Where can tourism-led growth and economy-driven tourism growth occur?¹

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Abstract

In this study, we investigate the causal relationships between international tourism growth and regional economic expansion in China, and more importantly, disclose the factors determining the occurrence of these relationships. The empirical results reveal that 10 out of 29 regions experienced tourism-led growth (TLG) during 1978 to 2013, whereas nine regions experienced economy-driven tourism growth (EDTG). Different from the past literature, this study uses Bayesian probit models to unveil the factors influencing these different growth patterns. Our results suggest that regions with less-developed economies, larger economic sizes, and covering larger geographic areas are more likely to experience TLG, and regions with less-developed economies are more likely to experience EDTG as well. Lastly, practical implications are provided.

Keywords: tourism-led growth; economy-driven tourism growth; Toda-Yamamoto Granger causality test; Bayesian bivariate probit model

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1. INTRODUCTION

As a service industry that attracts capital investment (de la Mata and Llano-Verduras 2012), creates employment opportunities (Fawaz, Rahnema, and Stout 2014), stimulates foreign exchange earnings (Balaguer and Cantavella-Jordá 2002), and facilitates innovation transfers (Weidenfeld 2013), tourism has long been recognized as a significant contributor to local economies (Brida, Cortes-Jimenez, and Pulina 2016; Castro-Nuño, Molina-Toucedo, and Pablo-Romero 2013). The economic benefits created by the tourism industry also spill over into other economic sectors through various backward- and forward- linkages. Owing to its substantial multiplier effect, local governments and members of society support tourism development to improve economic conditions and boost employment opportunities. Moreover, some induced economic benefits concomitant with tourism growth include burgeoning investments in public infrastructure, extended openness to foreign investment, and poverty reduction. Numerous empirical studies have confirmed that developing a flourishing tourism industry invigorates local economies and improves the living standards of local residents (Cárdenas-García, Sánchez-Rivero, and Pulido-Fernández 2015).

Recognizing the tourism industry as a catalyst for economic growth, Balaguer and Cantavella-Jordá (2002) proposed the tourism-led growth (TLG) hypothesis, which postulates a unidirectional causal relationship between international tourism expansion and economic growth. This pioneering paper triggered substantial research interest in the nexus between tourism expansion and economic growth, and empirical efforts to validate the TLG hypothesis are ongoing (Brida et al. 2016; del P. Pablo-Romero and Molina 2013). At the same time, local economic expansion likely facilitates tourism growth by attracting business travelers and improving physical and human capital, such as infrastructure, health, and education (Eugenio-Martin, Martín-Morales, and Sinclair 2008). This causal relationship, embedded in the economy-driven tourism growth (EDTG) hypothesis, has been empirically confirmed in several studies (Cortés-Jiménez, Nowak, and Sahli 2011; Oh 2005; Payne and Mervar 2010).

According to a systematic and in-depth survey by Brida *et al.* (2016), the TLG hypothesis has been confirmed by a number of empirical studies, but rejected in several countries. In another review, del P. Pablo-Romero and Molina (2013) found that the TLG hypothesis has been rejected in at least 13 studies. These mixed and inconclusive results for different countries indicate that further research is needed to investigate country-specific factors influencing the occurrence of TLG. Tang and Jang (2009) explained that the inconsistent results of the tourism-economy relationship might be a reflection of the country effect which could be attributed to nation-specific factors such as the weight of tourism in the overall economy, the size and openness of the economy, and the production capacity constraints. Furthermore, Cárdenas-García, Sánchez-Rivero, and Pulido-Fernández (2015) showed that the relationship between tourism and economic growth can be different for countries at different development levels. Since most researchers have focused primarily on a single country or region, it is difficult to compare and evaluate the results across different studies. First, tourism-related variables might be measured inconsistently across different national statistical systems. For instance, according to United Nations World Tourism Organization (UNWTO, 2017) and Wu, Song and Shen (2017), visitor arrivals, tourist arrivals (excluding same-day visitors), tourist arrivals at hotels and similar establishments, nights of tourists in hotels and similar establishments are used by different countries to record international tourist arrivals statistics. Second, as argued by del P. Pablo-Romero and Molina (2013), the results

of TLG tests are sensitive to the specifications of econometric models; therefore, the substantial diversity that exists among model specifications in past studies impedes further comparisons and synchronization of the empirical results. To the best of our knowledge, despite the existence of a large number of studies investigating the nexus between tourism expansion and economic growth, researchers have not yet empirically investigated the factors explaining the existence of TLG or EDTG based on rigorous econometric analysis and statistical evidence. In a comparable term, why may TLG or EDTG take place in some countries or regions, but not the others? Under what conditions may TLG or EDTG occur? These research questions are yet to be answered.

This study aims to fill the above research gap in the TLG literature by employing a two-step modeling approach. Based on the first-step causality test results with a sample of 29 Chinese provincial regions using annual data from 1978 to 2013, a Bayesian bivariate probit model is used in the second step to identify the determinants of TLG and EDTG trajectories for these regions. We aim to contribute to the current debate over the TLG hypothesis and the economic underpinnings of TLG and EDTG by comparing causality results across different regions within a single country. We select China as the setting for our case study because it has the fourth-largest tourism market worldwide from 2012 onwards in terms of the visitor volume: in 2016, international arrivals reached 59.3 million, and international tourism revenue totaled USD 44.4 billion (UNWTO, 2018). Unlike previous research focusing on a single country/region, we test the TLG and EDTG hypotheses using annual data from 29 provincial regions in China. The statistical results are directly comparable since a common econometric method is applied, the same statistical measurements are used, and all the regions in the sample are from the same economic, political and cultural system within a single country. Based on the Toda-Yamamoto (T-Y) Granger causality test, we utilize Bayesian bivariate/univariate probit models to unveil the factors explaining the four types of causality results: no causality, unidirectional causality from tourism expansion to economic growth (TLG), unidirectional causality from economic growth to tourism expansion (EDTG), and bi-directional causality between the two (TLG and EDTG). Bayesian inference is particularly useful in our context of a small sample to generate finite-sample results based on posterior distribution (Rossi, Allenby, and McCulloch 2012). In summary, this study attempts to shed light on the factors explaining which growth pattern is likely to take place by using advanced econometric methods, and the results are expected to provide scientific evidence to policymakers in formulating appropriate strategic plans to facilitate tourism development.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 *Tourism-led growth*

The theoretical background of the TLG hypothesis is rooted in a conventional export-led growth hypothesis that highlights the vital role of export expansion in stimulating economic growth. Exports contribute to economic growth by diffusing technological knowledge, improving production allocation efficiency, and achieving economies of scale and scope (Brida *et al.* 2016). Regarded as a particular type of export, international tourism helps accumulate foreign exchange earnings, which are vital to import the goods necessary for production in other economic sectors (Castro-Nuño *et al.* 2013). Through these mechanisms, international tourism is likely to facilitate economic growth.

