air	2	1.80	0.406	Unidirectional causality
Air	GDP		17.68***	0.000	GDP → Air
GDP	OthTpt	2	1.34	0.511	Unidirectional causality
OthTpt	GDP		4.77*	0.092	GDP → OthTpt
GDP	Food	2	1.66	0.437	Unidirectional causality
Food	GDP		9.73***	0.008	GDP → Food
GDP	Rec	4	5.87	0.209	Unidirectional causality
Rec	GDP		8.53*	0.074	GDP → Rec
GDP	Shop	3	1.60	0.660	Unidirectional causality
Shop	GDP		12.44***	0.006	GDP → Shop

Notes: One, two, and three asteroids indicate statistical significance at 10%, 5%, and 1%, respectively. → denotes the direction of causality.

overall economic cycle in the U.S. and that the relationship between the two conforms to the economic-driven tourism growth (EDTG) hypothesis often observed in developed countries. This finding should not come as a surprise given the small share of tourism output in the U.S. GDP. Additionally, while tourism globally is considered a luxury good, Yazdi and Khanalizadeh (2017) find that the income elasticity of international tourists into the US from 14 nations is less than unity. For domestic tourism that accounts for nearly 80% of the U.S. total tourism receipts (OECD, 2018), Zheng and Zhang (2013) find that the mean income elasticity of tourism expenditure for domestic travellers in the U.S. is 0.54 in 2011. These findings suggest that the international and domestic tourism demand in the U.S. may trail the overall economic performance as they are overall income-inelastic. Meanwhile, many tourism-related businesses require a large upfront investment, making it difficult to adjust supply in the short-run. Tourism supply could be rather inelastic and as in the case of tourism demand, lags the general economic activity. A similar argument was made in Corgel (2004) who shows that the cycles in the hotel industry follow the general business cycles but with a lag.

5.2. *The linkages within tourism-related industries*

A relevant question to the tourism sector is whether the performance of one industry helps predict the performance of another. The goods and services in the individual tourism industries may serve as substitutes or complements and therefore produce different relational outcomes. Furthermore, tourists often consume goods and services from more than one tourism sectors. Against this backdrop, we investigate the lead-lag relationship between the six sub-industries. Such information is of particular relevance when making investment and marketing decisions as decision-makers are often faced with resource constraints.

We first apply the bounds test to each pair of tourism industries, the results of which are presented in Table 4. With the only exception between the air and the other transportation sectors, we fail to identify any long-run relationship in the remaining pairs of industries. As can be seen in Fig. 1, while the performance of each sector in general followed a similar trend, there are periods when the real output of one sector is driven by idiosyncratic factors uncorrelated with other industries. The lack of cointegration relationship within the tourism sector suggests that in the long-run, the performance of each sector may behave rather differently, depending predominantly on sector-specific factors.

Table 5 shows the pairwise Granger causality test for the six tourism-related sectors. No causality exists between the food and beverage (Food) industry and three other industries, including Rec, Shop, and OthTpt. There is, however, a unidirectional causality running between all other pairs of industries. To provide a clearer picture of the relationship among the six sectors, we plot in Fig. 2 the directions of causality presented in Table 5.

Table 4
Bivariate bounds test of cointegration between tourism industries.

Dep var	Function	F-stat	Critical Values		Decision
			Lower	Upper	
Air	F(Air/Lodging)	3.833	4.94	5.73	No cointegration
OthTpt	F(OthTpt/Lodging)	2.160	4.94	5.73	No cointegration
Food	F(Food/Lodging)	3.037	4.94	5.73	No cointegration
Rec	F(Rec/Lodging)	3.377	4.94	5.73	No cointegration
Shop	F(Shop/Lodging)	4.023	4.94	5.73	No cointegration
Food	F(Food/OthTpt)	2.154	4.94	5.73	No cointegration
Rec	F(Rec/OthTpt)	2.287	4.94	5.73	No cointegration
Shop	F(Shop/OthTpt)	1.363	4.94	5.73	No cointegration
Air	F(Air/OthTpt)	6.030	4.94	5.73	Cointegration
Food	F(Food/Air)	1.780	4.94	5.73	No cointegration
Rec	F(Rec/Air)	2.059	4.94	5.73	No cointegration
Shop	F(Shop/Air)	1.747	4.94	5.73	No cointegration
Rec	F(Rec/Food)	4.369	4.94	5.73	No cointegration
Shop	F(Shop/Food)	2.636	4.94	5.73	No cointegration
Shop	F(Shop/Rec)	2.747	4.94	5.73	No cointegration

Notes: H_0—no cointegration between GDP and the tourism sub-sector.

Table 5
Toda-Yamamoto bivariate Granger causality test between pairs of tourism industries).

