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Does international tourism spur international trade and output? Evidence from wavelet analysis

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Abstract
In this article, we attempt to examine the nexus of trade, economic growth, and international tourism. We resort to wavelet-based analysis to capture the time–frequency-based lead–lag dynamics of this nexus. Considering the monthly data spanning from January 1999 to February 2018 for the United States, we find the evidence that (a) increasing trade leads to higher tourist inflows (in terms of receipts), (b) tourist receipts are lagged by economic growth, and (c) these relationships are significant in the long term. We believe that these results are crucial for policymakers to frame policies regarding tourism in the United States.

Keywords
economic growth, international tourism, international trade, wavelet analysis

Introduction

Understanding the nexus of trade, economic growth, and international tourism has been a central theme in the domain of tourism economics because of their socioeconomic implications. It is commonly held that countries with higher trade intensities with the rest of the world are more open, which facilitates the channel for travel and tourism (Santana-Gallego et al., 2011). The burgeoning empirical literature on the trade–tourism relationship provides definitive evidence of the nexus with bidirectional causation (Santana-Gallego et al., 2011, 2016). The literature can be broadly

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bifurcated in two different strands: (a) tourism promotes trade and (b) trade promotes tourism. Kulendran and Wilson (2000) argue that business trips and visits to the host country would result in the international exchange of goods and services in the subsequent years. In addition, Katircioglu (2009) also hypothesizes the possibility that leisure visitors on holiday trips may also find potential trading opportunities, which they might actualize at a later stage. For instance, tourists may find certain goods or services lucrative and they might also recognize its utility in their country, which could result in imports by the tourist's home destination. Besides, the consumption of goods or services by foreign nationals during their trips also boosts the trade balances.

The other strand, which believes trade promotes tourism, contends that existing trade relationships stimulate business trips to destination countries. Moreover, the availability of the same goods or services in the destination country imported through trade, which is consumed by tourists in their own country, also facilitates tourism (Khan et al., 2005; Kulendran and Wilson, 2000). Another perspective that supports the hypothesis of trade leading tourism could be viewed through the lenses of the traditional problem of asymmetric information. Ledesma-Rodríguez et al. (2001) and Ledesma et al. (2005) opine that information asymmetry is one of the key characteristic features of tourism markets. Thus, there remains a possibility that friends and relatives of trade visitors may gather information and recommendation about the destination country, which would make them potential visitors (Santana-Gallego et al., 2011). Ledesma-Rodríguez et al. (2001) and Ledesma et al. (2005) also interestingly argue that such recommendations and repeat visits could also be an outcome of adverse selection. Nevertheless, the influence of previous visits and recommendations of family and friends as a source of destination information is well established in the empirical literature (Ledesma-Rodríguez et al., 2001; Ledesma et al., 2005).

On the other hand, the nexus between tourism and economic growth is dealt with paramount importance in the literature. Traditionally, scholars across the world have exhibited their profound interest in exploring the impact of tourism on national economic output growth. However, Balaguer and Cantavella-Jorda (2002) were the one who formally introduced the concept as the tourism-led growth hypothesis (TLGH). Undeniably, tourism leads to economic growth for both developing and developed countries alike. Brida et al. (2016) present a review of literature containing nearly 100 articles, where they hold the TLGH to be a valid proposition with some exceptions. However, the sample articles primarily focused on developing countries. Nonetheless, the phenomenon of TLGH is also prominent in developed countries like Spain (Balaguer and Cantavella-Jorda, 2002). Also, in the developed economies like the United States, receipts from the tourists have contributed US$1.5 trillion during 2016 as per the report of the World Travel and Tourism Council. The report also communicates that the tourism sector has created 14 million jobs, nearly 9.4% of the country's total jobs. Across 29 states in the United States, tourism is in the top three positions for employment opportunities. Though, in no way, we can negate the contribution of tourist inflows to any economy irrespective of its status of developed and developing, we can draw a line of distinction.