Moreover, as an exogenous part of aggregate demand, international tourism is expected to have a positive effect on national income, and subsequently on employment through Keynesian multiplier effects (Seetanah 2011). As suggested by neoclassical growth theory, some countries specialize in tourism to remedy other competitive disadvantages, such as technological deficiency (Brida *et al.* 2016). In addition, tourism can facilitate the use of resources that are in line with the factor endowment of a country, improve a country's infrastructure, help transfer new technological and managerial skills into an economy, and possibly help create positive linkages with other sectors of the economy including agriculture, manufacturing and other service industries (Modeste 1994, cited in Ridderstaat, Croes, and Nijkamp 2014). The TLG hypothesis has been examined in a large body of empirical literature through the use of various econometric methods (Cárdenas-García and Sánchez-Rivero 2015; Castro-Nuño *et al.* 2013). Notably, Castro-Nuño *et al.* (2013) conducted a meta-analysis based on panel data studies on the TLG hypothesis, and their results confirm the contribution of tourism to economic growth.

However, the TLG hypothesis has been rejected in several countries such as Croatia (Payne and Mervar 2010), Cyprus (Katircioglu 2009), Korea (Oh 2005), Tunisia (Cortés-Jiménez *et al.* 2011), Malta and Egypt (Aslan 2013), and the United States (Tang and Jang 2009). Figini and Vici (2010) showed that even though tourism boosted national economic growth in the 1980s, tourism's stimulation effect worldwide was no longer significant after 1990. Several plausible reasons could explain the lack of TLG in particular countries/regions. Applying a dynamic trade model with four agents, Albaladejo Pina and Martínez-García (2013) found that as an endogenous factor, the quality of tourist services is important in maintaining tourism's role in promoting long-term growth. Another stream of research highlights that the economic stimulation injected by the tourism industry can be transitional, and a high level of tourism specialization can impede long-term economic growth (Lanza, Temple, and Urga 2003).

Lanza *et al.* (2003) and Algieri (2006) suggested that the amount of economic benefit derived from the tourism industry depends on the magnitude of substitution elasticity between tourism and other goods/services. Recently, Cárdenas-García *et al.* (2013) proposed a theoretical framework for understanding the influence of tourism growth on economic expansion from economic, environmental and sociocultural perspectives. The significant contribution of tourism to economic growth occurs only when those benefits outweigh the corresponding costs. Lastly, Ma, Hong, and Zhang (2015) suggested that even though local tourism helps facilitate economic growth, it does not shrink economic disparities between different regions due to the polarizing effect that expands gaps between tourism clusters.

Others have found that tourism growth may have a negative impact on welfare under certain conditions (Copeland 1991). The Dutch Disease effect could be an important danger leading to distortion of the real exchange rate and de-industrialization (Chao, Hazari, Laffargue, Sgro, and Yu 2006). Tourism also could reduce the welfare of local citizens due to trade distortion stemming from inappropriate export taxes and/or import subsidies (Chen and Devereux 1999). With a general equilibrium analysis of the effects of tourism on other economic sectors, Nowak, Sahli, and Sgro (2003) also found that welfare and manufacturing output may fall as a result of increased tourism under certain conditions. Nowak and Sahli (2007) argued that the symptoms of Dutch Disease may

also result from tourism demand shocks, with welfare reduction stemming from labor losses and intense tourism-related land use.

Although it has been recognized as a potential economic development strategy, tourism is not always a panacea for economic growth; only under certain geographic and socio-economic circumstances can tourism growth contribute to economic prosperity (Cárdenas-García and Sánchez-Rivero 2013; Cárdenas-García *et al.* 2013; Fawaz *et al.* 2014; Ivanov and Webster 2013). First, a threshold level of economic development should be achieved before a country develops tourism (Eugenio-Martin *et al.* 2008). Fawaz *et al.* (2014) found that in low-income countries, the impact of international tourism on spurring economic growth is insignificant due to an insufficient level of infrastructure support. Second, Cárdenas-García and Sánchez-Rivero (2013) highlighted the importance of geographic features and appropriate infrastructure in transferring tourism expansion into economic growth. Through an empirical analysis of 144 countries, they found that the TLG hypothesis is not supported in the least-developed countries, and that undesirable geographic features and a lack of infrastructure impede the channeling of tourism earnings toward economic growth. Third, del P. Pablo-Romero and Molina (2013) conducted a thorough review of the empirical literature on TLG and highlighted that the relationship between tourism and economic growth in a country hinges on several factors, including the country's degree of specialization in tourism. Although tourism specialization leads to faster economic growth in small countries (Braun, Lanza, and Pigliaru 2007) and contributes to TLG (Oh 2005), the relationship between tourism specialization and economic growth can be non-linear. Adamou and Clerides (2010) found that tourism has little or even a negative impact on economic growth at high levels of specialization. This argument on the diminishing impact of tourism specialization was further empirically supported by Chang, Khamkaew, and McAleer (2012). Moreover, over-dependence on the tourism industry can be detrimental for sustainable economic growth for at least two reasons (Parrilla, Font, and Nadal 2007): (a) the depreciation of natural resources leads to economic deterioration over the long term; and (b) qualified human capital is scarce in tourism-dependent economies, making it difficult to increase labor productivity, and thus slowing down the economic growth (Parrilla *et al.* 2007).