Dep V.	Ind V.	Chi-sq	Dep V.	Ind V.	Chi-sq	Direction of causality
Lodging	Air	2.713	Air	Lodging	14.792***	Lodging → Air
Lodging	OthTpt	2.204	OthTpt	Lodging	6.950**	Lodging → OthTpt
Lodging	Food	12.838***	Food	Lodging	0.383	Food → Lodging
Lodging	Rec	12.655***	Rec	Lodging	0.673	Rec → Lodging
Lodging	Shop	17.726***	Shop	Lodging	1.357	Shop → Lodging
Air	OthTpt	9.896***	OthTpt	Air	3.730	OthTpt → Air
Air	Food	15.535***	Food	Air	2.312	Food → Air
Air	Rec	18.033***	Rec	Air	0.136	Rec → Air
Air	Shop	17.572***	Shop	Air	1.613	Shop → Air
OthTpt	Food	3.675	Food	OthTpt	3.017	No causality
OthTpt	Rec	6.709**	Rec	OthTpt	1.256	Rec → OthTpt
OthTpt	Shop	12.452***	Shop	OthTpt	1.383	Shop → OthTpt
Food	Rec	0.461	Rec	Food	3.810	No causality
Food	Shop	0.181	Shop	Food	1.765	No causality
Rec	Shop	3.412	Shop	Rec	7.967**	Rec → Shop

Notes: Model estimated with $d(\max) = 1$. Lag length selected by BIC. Additional lags are added to the model until autocorrelation disappears. One, two, and three asteroids indicate statistical significance at 10%, 5%, and 1%, respectively. → denotes the direction of causality.

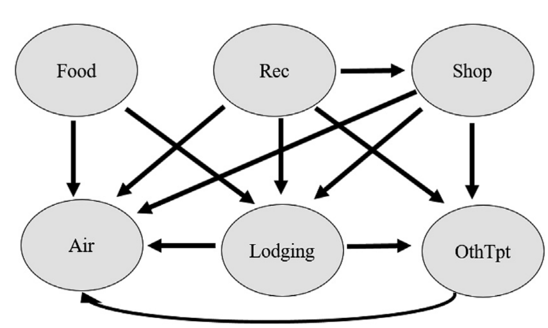

Fig. 2. Graphical representation of Granger causality between the tourism-related sub-industries.

Consistent with Tang and Jang (2009), we find the lodging industry has the most causal links to and from all other industries, making it the pivot sector of the tourism industry that serves as the role of information transmitter within the system. Tang and Jang (2009) further find that the performance of the airline industry precedes the other tourism industries, making it the leading sector in the tourism industry. On the contrary, we observe that the air transportation sector is the recipient of spillover effects from all other industries, with its performance led by the outputs of all other sectors.

The lagging performance of the air transportation sector can perhaps be explained by the different planning horizons of long-vs. short-distance trips. Compared to nearby destinations, trips to more distant destinations often require advanced planning such as coordinating vacation time, saving for the trip, obtaining visas and travel permits, etc. In a booming economy, consumers are likely to increase their expenditures on tourism, but first on nearby destinations, many of which can occur without air travel. As the disposable income grows, tourists could afford more long-distance trips that require not only air transportation but also longer planning horizons. For many travelers, these long-distance trips (or extended vacations) often occur on a later date than nearby trips, with the time difference sometimes go beyond a quarter. The impact of the overall economic condition on the tourism sector may therefore first show up in industries such as lodging, food, shopping, other transportation, and recreation, the goods and services of which are all consumed by tourists in short-distance trips, followed by the air transportation sector that often occur in long-distance trips.

As can be seen in Fig. 2, if we divide the six industries into two categories, one consisting of sectors providing comparable products in different destinations (i.e., Air, Lodging, and OthTpt) and the other consisting of sectors providing local offerings (i.e., Food, Rec, and Shop), the performance of the latter clearly leads the former. In particular, the recreation and entertainment sector anticipates the output of almost all other sectors. Zheng and Zhang (2013) report that in 1996 and 2011, the mean income elasticity of expenditure on sightseeing and entertainment was 1.31 and 1.26, respectively, based on the Consumer Expenditure Survey by the US Bureau of Labor Statistics. Meanwhile, they find that the mean income elasticities of expenditures on lodging, food and beverage, and transportation were all less than unity in both years. Therefore, it is possible that income-induced tourism behavior change due to GDP growth shows up first in the recreation and entertainment sector, followed by other sectors whose expenditures are less sensitive to income changes. While we are unaware of income elasticity estimates on tourism-related shopping expenditures in the U.S., the shopping sector, which includes all personal consumption expenditures excluding gasoline made by a tourist, could be overall rather sensitive to changes in income and the underlying economic activities. The expenditures on the shopping sector, as a result, may anticipate the performance of sectors that are considered more of a necessity to tourists.