Katircioglu (2009) argues that tourism is undoubtedly a major source of foreign exchange for either class of countries. However, the dependency on tourism for economic growth should be less for larger economies since the other sectors also operate in prominence. Furthermore, better amenities in respect of transportation, infrastructure, and communication system are also necessary to boost tourism (Santana-Gallego et al., 2011). Thus, the developed economies with superior social amenities, stringent law and order systems, and better recreational facilities should be able to attract more visitors in general. Developed countries can provide better transportation infrastructure and information and communications technology (ICT)—this allows ease of access to the

country and the Internet/Wi-Fi. While developed countries provide these services primarily for their residents, the benefits spill over to potential tourists and help in the marketing of the destination. Nevertheless, even if we withhold the assumption of high tourist visits to developed countries, the other argument that may crop up is with a higher growth rate in countries in which foreign visitors might look out for business opportunities. This may again lead to trade causing tourism hypothesis. Thus, there appears a theoretical possibility pertaining to reversal of TLGH, that is, growth-led tourism hypothesis (GLTH) (Du et al., 2016).

Therefore, in this article, we attempt to unravel the nexus of economic growth and trade with tourist receipts for the United States. As a choice of the methodology, we resort to the wavelet-based analysis to understand the nature of the relationship in the long and short run. The understanding of frequency-based behavior (i.e. short or long run) of the nexus is also emphasized in past literature (Brida et al., 2016; Santana-Gallego et al., 2011; Suresh and Tiwari, 2018), which justifies our methodological choice. We report three major empirical pieces of evidence: (a) increasing trade leads to higher tourist inflows, (b) a higher rate of economic growth attracts more tourists, and (c) stronger long-term coherencies for either of the pairs, that is, trade–tourism and trade–economic growth.

The rest of the article is structured as follows. The second section reviews the literature concerning the theme of our study. The third section presents the variables, statistical properties of data, and the estimation methodology. The fourth section analyzes the empirical findings of our study. Finally, the fifth section concludes and lays out the scope for future research.

Literature review

After reviewing the literature aligned with the objective of our study, we have bifurcated the review section into three subsegments, which are discernible to readers. The first segment reviews the relationship of tourism with trade, the second segment reviews the relationship of tourism with economic growth, and the third segment reviews the studies in tourism literature that use the wavelet-based methodologies.

Literature on tourism and trade

The empirical literature on the relationship is widely established and it investigates several aspects of the relationship. Based on the theme of the articles, we can show two possible classifications. The first group investigates bilateral links between these two variables. For example, Kulendran and Wilson (2000) investigate the association between international travel flow and trade in the context of Australia. Primarily focused on the four large trading partners of Australia, the study concludes that international trade pushed international tourism. The reverse association between these variables was also observed in this study. Similarly, using Singaporean data, Khan et al. (2005) also find similar results. Furthermore, Shan and Wilson (2001) using Chinese data and Santana-Gallego et al. (2011) with Organization for Economic Cooperation and Development data suggest similar implications. The second line of thought stresses upon the notion of "international trade causes tourism hypothesis." As we mentioned in the introduction section, this line of literature holds that successful business trips and identification of business opportunities through leisure could facilitate trade later. Many studies propose, empirically examine, and accept this proposition (Eilat and Einav, 2004; Goh and Law, 2003; Oh et al., 1995; Santana-Gallego et al.,

2010). The methodological approaches adopted by the scholars are the econometric tools such as Granger causality and co-integration tests.

Literature on tourism and economic growth

There exist several studies on exploring the association between economic growth and tourism. The broad base of literature highlights several aspects of tourism leading to economic growth. McKinnon (1964) posits that tourism is a credible way of earning foreign exchange that contributes to capital goods and hence facilitates the production process. Brau et al. (2007) argue that for small economies, tourism is a potentially effective channel to trigger economic growth. Similarly, Narayan (2004) shows that as a result of increasing tourism spending by 10%, the gross domestic product (GDP) in the longer term could increase by 0.5%. Gokovali (2010) also studies this relationship by considering the Turkish data and reports that the tourism revenue and economic output show elasticity of 0.53. Recent studies also suggest that Malaysia adopts the hypothesis of "economic-driven tourism growth" while Singapore adopts "tourism-led economic growth" (Du et al., 2016). Further, in the exhaustive literature review by Brida et al. (2016), many similar pieces of evidence can be traced.