However other scholars have found that only countries with low levels of economic development can experience TLG. Taking advantage of unique tourism-related resource endowments can be a reasonable economic development strategy for nations with limited capital assets (Yang and Fik 2014). Empirical evidence shows that developing countries always benefit from tourism specialization (Sequeira and Maçãs Nunes 2008). Using a growth decomposition method, Ivanov and Webster (2013) calibrated the impact of tourism on economic growth in 174 countries and found that the impact is highest in Africa, Asia, Latin America and the Caribbean, areas with many less-developed countries. Eugenio-Martín, Martín Morales, and Scarpa (2004) studied the relationship between tourism and economic growth in Latin American countries and suggested that tourism development contributes to national economic growth in countries with a low level of gross domestic product (GDP) per capita. Based on the findings in the literature, we propose our first research hypothesis as follows:

H1: Regions with less-developed economies are more likely to experience tourism-led growth.

After recognizing the mixed results of the causality direction between tourism and economic growth, Kim, Chen, and Jang (2006) suggested that size of an economy can be a determinant of this causality. Sequeira and Maças Nunes (2008) found empirical evidence that tourism's contribution to economic growth decreases once small countries are included in the econometric model, indicating that a small local economy impedes tourism's economic stimulation. Moreover, in several studies, researchers identified a larger economic multiplier of tourism in larger economies (Pratt 2011; van Leeuwen, Nijkamp, and Rietveld 2009). Huse, Gustavsen, and Almedal (1998) argued that a large economic base can provide more diversified economic structure, and as a result, tourism overflows can be more readily absorbed by forward- and backward-linked industries. A diversified economy also enables the tourism industry to connect to suitable local suppliers, thereby boosting the local economy to a larger degree (Robles Teigeiro and Díaz 2014; van Leeuwen *et al.* 2009). To investigate the relationship between economic size and TLG, we propose the following hypothesis:

H2: Regions with larger economies are more likely to experience tourism-led growth.

The geographic area of a region determines its potential to offer a wealth of natural and cultural resources to cater to a wide variety of needs from incoming tourists. According to Lanza and Pigliaru (2000), the relative endowment of natural resources determines the degree to which small economies specialize in tourism and experience the associated fast economic growth. More importantly, according to Luo, Yan, and Yang (2016), Chinese provincial regions covering larger geographic areas tend to have more diverse tourist attractions. As suggested by the first law of geography (i.e., distance decay theory), near things are more related than distant things (McKercher, Chan, and Lam 2008). Therefore, within a geographically large provincial region, those destinations relatively distant from each other within the region are likely to offer different tourist experiences, making the whole region more attractive to tourists as a bundle of diverse tourism products. This variety of attractions can motivate tourists to stay longer and spend more (Leones, Colby, and Crandall 1998), resulting in massive injections of capital into the local economy. Moreover, a wide variety of attractions reduces and mitigates the seasonality of tourist activities because more destinations are likely to be interesting to tourists at different times throughout the year (Claver-Cortés, Molina-Azorín, and Pereira-Moliner 2007). In turn, reduced seasonality alleviates the problem of low-efficiency use of inflexible resources during off-peak seasons and improves a region's ability to sustain economic benefits of tourism in the long run (Koenig-Lewis and Bischoff 2005). Hence, we propose the following hypothesis:

H3: Regions covering larger geographic areas are more likely to experience tourism-led growth.

2.2 Economy-driven tourism growth

Natural resources are not enough to achieve sustainable tourism growth (Croes 2011); local economic growth plays a key role in facilitating local tourism development (Eugenio-Martin *et al.* 2008). As countries experience economic growth and expansion, the concomitant boost in international trade contributes to an increasing number of international arrivals in the form of business travelers (Oh 2005). Moreover, economic expansion leads to increasing physical and human capital and a nurturing economic environment that proliferates tourism growth (Antonakakis, Dragouni, and Filis 2015). In particular, economic growth improves tourism-related infrastructure and service quality (Eugenio-Martin *et al.* 2008) through spillover effects from other

economic sectors (Capone and Boix 2008). More specifically, the investment in some transport infrastructure can be vital to tourism growth (Khadaroo and Seetanah 2007). Lastly, a high level of economic development is associated with a better educational system, which provides sufficient skilled labor to the tourism industry (Eugenio-Martin et al. 2008), thereby enhancing the competitiveness of the destination. In some empirical studies, researchers found a unidirectional causal relationship between local economic expansion and tourism growth, whereas others even suggested a reciprocal relationship between them (Durberry 2004; Kim *et al.* 2006). However, the EDTG hypothesis is not always supported due to different economic conditions of tourism destinations (Balaguer and Cantavella-Jordá 2002; Gunduz and Hatemi-J 2005; Lee and Chang 2008).

Yang and Fik (2014) found empirical evidence of a catch-up effect in regional tourism growth: regions with less-developed tourism industries experience faster tourism growth as they attempt to catch up with the leading regions. A better understanding of the nexus between tourism specialization and economic growth is crucial in a resource-scarce environment as it can provide insightful information as to policies to be implemented: to allocate more resources to the tourism industry aimed at obtaining higher levels of economic growth in the future, or to allocate funds to other tourism-related industries by channeling funds to tourism-related activities. Ridderstaat, Croes, and Nijkamp (2014) found a bilateral causality between tourism development and economic growth in a small island destination (i.e., Aruba), suggesting that tourism is not only an engine for long-term economic growth, but the economic outcome can be an important impetus to provide long-run growth potential to tourism. Recognizing the economic benefits of the tourism industry, those regions with more depressed tourism economies are more motivated to develop tourism by leveraging and allocating existing resources to the tourism sector due to demonstration effects and knowledge transfers from regions where the tourism industry is more developed (Yang and Wong 2012). Therefore, we propose the following research hypothesis:

H4: Less tourism specialized regions are more likely to experience economy-driven tourism growth.