The discrepancies between our results and those in Tang and Jang (2009) may be partly due to the use of different datasets and sample periods. The omission of the privately-owned firms and the narrowly-defined sectors in Tang and Jang (2009) could underestimate the role of the food and beverage and the recreation and entertainment sectors. The aggregate sales data could contain a substantial portion of non-tourism and non-US revenues, further complicating the estimation results. Additionally, Tang and Jang (2009) consider a sample period of 1980–2005, whereas in our analysis the sample considered is 1998–2017, a period when growth in leisure travelers' expenditure significantly outpaced business travel expenditures (US Travel Association, 2018a). The rise in leisure travel suggests that activities satisfying personal pleasure, including food, shopping, and recreation play more significant roles than in previous periods. Perhaps even more importantly, since neither Tang and Jang (2009) nor the present study considers contextual variables in the empirical analysis, the differences in the findings could also be due to the effect of other factors that may have evolved over the two study periods.

6. Conclusions

This paper examines the relationship between GDP and the real output of six tourism industries in the U.S., and within the tourism industries using quarterly data from 1998 to 2017. We find that except for the lodging and the food and beverage sectors, GDP is not cointegrated with any of the remaining tourism sectors. No long-run relationship exists within the tourism industries except between the air transportation and other transportation sectors. The Toda-Yamamoto causality test indicates that there exists a unidirectional causality running from GDP to the six tourism sectors, supporting the economy-driven tourism growth hypothesis predominantly observed in developed countries where tourism revenues only account for a small portion of the overall economy. Within the tourism sector, the performance of shopping, food and beverage, and recreation and entertainment industries in general leads the output of the other three industries, i.e., air transportation, lodging, and other transportation.

Our results have implications at both the micro and macro levels. Due to the weak linkage between tourism sub-industries and economic growth in the long-run, investment activities to increase tourism revenues may not necessarily need to follow the general business cycle. As contended by Tang and Jang (2009), tourism investment could be successful in the long-term even when the general economy is suffering a sustained stagnation. In the short-run, however, the unidirectional causality from GDP to tourism industries suggest that policies/strategies to market and enhance patronage of US tourism goods and services at the federal, state, and local levels should take a cue from current economic activities. A booming economy and favourable business environment could stimulate investment in roads, transportations systems (by road, air, and water), mobile telecommunication, and other facilities, benefiting the tourism-related sectors. At the micro-level, since investment in the tourism industry may be capital intensive and investors often face resource constraints, the timing of investment should be tied to the performance of the general economy that precedes the tourism industries, which could help investors achieve business success in the short-run.

The interrelationship among the tourism industries appears to show greater inter-linkages compared to that between GDP and the tourism sub-industries, consistent with the observation that tourists are likely to consume goods and services from different tourism industries. The recreation and entertainment industry appears to be the leading industry in the tourism sector because its performance precedes all other related industries except for the food and beverage industry, contrasting earlier work of Tang and Jang (2009) in which air transportation was the leading sector. We attribute the information-recipient role of the air transportation sector in part to the longer planning horizons of extended vacations, most of which require air transportation, as compared to trips with nearby destinations that often do not involve air transportation. Investment and marketing decisions by public or private parties in the air transport sector, therefore, should be evaluated by jointly considering the performance of other tourism sectors.

We further find that the performances of industries providing local offerings, namely the food and beverage, recreation and entertainment, and shopping industries, in general precede the real output of the other three industries delivering comparable cross-destination services. Therefore, tourism companies and policymakers may wish to direct their marketing efforts toward increasing the visibility of the local culinary, leisure, and shopping options as a means to attract tourists, which in turn could generate spillover effects to other sub-sectors. Due to the multiplier effect on the other sectors, stimulating the growth of the food and beverage, the recreation and entertainment, and the shopping sectors should be treated with a high priority in the U.S.

Additionally, we find that the accommodation industry is the primary channel through which information transmits within the tourism industry, receiving information from food, shopping, and recreation and entertainment sectors while sending information to the air and other transportation sectors. It is the fulcrum around which the rest of tourism sub-industries revolves, making it the most connected sub-industry, a finding consistent with Tang and Jang (2009). Therefore, the accommodation sector should be keenly watched when making decisions on public and private investment in all other tourism sectors.

It is evident that examining the causality between economic growth and the disaggregated tourism industry unveils results that are hitherto obscured when aggregated tourism is employed. More research on the purpose of tourist visits and its influence on the industry and general economy is needed to inform the decision making in the government and private sectors in the tourism industry. Future studies may also wish to further explore the reasons behind the leading role of sectors providing local offerings in the tourism sector, as well as the information-recipient role of the air transportation industry. In addition, one limitation of the present paper is that we do not control for other exogenous variables in the empirical analysis, most notably exchange rates that could significantly affect the inbound tourism demand to the U.S. from other countries. While our results should largely be valid for domestic tourism demand which accounts for the bulk of the total tourism expenditures in the U.S., future studies may include the U.S. dollar exchange rates and other exogenous variables so that a more accurate picture of the tourism-economic growth relationship may be obtained.

Declarations of interest

None.

Author contribution

Conceived the analysis: D.N. Aratuo.
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