Wavelets in tourism

Applications of wavelet theory in economics and finance literature are well established on account of its superior ability over traditional econometric techniques to analyze data in a time–frequency domain (Das et al., 2018; Reboredo and Rivera-Castro, 2013). The use of wavelet theory in tourism is at a nascent stage. However, its use is evident in unraveling of some crucial research questions in tourism literature. For example, using this method, Raza et al. (2017) study how tourism development causes environmental degradation in the context of United States. Similarly, Suresh and Tiwari (2018) use the wavelet methodology to examine the relationship between trade and output with tourist arrivals. Recently, Singh et al. (2018) study the relationship between tourist footfalls and economic policy uncertainty. Similarly, in this study, we use wavelets to analyze the nexus of trade and economic growth with tourist receipts.

In this study, we revisit the nexus of economic growth and trade with tourist receipts in the context of a developed country, that is, the United States. Since this relationship varies across the time and different frequencies, we resort to the wavelet-based analysis. Thus, we are able to address the questions such as (a) whether the relationship between the variables holds in the long, medium, or short run and (b) does trade/economic growth lead tourism receipts or vice versa? These questions are intriguing and are rarely answered in the literature of tourism economics, and therefore, we have examined them in this study.

Method

This section contains the description of the data source and estimation methodology used in this study.

Data source

We discuss the data used in this study. As mentioned earlier, we attempt to unravel the relationship between trade and economic growth with tourist receipts. We convert all the variables in real terms

considering the consumer price index. To substitute the variable *trade*, we consider the summation of total value of imports and exports following Suresh and Tiwari (2018) (values are in million US$). The variable *receipt* is the quantum of spending by tourists visiting the United States (values are in million US$). Finally, to represent the indicator of economic growth or output, we use the industrial production index (IPI). We consider *IPI* as a proxy for output instead of GDP following previous studies (Das et al., 2018; Li, 2013) with an intent to obtain large-enough samples (since GDP is reported quarterly and IPI is reported monthly). Thus, we consider monthly data set that spans from January 1999 to February 2018. Figure 1 exhibits the time series plot of three variables. For the purpose of analysis, we convert the original data in a logged form taking the first difference and present their statistical properties in Table 1. The results show that all the variables are skewed and kurtotic and hence non-normal as indicated by the Jarque–Bera test. The Ljung–Box Q-statistic rejects the hypothesis of serial dependence at 5% level. Further, the augmented Dickey–Fuller (Dickey and Fuller, 1979) and Phillips–Perron (Phillips and Perron, 1988) tests show that the series are stationary.

Estimation methodology

This segment of the study describes the estimation strategy employed to understand the nexus of trade and output with tourist receipts. At the first stance, as for the preliminary analysis, we perform rolling correlation analysis to understand the time-varying nature of the relationship. Second, we use wavelet-based approach to captivate the time–frequency-based behavior of the relationship among the concerned variables. We briefly explain the continuous wavelet transform (CWT) as follows (Gençay et al., 2002).

The CWT of $x(t)$ is expressed as

$$W_x(\tau,u) = \int_{-\infty}^{\infty} x(t)\, \tilde{\chi}^*_{(\tau,u)}\ (t)\mathrm{dt}; u \neq 0;\ \tau,u \in \mathbb{R} \tag{1}$$

where $x(t)\tilde{\chi}^*_{(\tau,u)}\ (t)$ is the complex conjugate of $\tilde{\chi}_{(\tau,u)}(t)$. The transformed output is identified by its scale and translation which is represented by a matrix of coefficients of order $|2 \times 2|$. $x(t)$ is transformed into a signal with respect to a translation parameter τ, the location indicator, and a scaling parameter u, the length indicator, where $\tau,u \in \mathbb{R}$. χ, the mother wavelet, is denoted by

$$\tilde{\chi}_{(\tau,u)}(t) = \frac{1}{\sqrt{|u|}}\chi\left(\frac{t-\tau}{u}\right) \tag{2}$$