Less developed regions generally lack well-developed secondary sectors (e.g., manufacturing industries); thus tourism has a comparative advantage (Belay 2007). Also, compared to manufacturing industries, tourism requires relatively lower levels of capital and technology inputs. Hence, it is relatively easier to develop and tends to be chosen as an economic strategy for poverty reduction (Croes and Vanegas 2008). Less-developed regions are more willing to allocate the capital assets gained through their economic expansion to support tourism growth in order to leverage the benefits from tourism specialization that are available specifically to under-developed economies (Sequeira and Maças Nunes 2008). Therefore, we propose the following research hypothesis:

H5: Regions with less-developed economies are more likely to experience economy-driven tourism growth.

Tourism, especially international tourism, imposes a substantial demand on high-quality infrastructure to cater to tourists' needs to provide a comprehensive experience of traveling (Akinboade and Braimoh 2010). Oh (2005) studied the relationship between gross domestic

product (GDP) and aggregate tourism receipts, and discovered a one-way causal relationship for EDTG in South Korea. Oh (2005) further argued that the rapid economic expansion in South Korea tend to attract more international travel and lead to an increase in tourism growth. Consistent with Oh's (2005) findings, Tang and Jang (2009) identified a uni-directional causality from GDP to four tourism industries (i.e. airline, casino, hotel, and restaurant industries), suggesting that tourism industries in the USA generally benefitted from economic development in the short term but lacked a long-term equilibrium with the economy. Based on Taiwan's GDP and total tourist arrivals, Kim *et al.* (2006) obtained opposite findings from those of Oh (2005), i.e., the long-run equilibrium and a reciprocal relationship between economic development and tourism expansion were identified. They explained that the difference may arise from the size of the economy: Taiwan is a smaller economy than South Korea and thus is more sensitive to tourism fluctuations. Findings from Kim *et al.* (2006) and Tang and Jang (2009) indicate that a larger economy is more likely to support the EDTG hypothesis. Economies of scale play a dominant role in stimulating EDTG. For the tourism business, owing to scale economies, efficiency is also greater with increasing scale, leading to a lower variable cost (Zhang and Jensen 2007). In a region with a large economic base, the scale economies are more likely to achieve, and because of external economies, many facilities and infrastructure that are not specifically designed for tourism become available to incoming tourists (Capone and Boix 2008). Hence, the relationship between economic size and EDTG can be proposed in the following hypothesis:

H6: Regions with a larger size of the local economy are more likely to experience economy-driven tourism growth.

3. METHODOLOGY

We adopt a two-step approach to empirical analysis. While the first-step analysis involves time series analysis to gauge the occurrences of TLG and EDTG of each provincial region after stationarity, cointegration and causality tests, the second-step analysis is cross-sectional by its nature to investigate factors explaining the occurrences of TLG and EDTG using Bayesian bivariate probit models.

3.1 Stationarity, cointegration, and causality tests

We first use several stationarity, cointegration, and causality tests to test the TLG and EDTG hypotheses for each provincial region. We selected two key variables: one measuring tourism development and the other measuring economic growth. The measurements adopted in this study are in line with the majority of past literature (Corrie, Stoeckl, and Chaiechi 2013). The tourism revenue series (*TR*) is international tourism revenue of the provincial region in 2010 prices that are adjusted by consumer price index and transformed into the local currency of RMB. We measured economic growth as the real gross domestic product (*RGDP*) volume in 2010 prices. We used real terms for all variables, which were expressed as natural logarithms using data from 29 provincial regions in China. All data were obtained from the Chinese Tourism Statistical Yearbook and Chinese Statistical Yearbook (1979-2014). We excluded Sichuan province and Chongqing municipal city due to data unavailability and administrative changes.

To check for the presence of unit roots, we adopted the ERS test proposed by Elliott, Rothenberg, and Stock (1996) and the Ng and Perron test developed by Ng and Perron (2001) to improve the power of the unit root test. We also performed a commonly used stationarity test, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to complement the ERS test. After determining the integration order of the series, we used the cointegration model to examine the long-run equilibrium relationships among the relevant variables since time series are non-stationary. More specifically, we employed bounds tests for cointegration—the autoregressive distributed lag (ARDL) modeling approach proposed by Pesaran *et al.* (2001), which confers the advantage of accommodating variables with different integration orders (Narayan and Narayan 2005). In the model, we included a set of dummy variables to capture the impact of mega-events (e.g., the outbreak of severe acute respiratory syndrome (SARS) in 2003; multiple events in 2008, including the earthquake in Sichuan and visa restrictions before the Olympic Games). We selected optimal lag orders based on the Schwarz Bayesian criterion (SBC) (Pesaran and Shin 1998) and employed the F -test and t -test to test the null hypothesis of no long-run relationship between two variables.

The Granger causality test (Granger 1988) was designed to determine whether the lag(s) of one variable has a statistically significant influence on another variable. In this study we applied a refined causality test proposed by Toda and Yamamoto (1995) to overcome the pretest biases with the traditional Granger causality test (He and Maekawa 2001; Shan and Wilson 2001) by incorporating extra lags into the model to test hypotheses expressed as restrictions on the parameters of vector autoregressive (VAR) models without pretesting unit roots and cointegrating ranks. We estimated an augmented VAR($k + d_{\max}$) model, where k indicates the order of integration and $d_{\max}$ is the maximum order of integration that might occur in the process. We could then test linear or nonlinear restrictions on the first k matrices of coefficients using standard asymptotic theory. Since our focal interest was each unit rather than the entire group, we did not employ the panel Granger causality test further.

3.2 Bayesian bivariate probit model

We adopted a bivariate probit model consisting of two probit equations to understand the joint determination of two dummy variables, y_1 and y_2 . Assume there are two latent variables, y_1^* and y_2^* , such that

$$y_1^* = \mathbf{x}_1\beta_1 + v_1; y_1 = 1 \text{ if } y_1^* > 0; y_1 = 0, \text{ otherwise};$$

$$y_2^* = \mathbf{x}_2\beta_2 + v_2; y_2 = 1 \text{ if } y_2^* > 0; y_2 = 0, \text{ otherwise};$$

$$\begin{pmatrix} v_1 \\ v_2 \end{pmatrix} | \mathbf{x}_1, \mathbf{x}_2 \sim N(\mathbf{0}, \mathbf{\Sigma}). \quad (1)$$

In the model, the disturbance terms v_1 and v_2 are assumed to be correlated under a bivariate normal distribution with a variance-covariance matrix $\mathbf{\Sigma}$. The association between y_1 and y_2 can be captured by the correlation coefficient σ in the matrix. To yield the posterior distribution, we first introduced the prior distribution by assuming a normal distribution for β_1 and β_2 , and an inverted Wishart distribution for the variance-covariance matrix $\mathbf{\Sigma}$ of the error terms. The joint posterior distribution can be written as:

$$p(\beta, \omega, \Sigma | y) \propto \{\prod p(\beta)\} p(\Sigma^{-1}) \{\prod p(\omega | \beta, \Sigma)\} \quad (2)$$

where ω represents the latent value of y . Since the left-hand side term cannot be estimated analytically, we had to resort to simulation methods to draw a sequence of estimates. Following the procedure documented by Edwards and Allenby (2003), we used Gibbs sampling, a Markov chain Monte Carlo (MCMC) algorithm, to obtain a sequence of observations when a stationary distribution is converged independently from the initial status. With starting values of $\omega_{(0)}$, $\beta_{(0)}$ and $\Sigma_{(0)}$, the detailed drawing and sampling algorithm is specified as follows:

$$\omega_{(1)} | \omega_{(0)}, \beta_{(0)}, \Sigma_{(0)}, y \sim N \left(\left(\mathbf{X}\beta_{(0)} - \sigma\gamma'(\omega_{(0)} - \mathbf{X}\beta_{(0)}) \right), \sigma^{-1} \right) \times [I(y = 1)I(\omega > 0) + I(y = 0)I(\omega < 0)] \quad (3)$$

$$\beta_{(1)} | \omega_{(1)}, \Sigma_{(0)} \sim N \left((\mathbf{X}'\Sigma_{(0)}^{-1}\mathbf{X} + \mathbf{A})^{-1}(\mathbf{X}'\Sigma_{(0)}^{-1}\omega_{(1)} + \mathbf{A}\bar{\beta}), (\mathbf{X}'\Sigma_{(0)}^{-1}\mathbf{X} + \mathbf{A})^{-1} \right) \quad (4)$$

$$\Sigma_{(1)} | \omega_{(1)}, \beta_{(1)} \sim \text{Inverted Wishart}(n + g_0, \Sigma(\omega_{(1)} - \mathbf{X}\beta_{(1)})'(\omega_{(1)} - \mathbf{X}\beta_{(1)}) + G_0) \quad (5)$$

where γ' is the row vector of $\Sigma_{(0)}^{-1}$, $\mathbf{A}$ is specified from the prior distribution of β , and g_0 and G_0 are parameters from the prior distribution of Σ . After repeating the whole process for a large number of times, we were able to conduct the analysis based on those simulated values after excluding some values simulated at the beginning. This Gibbs algorithm is also applicable to the Bayesian univariate probit model (Rossi, Allenby, and McCulloch 2012). All model estimation procedures were finished by R package ‘bayesm’ (Bayesian Inference for Marketing/Micro-Econometrics).

Bayesian inference is particularly helpful for two reasons. First, compared to conventional maximum likelihood based estimators relying on asymptotic properties, Bayesian estimates provide the benefits of finite-sample results based on the posterior distribution of parameters (Rossi *et al.* 2012), and overcome the global maximum problem of maximum likelihood estimation, which are particularly useful in our case with a small sample size. Second, under the Bayesian estimation framework, the prior distribution can be specified to incorporate unobserved heterogeneity, which can be explained as the spatial heterogeneity in regional tourism growth in our context (Yang and Fik 2014). For example, this heterogeneity can be explained by the demonstration effect arising from the inter-regional competition in tourism growth. Overlooking this potential unobserved heterogeneity may lead to misleading estimation results.

Based on the results from the Granger causality test, we specified the first probit equation to understand what factors facilitate/hinder the transformation of regional tourism expansion into economic growth, and the second probit equation to help identify what factors influence the channeling of regional economic growth into tourism expansion. Therefore, in Equation (1), $y_1 = 1$ for the TLG cases, and $y_1 = 0$ otherwise, whereas $y_2 = 1$ for the EDTG cases, and $y_2 = 0$ otherwise. To test research hypotheses 1–6, we incorporated the following independent variables to understand the conditions under which a region can experience TLG and/or EDTG:

- $\ln GDP_per$, the log of GDP per capita (in 2010 prices), which represents the level of economic development (De Vita and Kyaw 2016). This variable is included in the TLG and EDTG equations to test Hypotheses 1 and 5, respectively;

- $\ln GDP$, the log of GDP (in 10,000 RMB of 2010 prices), which represents the size of the economy of each region. This variable is included in the TLG and EDTG equations to test Hypotheses 2 and 6, respectively;
- $\ln area$, the log of land area (in 10,000 km²), which represents the land area of each region. This variable is included in the TLG equation to test Hypothesis 3;
- $\ln tour_GDP$, the log of international tourism revenue relative to GDP, which represents the level of tourism specialization and tourism dependence (Zuo and Huang 2018). This variable is included in the EDTG equation to test Hypothesis 4.

Since the dependent variables were measured for a period covering multiple years, we used independent variables at the beginning of study period to reasonably alleviate the endogeneity problem in the econometric model (Lesage and Fischer 2008).

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Results of stationarity, cointegration and causality tests

The time series plots of the focal variables clearly show that real tourism revenue (TR) and real GDP ($RGDP$) for all 29 regions rose steadily over the study period (see Figure 1 for some selected regions as examples). Based on this preliminary result, we included a linear trend in the application of unit root tests. We performed the three unit root tests described earlier using initial data for both the TR and $RGDP$ series; if non-stationarity was detected, we performed the tests using first differences data. The three tests rendered the same results in most cases. Due to space constraints, the results are not reported here but are available upon request. At the 0.05 significance level, 27 TR and 28 $RGDP$ series are $I(1)$, while only two TR series (i.e., Guangdong and Guangxi) and one $RGDP$ series (i.e., Ningxia) are $I(0)$. Since the maximum order of integration $d_{\max}$ is 1 for all of the focal variables, we were able to examine the presence of cointegration between tourism and economic growth for 29 regions in China.