We consider the Morlet wavelet, in this study, because of its applicability in the economics literature. It is defined as

$$\chi^M(t) = \frac{1}{\pi^{0.25}}\exp(i\omega_0 t)\exp(-t^2/2) \tag{3}$$

The wavelet coherence is defined as a bivariate framework for observing the interaction between two time series. Cross-wavelet transform is useful in this respect and defined as

$$W_{xy}(\tau,u) = W_x(\tau,u)W^*_y(\tau,u) \tag{4}$$

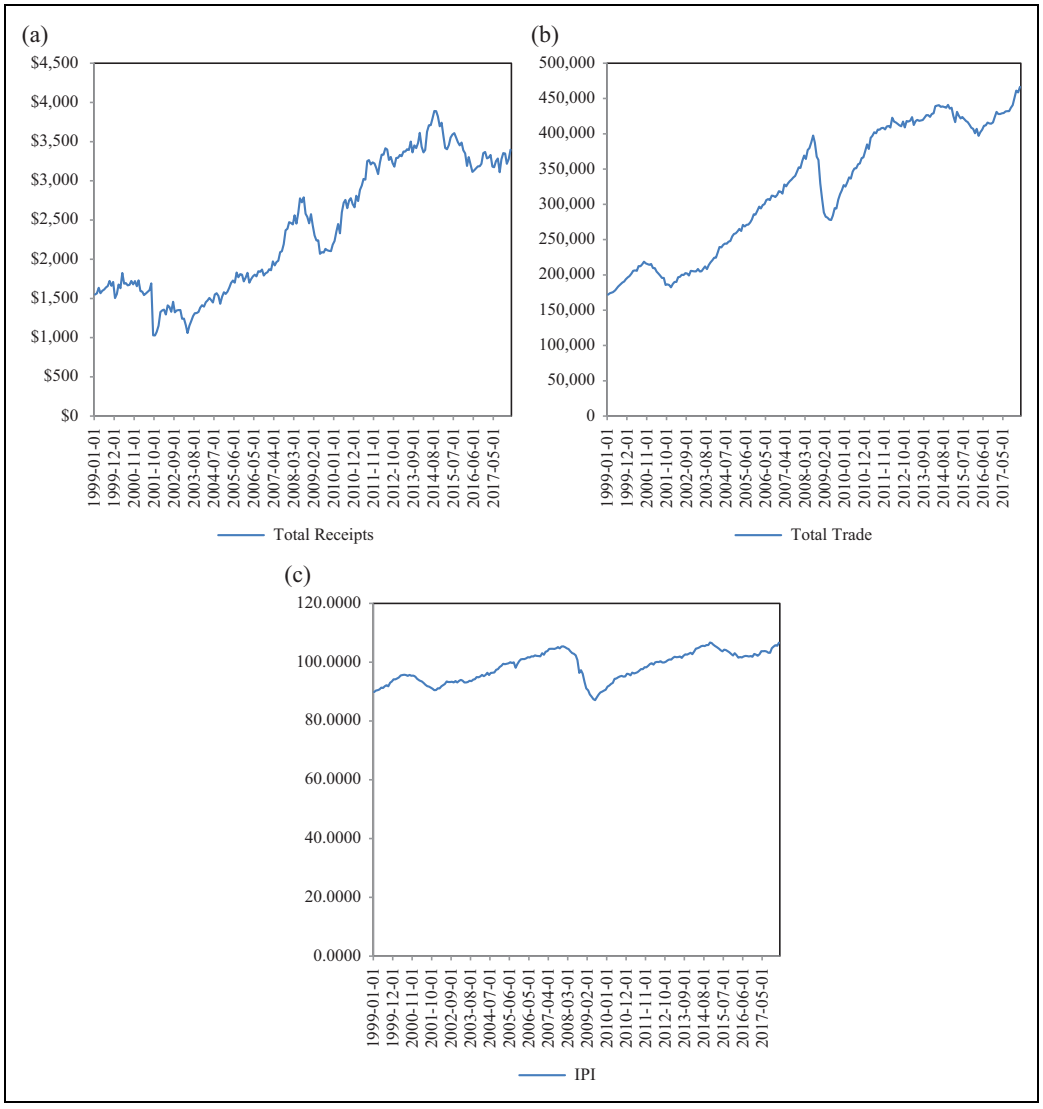

Figure 1. Time series plot of variables. (a) Tourism receipts, (b) trade, and (c) IPI economic growth. IPI: industrial production index.

The squared wavelet coherence coefficient is given by

$$R_{xy}^2(\tau,u) = \frac{S\left(u^{-1}W_n^{xy}(\tau,u)\right)}{S\left(u^{-1}|W_n^x(\tau,u)|^2\right)\cdot S\left(u^{-1}|W_n^y(\tau,u)|^2\right)} \tag{5}$$

where S is a smoothing parameter. $R_{xy}^2(\tau,u) \in [0,1]$ signifies a stronger (weaker) correlation for values close to one (zero). Since the theoretical distribution of wavelet coherence is unknown, we

Table 1. Descriptive statistics.

Statistic	Receipts	Trade	IPI
Mean (×100)	0.161	0.254	−0.107
SD	0.051	0.017	0.007
Maximum	0.141	0.040	0.018
Minimum	−0.500	−0.079	−0.045
Skewness	−4.171	−1.190	−1.501
Kurtosis	42.892	7.169	10.603
JB	15,848.000	219.870	637.560
LB *Q*-Statstic	16.804	79.356	46.163
ADF	−16.942	−13.003	−12.661
PP	−17.126	−13.716	−12.828

Note: IPI: industrial production index; JB: Jarque–Bera; LB: Ljung–Box; ADF: augmented Dickey–Fuller; PP: Phillips–Perron; SD: standard deviation. At 5% level, 5.99 is the critical value of JB test. Lag of LB test is taken as 10.

use the Monte Carlo technique for finding the statistical significance. A sufficient number of zeroes are filled up to avoid the influence of errors because of a finite time series with finite wavelets. The wavelet coherence phase differences, used for observing the intervals of oscillations of two time series, are defined as

$$\gamma_{xy}(\tau,u)=\tan^{-1}\frac{\mathrm{Im}\{S\left(u^{-1}W_n^{xy}(\tau,u)\right)\}}{\mathrm{Re}\{S\left(u^{-1}W_n^{xy}(\tau,u)\right)\}},\ \gamma_{xy}\in[-\pi,\pi] \tag{6}$$

where Im{.} and Re{.}, respectively, denoted the real and imaginary parts of CWT. The phase in wavelet coherence plots is indicated by arrows. The examined time series tends to move together when "zero" phase difference is indicated. The phase (antiphase) property of the time series is signposted by right (left) arrows indicating a positive (negative) correlation. The lead/lag relationship is designated by an arrow trending upward (downward), which indicates the first (second) series leading to the second (first) series by 90°.

Empirical results and discussions

This section discusses the empirical findings along with theoretical implications. Before we proceed to the wavelet-based results, we attempt to understand the time-varying correlations for two pairs, namely, trade receipts and IPI receipts. Figure 2 exhibits the rolling correlations with 36 months window. Additionally, the descriptive statistics of the rolling correlations are presented in Table 2. Both pairs show similar characteristic of correlations. The correlations drop around the period of 2007–2008, this period corresponds to the global financial crisis, which had a severe adverse impact on spending and production. Similar artifact may be observed around the period of 2017 owing to the fact that in January 2017, the United States temporarily banned tourist arrival from seven countries that included Iran, Iraq, Libya, Syria, Somalia, Sudan, and Yemen, besides the other entry regulations imposed by the government. The descriptive statistics show that the average rolling correlations for the trade receipts pair are stronger than IPI receipts. However, the deviation in the correlations is almost similar for both the pairs.