We estimated the long-run relationship between TR and $RGDP$ using the ARDL bounds test procedure. Given the size of our dataset, we selected a maximum order of 2 and chose appropriate lags based on SBC values (Pesaran and Shin 1998). We report the cointegration test results in Table 1. The null hypothesis of no cointegration is rejected, suggesting a cointegration relationship between TR and $RGDP$ for seven regions (Anhui, Guangdong, Hainan, Inner Mongolia, Ningxia, Shaanxi, and Shanghai) since the calculated F - and t -statistics are higher than the upper bound at the 0.05 significance level. The resulting F - and t -statistics show the existence of long-run cointegration relationships between $RGDP$ and TR for two provinces (Jiangxi and Shaanxi). The F -statistics for Guangdong, Guizhou, Hubei, Inner Mongolia, Shanghai, Xinjiang, and Yunnan are higher than the upper bound at the 0.05 significance level; however, their corresponding t -statistics are too small to reject the null hypothesis of no cointegration between $RGDP$ and TR owing to small sample size.

(a) Beijing

(b) Guangxi

(c) Hubei

(d) Jiangsu

Figure 1 Plots of real tourism revenue and real GDP of selected provinces

Note: The solid lines represent real tourism revenue (TR), and the dotted lines real GDP (RGDP).

Table 1 ARDL bounds test and T-Y Granger causality test results

Region	k ($k + d_{\max}$)	T-Y Granger causality tests				ARDL bounds tests			
		H_0 : $RGDP$ does not Granger cause TR		H_0 : TR does not Granger cause $RGDP$		EDTG		TLG	
		χ^2	Dummies	χ^2	Dummies	t -value	F -value	t -value	F -value
Anhui	1(2)	8.784***	D89, D03	0.221	D89, D94	-5.387***	15.148***	-0.944	0.568
Beijing	1(2)	0.309	D89, D94, D03	2.015	—	-1.397	3.648	-0.400	0.361
Fujian	1(2)	4.251***	D03	1.123	D89	-2.573	11.153***	-0.249	0.321
Gansu	2(3)	1.384	D03, D08	3.793	D89	-1.910	4.283	-0.699	0.323
Guangdong	4(5)	5.598	D89	13.001**	D89	-8.754***	46.731***	-3.341	5.929**
Guangxi	3(4)	17.877***	D94, D03	11.504***	D89	-3.072	4.745	-1.717	3.081
Guizhou	2(3)	0.534	D89, D94, D03	8.161**	D89	-3.440	5.990	-2.082	9.480**
Hainan	5(6)	21.957***	D94	4.374	—	-3.549**	6.587**	-0.364	0.483
Hebei	1(2)	0.010	D89, D94, D03	0.202	D89, D94	-0.779	1.382	-1.393	1.631
Heilongjiang	1(2)	5.002	D94	2.232	—	-0.774	5.523	-1.362	0.940
Henan	2(3)	6.797**	D94, D03	2.215	D89	-2.244	5.958**	-0.584	0.204
Hubei	2(3)	3.528	D89, D03	10.204***	—	-0.050	1.796	-2.233	4.958**
Hunan	1(2)	1.518	D03	3.771	D89	-0.354	0.490	-2.302	4.328
Inner Mongolia	4(5)	39.537***	D89, D03, D08	10.079**	D89, D94	-4.582***	10.516***	-3.230	9.510**
Jiangsu	2(3)	9.037**	D89	0.902	D89	-1.984	5.690**	-0.914	1.176
Jiangxi	1(2)	1.636	D89, D03	6.048**	D89	-0.346	2.072	-3.240**	7.086**
Jilin	1(2)	8.833***	D89, D94, D98, D03	0.822	D89	-3.412	6.221**	-1.569	1.936
Liaoning	3(4)	1.039	D89, D94, D03	6.933	—	-1.165	2.128	-2.706	3.705
Ningxia	1(2)	3.723	D89, D03	0.008	—	-5.339***	15.147***	-2.333	2.968
Qinghai	2(3)	0.982	D03, D08	0.240	—	-1.778	2.334	-1.006	0.947
Shaanxi	4(5)	0.602	D89, D94, D03	20.489***	D94	-6.532***	24.458***	-3.801**	8.047**
Shandong	4(5)	10.368**	D94, D03	4.131	—	-1.984	8.391***	-2.336	2.856
Shanghai	1(2)	2.551	D89	0.004	D89	-4.317***	9.749***	-2.799	19.991***

Table 1 Continued.

Region	k ($k + d_{\max}$)	T-Y Granger causality tests				ARDL bounds tests			
		H_0 : $RGDP$ does not Granger cause TR		H_0 : TR does not Granger cause $RGDP$		EDTG		TLG	
		χ^2	Dummies	χ^2	Dummies	t -value	F -value	t -value	F -value
Shanxi	1(2)	1.671	D89, D94, D03	4.222**	D94	-1.994	1.994	-0.579	0.591
Tianjin	5(6)	10.901	–	3.476	D89	-2.711	4.513	-0.773	0.339
Tibet	4(5)	0.762	D03, D08	6.896	D89	-2.423	3.031	-2.370	4.308
Xinjiang	1(2)	1.700	D89, D03	4.554**	D89	-2.338	4.104	-2.908	9.118**
Yunnan	3(4)	5.231	D89	13.477***	D89	-2.245	6.201**	-0.356	6.793**
Zhejiang	2(3)	1.739	D89	1.941	D89	-1.769	3.780	-0.867	0.461
Critical value bounds of the F- and t-statistics ($k = 1$)									
		1%		5%					
		$I(0)$	$I(1)$	$I(0)$	$I(1)$				
F_C		6.84	7.84	4.94	5.73				
F_{CT}		8.74	9.63	6.56	7.30				
t_C		-3.43	-3.82	-2.86	-3.22				
t_{CT}		-3.96	-4.26	-3.41	-3.69				

Note: (1) ***, and ** indicate rejection of null hypothesis at the 1% and 5% significance levels, respectively. (2) The results of lag structure and VAR order are not presented to economize space but they are available from the authors upon request. (3) C: Unrestricted intercept and no trend, CT: Unrestricted intercept and unrestricted trend. (4) D89: a dummy variable for the June Fourth Incident in 1989; D94: a dummy variable for China's RMB exchange rate reform in 1994, D98: a dummy variable for the Asian financial crisis; D03: a dummy variable for the outbreak of Severe acute respiratory syndrome (SARS) in 2003; D08: a dummy variable for the earthquake in Sichuan and visa restrictions prior to the Olympic Games in 2008.