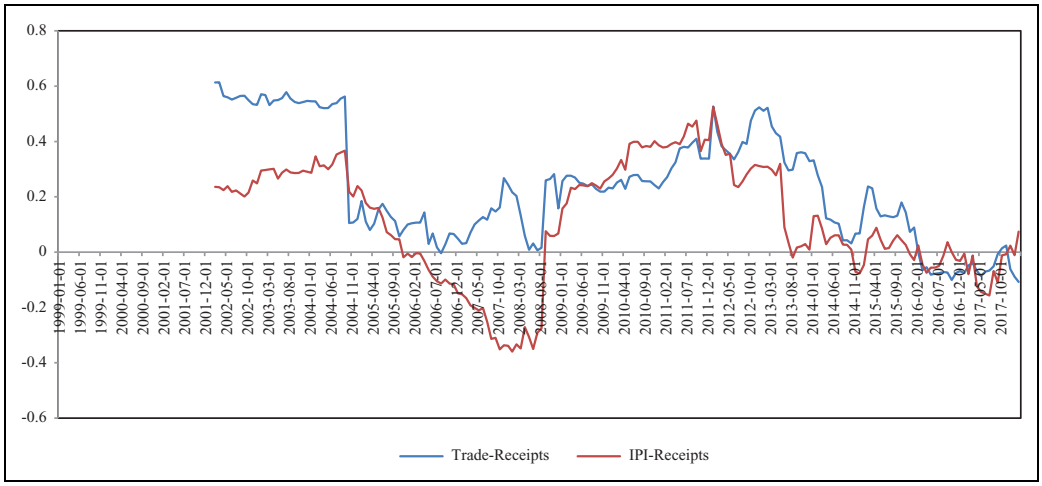

Figure 2. Thirty-six months (3 years) rolling correlations.

Table 2. Descriptive statistics of 36-month rolling correlation.

Statistic	Trade receipts	IPI receipts
Mean	0.235	0.115
SD	0.202	0.211
Maximum	0.614	0.525
Minimum	−0.107	−0.360

Note: IPI: industrial production index; SD: standard deviation.

In the next step, we discuss the results of the wavelet coherence analysis. Figure 3 exhibits the coherence maps for each of the pairs in a bivariate framework. To facilitate the ease of interpretation, we provide the scales in the vertical axis in the term of months. Thus, the maps show the co-movement dynamics from 4 months to 64 months. The horizontal axis corresponds to the timeline (the lower axis shows the count of observations and the upper axis shows the corresponding year). The red islands in the coherence maps signify stronger coherence (closer to coefficient 1). The blue zones indicate the weaker coherence (closer to coefficient 0). The black bold contour in the coherence plot demarcates zones that are statistically significant at 5% level. Two equal length, white noise time series are considered for determining the significant coherences using a Monte Carlo simulation of 1000 sets. The arrows in the coherence maps indicate lead/lag relationships. The arrows heading toward right (→)/left (←) describe positive/negative relationship. The upward (↑), upward-right (↗), and downward-left (↙) arrows describe the first variable's lead over the second. Similarly, the downward (↓), downward-right (↘), and upward-left (↖) arrows describe the second variable's lead over the first (Das et al., 2018; Jiang et al., 2017). The blackish area represents the edge affected region, which is statistically insignificant and is also called the cone of influence.

By virtue of the interpretation rules as described above, we find that the significant coherencies between the variables occur mainly in the medium to the long run that is consistent with Suresh and

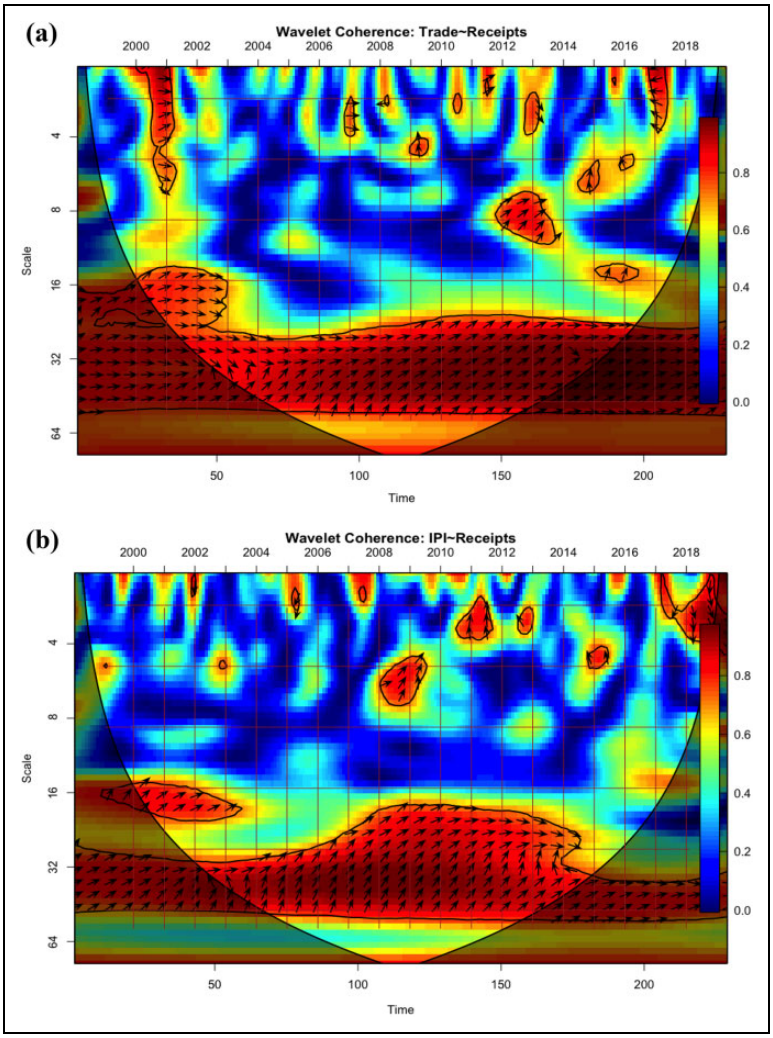

Figure 3. Wavelet coherence maps. (a) Trade–tourism receipts and (b) IPI economic growth–tourism receipts. *Note*: The black contour represents the estimates from Monte Carlo simulations at 5% significance level. The blue (red) color denotes low (high) coherency region. The power of coherence coefficients is shown using the color bar (on the right). IPI: industrial production index.

Tiwari (2018) and others (Eilat and Einav, 2004; Goh and Law, 2003; Oh et al., 1995; Santana-Gallego et al., 2010). The significant relationship may be observed between 16 months and 64 months, which essentially means that these variables hold economic implications in the medium to long run.

The lead–lag analysis shows some interesting results. First, we find that the arrows in Figure 3(a) point toward the right (→), which indicates a positive association among the variables. Then, we find that the arrows are mostly pointed upward (↑) and right-upward (↗), which signifies the fact that in our sample of the United States, trade leads tourism that is

conformity with the trade leads tourism hypothesis. This finding is similar to Suresh and Tiwari (2018) where Indian data have been used. When we compare India and United States as the representative of developing and developed economy, respectively, we find that the findings are similar. We have used Suresh and Tiwari (2018) for the comparison of results since our study is closely related and is methodologically similar to it. On analyzing the lead–lag relationship in Figure 3(b) for the pair IPI receipts, we find that positive association and IPI lead to tourist receipts. This is an interesting finding as it suffices the theoretical connotation pertaining to the reversal of TLGH, that is, GLTH. Suresh and Tiwari (2018) find the evidence in support of TLGH for India. However, in the context of Unites States, we find that growth leads tourist receipts by the several channels as discussed. Thus, our results validate the hypothesis set by us in the beginning of the study.

Conclusions and scope for future research

In this study, we deal with an interesting and intriguing question of whether tourism influences international trade and economic growth. Among the other spheres of research in tourism literature, the relevance of this domain of research, in particular, has been widely recognized by scholars (Balaguer and Cantavella-Jorda, 2002; Brida et al., 2016; Katircioglu, 2009; Kulendran and Wilson, 2000). The first question we have dealt with is whether there is any nexus between trade and tourism. The literature suggests a bidirectional relationship between these two variables. The empirical evidence advocates both forms of channels, that is, tourism leads trade and vice versa. We find the evidence that trade leads tourism, which is consistent with previous studies (Suresh and Tiwari, 2018). Thus, this insight is crucial for policymaking with regard to tourism in the United States. By maintaining and developing the bilateral trade activities with a large number of partners, the United States can continue to conserve tourism inflows from partner countries and increase the inflow further with new partnerships. Second, we find that the reversal of TLGH applies in the context of the United States similar to Du et al. (2016). In other words, though it cannot be denied that tourism contributes to economic growth and favors trade balance, in the case of developed economies (or economies with progressive growth both socially and economically *per se*) existing economic growth could also be a driver of tourist receipt. With higher levels of economic growth, a country can invest in the maintenance and beautification of cultural heritage and can establish amusement parks and other recreational outlets. Additionally, with better civic amenities and law and order systems, tourism could function even more efficiently. Thus, to respond to the question that we asked: Does international tourism spur international trade and output? The answer is no in the context of the United States and for the considered period. We find the evidence in the other way round.

We believe that our findings are crucial for policymakers as well as for the various stakeholders in the economy, though generalization of results could be a little limited. The variables—tourism, trade, and economic growth are impacted by many other macroeconomic factors that we could not accommodate in this study. However, this limitation of our study opens avenues for future studies.

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