Table 1 shows the T-Y Granger causality test results in 29 regions. The null hypothesis of “*RGDP* does not Granger cause *TR*” is rejected in the cases of Anhui, Fujian, Hainan, Henan, Jiangsu, Jilin, and Shandong at the 0.05 significance level, supporting the EDTG hypothesis in these seven regions. Table 1 also shows that there is strong evidence of unidirectional causality from *TR* to *RGDP* at the 0.05 level of significance in eight regions: Guangdong, Guizhou, Hubei, Jiangxi, Shaanxi, Shanxi, Xinjiang, and Yunnan. Therefore, the TLG hypothesis is empirically corroborated in these regions. In addition, a bi-causal relationship is observed between *TR* and *RGDP* in the cases of Guangxi and Inner Mongolia, suggesting endogeneity or feedback between international tourism revenues and economic growth in Guangxi and Inner Mongolia. Moreover, no Granger causal relationship between tourism and economic growth is found in any direction in 12 regions (i.e., Beijing, Gansu, Hebei, Heilongjiang, Hunan, Liaoning, Ningxia, Qinghai, Shanghai, Tianjin, Tibet, and Zhejiang), as reported in Table 1.

4.2 Results of Bayesian bivariate/univariate probit models

We estimated a series of Bayesian probit models to test the six research hypotheses proposed in Section 2. Following the suggestions from Rossi *et al.* (2012), we specified the prior distribution of parameters as follows:

$$\begin{aligned} \begin{pmatrix} v_1 \\ v_2 \end{pmatrix} &\sim N(0, 0.01 \cdot \mathbf{I}) \\ \Sigma &\sim \text{inverted Wishart}(4, 4 \cdot \mathbf{I}) \end{aligned} \quad (6)$$

where $\mathbf{I}$ is a 2-by-2 identity matrix. We ran 100,000 MCMC draws, and discarded the first 10,000 samples drawn during the burn-in period. The results of these models are presented in Table 2. In the table, the four columns indicate the posterior mean, standard deviation and the lower and upper bounds of the 95% posterior density intervals for each parameter, which is the credible region obtained from the posterior as a direct output of the estimation process. Note that the frequentist notion of significance for the coefficient can be evaluated based on whether or not the posterior density set includes 0. Following the suggestions from Koop, Poirier, and Tobias (2007), a parameter is regarded as “significant” if its associated 95% posterior interval does not include 0. Furthermore, the term “moderately significant” is used if the 90% posterior interval does not include 0. We report the sample proportion of correct prediction as a measure of fit, calculated based on the posterior means of the fitted probabilities (Amisano and Giorgetti, 2013).

We included all six independent variables in the Bayesian bivariate probit model (see Model 1). Four of them have 95% posterior density intervals that do not include 0: $\ln GDP_per$, $\ln GDP$ and $\ln area$ in the TLG equation, and $\ln GDP_per$ in the EDTG equation. Further, $\ln GDP$ in the EDTG equation has a 90% posterior interval that does not include 0. The posterior mean of $\ln GDP_per$ is negative in the TLG and EDTG equations; thus Hypotheses 1 and 5 are supported. The results suggest that the regions with less-developed economies were more likely to experience TLG and EDTG during the study period. The positive and significant posterior means of $\ln GDP$ and $\ln area$ (in the TLG equation) lend support to Hypotheses 2, 3 and 6, indicating that the regions with larger economies and covering larger geographic areas were more likely to experience TLG during the study period. However, Hypothesis 4 is not supported. A possible explanation can be that regions with low dependence on tourism growth are usually endowed with less affluent tourism resources, and the lack of resources can hinder further development of tourism.

Table 2 Results of Bayesian bivariate probit models

	Posterior mean	Posterior S.D.	Lower bound of 95% interval	Upper bound of 95% interval
<u>Model 1 (Bayesian bivariate probit)</u>				
TLE Equation				
<i>lnGDP_per</i>	-3.69**	1.59	-7.32	-1.20
<i>lnGDP</i>	0.94**	0.54	0.069	2.18
<i>lnarea</i>	1.28**	0.60	0.35	2.67
<i>constant</i>	1.28	4.65	-7.35	11.69
EDTG Equation				
<i>Intour_GDP</i>	0.10	0.16	-0.22	0.43
<i>lnGDP</i>	0.56*	0.32	-0.0062	1.24
<i>lnGDP_per</i>	-1.31**	0.69	-2.97	-0.27
<i>constant</i>	4.63	3.82	-1.09	13.77
σ	-0.65*	0.28	-0.97	0.05
N=29				
<u>Model 2 (Bayesian bivariate probit)</u>				
TLE Equation				
<i>lnGDP_per</i>	-3.82**	1.63	-8.57	-1.26
<i>lnGDP</i>	0.95**	0.55	0.046	2.20
<i>lnarea</i>	1.32**	0.62	0.33	2.76
<i>constant</i>	1.54	5.12	-7.97	12.85
EDTG Equation				
<i>lnGDP</i>	0.51*	0.30	-0.045	1.16
<i>lnGDP_per</i>	-1.28*	0.67	-2.84	-0.24
<i>constant</i>	4.81	3.73	-1.06	13.51
σ	-0.63	0.26	-0.96	0.015
N=29				
<u>Model 3 (Bayesian univariate probit)</u>				
TLE Equation				
<i>lnGDP_per</i>	-3.74**	1.34	-6.64	-1.40
<i>lnGDP</i>	0.78*	0.49	-0.069	1.90
<i>lnarea</i>	1.26**	0.57	0.30	2.50
<i>constant</i>	2.75	7.08	-11.12	16.70
N=29				
<u>Model 4 (Bayesian univariate probit)</u>				
EDTG Equation				
<i>lnGDP</i>	0.37	0.33	-0.24	1.06
<i>lnGDP_per</i>	-1.64**	0.78	-3.31	-0.27
<i>constant</i>	7.64*	4.44	-0.21	17.04
N=29				

Note: ** indicates that the 95% posterior interval does not include 0, and * indicates that 90% posterior interval does not include 0.

In Model 2, we excluded *Intour_GDP*, which is not significant in Model 1. The Bayesian estimation results suggest that the 95% posterior density intervals of *lnGDP_per*, *lnGDP*, and *lnarea* in the TLG equation and *lnGDP_per* in the EDTG equation still exclude 0, indicating that they are significant. Moreover, *lnGDP* in the EDTG equation is moderately significant. Hence, the results confirm Hypotheses 1, 2, 3 and 5, and provide moderate support for Hypothesis 6.

Since σ is estimated to be not significant in Model 2, we also estimated the TLG and EDTG equations separately in univariate Bayesian probit models (Models 3 and 4, respectively). The results are very similar to Model 2, showing that the parameters associated with *lnGDP_per* and

$\ln area$ in the TLG equation and $\ln GDP_per$ in the EDTG equation are significant, whereas those associated with $\ln GDP$ in the TLG equation are moderately significant. However, $\ln GDP$ in the EDTG equation is estimated to be insignificant in Model 4 after removing the interconnectedness specification between TLG and EDTG equations.

5. CONCLUSIONS

This study contributes to the debate in the TLG and EDTG literature by further investigating what factors affect the occurrence of TLG or EDTG. Empirical evidence was presented based on rigorous statistical methods including Bayesian inference in a comparable setting of 29 provincial regions in China. In this paper, we started with empirically testing the validity of the TLG and EDTG hypotheses for individual regions using the T-Y Granger causality test. The results indicated a bi-directional causality for two regions (Guangxi and Inner Mongolia), a unidirectional causality from economic growth to international tourism revenue for seven regions, and a reverse causality for eight regions among the 29 provincial regions in China. Different from previous studies, we further employed Bayesian probit models to unveil the key factors explaining the presence of TLG and EDTG. The results suggested that the regions with less-developed economies, larger economies, and covering larger geographic areas are more likely to experience TLG, and those regions less-developed economies are more likely to experience EDTG. It is particularly interesting to note that our results highlighted path dependence in tourism development (Ma and Hassink, 2013), and both EDTG and TLG are more likely to be observed in less developed regions. One potential reason is that with the invested software and hardware in less developed regions to support tourism, these regions' economies are particularly nurturing for tourism economies, and more tourism investment can be budgeted after economic expansion as suggested by EDTG.

This study represents one of the pioneering efforts unveiling region-level factors associated with the occurrences of TLG and EDTG. Although past studies examined some of these factors by categorizing regions/countries into relatively homogenous groups (Lee and Chang 2008) or considering the single threshold effect (Chiu and Yeh 2016), our results provided a list of well-defined factors under rigorous two-step analysis. Unlike previous empirical studies applying panel causality tests to understand the tourism growth – economic expansion nexus across different groups (Lee and Chang 2008), our method is able to highlight individual factors that might be masked in the panel as a group. Also, different from past studies employing (dynamic) panel data model understanding TLG (Zuo and Huang 2018), our method gauged the TLG occurrence based on the first-step individual causality tests instead of the estimated coefficients from the regression, and therefore, its occurrence can be rigorously evaluated.

The findings of the Bayesian bivariate probit models provide further insights into the relationship between tourism and economic growth and provide important policy implications especially for effective resource allocation and policy differentiation given regional characteristics. First, since international tourism development has been found to be an effective strategy for shrinking the income gap across regions, particular policies should be proposed to facilitate TLG, and this strategy should be more promising in less developed areas. For example, to magnify the multiplier effect of tourism through various backward- and forward-linked sectors, inter-sectoral interconnectedness should be strengthened through tactic industrial planning at different levels. In particular, diversifying tourism products can be an efficient way to involve a wider variety of

economic sectors to participate in producing tourism-related outputs. Second, our results highlighted the important role of the size of economies in facilitating TLG, and economies of scale was found to play a salient role in transferring the tourism growth to economic expansion. Therefore, a single large tourism project with more intense investment is preferred to several segmented small projects to magnify TLG.

Our major results also provide implications for poverty reduction policies. As shown in our results, less economically developed regions are more likely to experience TLG and EDTG. Therefore, in various poverty reduction projects, the government should emphasize the important role of tourism in stimulating local economic growth. Once TLG occurs, such regions are able to better catch up with more developed regions through the spillovers from the tourism industry. Also, an EDTG in these regions will further strengthen the effect of tourism growth by allocating extra benefits from overall economic expansion to tourism investments.

Our results may be tempered by some limitations, which suggest directions for future studies. First, due to data unavailability, we were unable to incorporate other factors that may influence the occurrence of TLG and EDTG, such as tourism resource endowments (Lanza and Pigliaru 2000), environmental sustainability (Pulido-Fernández, Cárdenas-García, and Villanueva-Álvaro 2013), investment climate (Cárdenas-García and Pulido-Fernández 2014) and population characteristics (Sánchez-Rivero and Cárdenas-García 2014). We recommend that researchers consider other explanatory variables and use an international dataset for comparison in the future. Second, an application of the Granger causality approach in which annual data are used to investigate the causal relationship between tourism development and economic growth may suffer from small-sample biases. When longer time series or higher frequency (e.g., quarterly or monthly) data are available, more robust findings are likely to be reached. Third, we focused on detecting linear relationships between tourism development and economic growth in this study. Future efforts should probe possible nonlinear relationships between the two. Lastly, we focused on Chinese regions, and these results might not be generalizable to other countries. Hence, we recommend future empirical analysis on regional data of other countries.

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