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Is the domestic tourism cycle synchronized with the economic cycle? Evidence from Mainland China and Taiwan

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ABSTRACT

This study describes the linkage relationships between the economic cycle and the domestic tourism cycle in Mainland China and Taiwan. The Markov-switching vector autoregressive (MS-VAR) model is used to test the relationship between periodic variables. The results show that the domestic tourism cycle and the economic cycle of Mainland China have a reverse fluctuating trend and that in Taiwan, the domestic tourism cycle is synchronized with the economic cycle. Results support that the linkage relationships between the economic cycle and the domestic tourism cycle are different in two economies which has fundamental difference in the development stage and economic institutions.

Introduction

The economic cycle is a cyclical process in which the level of national economic development rises or falls according to its long-term growth trend (Chen & Liu, 2007; W. Z. Chen, 2013). It is a comprehensive reflection of the operation of the three industries and is typically measured through the growth rate of the real gross domestic product (Smeral, 2012). As an important sector of the tertiary industry that serves social life, the tourism cycle reflects the expansion and contraction of tourism activities due to internal and external shocks (Sheng, Zhou, Huang, & Li, 2014), which is generally measured using the growth rate of tourism receipts (Eeckels, Filis, & Leon, 2012; Guizzardi & Mazzocchi, 2010). From 2011 to 2016, the world economy experienced a period of slow growth during which the annual average growth rate of the global GDP was only 2.41% (World Bank, 2016). In contrast, global tourism strengthened from 2011 to 2016, with revenue growth at an annual average rate of 3.97% and a contribution to the global economy that increased from 9.1% to 10% (WTTC, 2016). The important role of tourism growth in the productivity

of a national economy has been recognized by governments worldwide, and many countries have produced strategies to promote their tourism industries as effectively as possible (Dritsakis, 2004; Gee, 1999; Hsu, 2017). For example, the French government promotes the development of food tourism and wine tourism by guiding various regions to develop historical, cultural and heritage resources actively. In addition, in 2012, the United States provided intellectual support to promote the development of the U.S. tourism industry by setting up a special group on tourism competitiveness composed of several government agencies.

As a key component of tourism, inbound tourism has long played a prominent role in balancing the international balance of payments, increasing currency retraction and improving the economic growth level of destination countries; thus, it has been strongly supported by many countries. Consistent with the practice orientation, research on the cyclical linkages between inbound tourism and economy, including comparative studies of relationships between the economic cycle and the international tourism cycle in different

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countries and the analysis of cyclic linkages in an individual country, has also become a focus of academia (Ghosh, 2017; Gouveia & Rodrigues, 2005; Katircioglu, 2009; Smeral, 2012; Wong, 1997).

However, different from the positive response of the research on inbound tourism cycles to its practice, research on the domestic tourism cycle obviously has lagged far behind the development of domestic tourism. Recently, as the global economic situation has become more complex and the instability of the export-oriented growth mode has increased, more regions have begun to stabilize economic growth by balancing exports, investment and consumption and have attached great importance to optimizing the economic growth structure and calming economic fluctuations by expanding domestic demand and encouraging consumption, especially domestic tourism consumption (Kalyanaram, 2009; Pu & Zhao, 2011; Zhao, Xu, & Zhu, 2015). Gradually, the enormous potential of the domestic tourism in optimizing the consumption structure and enhancing the endogenous driving forces of economy has been released. For this reason, both large developing economies such as Mainland China and India and small developed economies such as Taiwan, South Korea and Japan have focused on stimulating the vitality of economic growth by developing domestic tourism (Arlt, 2006; C. L. Chen, 2010; Kang, Kim, & Nicholls, 2014; Liu, 2009; WTTC, 2014). Despite this positive practice, there have been few studies about the linkages between the domestic tourism cycle and the economic cycle, and even fewer comparative analysis based on different economies. However, identifying the linkage between these two periodic variables is the premise for innovating the dimension of economic regulation and building up a macro-control framework which takes into account the stable development of domestic tourism, against a backdrop of the increasingly close relationship between economy and domestic tourism. Therefore, questions that require further study are as follows: What is the linkage relationship between the economic cycle and the domestic tourism cycle? Does this linkage vary in different economies, and how can it be measured accurately? How to formulate targeted strategies to take into account the stable development of both economy and domestic tourism?

To this end, this study uses the MS-VAR model, a cycle measurement tool with strong applicability, and takes Mainland China and Taiwan as cases,

focusing on linkages between economic cycles and domestic tourism cycles in different economies. The main reasons for selecting these two cases for comparative study are as follows. First, there are significant differences between Mainland China and Taiwan in economic institutions and economic development level, and the two are inward-oriented developing economy and outward-oriented developed economy, respectively. Not only do the two regions display typical representativeness in the classification of economic types, the differences between them also indicate that the specific cyclical linkages between the two could be in sharp contrast to each other, which is worthy of studying and could be easily explained from the perspective of economic attributes. Second, since the mid-1990s, both economies have attached great importance to the development of domestic tourism and to its role in invigorating economic growth (C. L. Chen, 2010; Tang, 2014). That is, linkage relationships between the economic cycle and the domestic tourism cycle in these two economies are not only comparable but also have practical significance for improving the synergistic growth level between economy and domestic tourism economy.

The paper contributes to the literature in three aspects. First, the MS-VAR model for measuring cyclical linkages is introduced to accurately quantify the linkage laws between the domestic tourism cycle and the economic cycle in specific economic types, based on which we conduct a comparative analysis. Second, combined with the determine causes of cyclical linkages in specific economic types, the linkage mechanism is explained theoretically. Third, findings from this study provide implications for policymakers and tourism managers about how to better ensure the stable development of both economy and domestic tourism.

The structure of this article is as follows. The next section reviews the related literature on relations between tourism and economy, with an emphasis on the linkages between the domestic tourism cycle and the economic cycle. The third section presents a brief overview of the differences between Mainland China and Taiwan in terms of their economic development stages, economic institutions and domestic tourism development. The fourth section specifies the econometric model and data used, following which we perform model fitting and present empirical findings and comparative analysis. Following the empirical findings, we draw conclusions and discuss

some managerial implications. Then we end this paper by outlining the limitation and future research.

Literature review

The relationship between the economic cycle and tourism

Basically, the economic cycle can be divided into a classical cycle and a growth cycle. The former is the cyclical fluctuation of the absolute level of the national economy and is often divided into four phases: recession, trough, expansion and peak. The growth cycle is the periodic rise and fall of the relative level of the national economy and is usually divided into two phases, expansion and contraction (Chen & Liu, 2007). From the perspective of correlation, there is a structural correspondence between economy and micro-industry sectors, which is like that between a system and units. Therefore, the stable growth of economy provides a basis for the efficient operation of various industrial sectors, especially the tourism industry, which is an important part of a national economy. Consistent with this, relevant studies have shown that changes in income level, employment environment and welfare benefits caused by fluctuations of the economic cycle in source countries will affect the scale of outbound tourism, which will lead to fluctuations of tourism in the main destination countries, especially small island countries, corresponding to the source countries (Croes & Ridderstaat, 2017; Mayers & Jackman, 2011). Furthermore, the economic cycle may also affect the growth of domestic tourism by triggering changes in national income, market opportunities, service quality and the supply scale of tourism products (Sui, Liu, & Yan, 2015). To more accurately quantify the time-varying relationship between the economic cycle and tourism, Divisekera and Kulendran (2006), Bleile (1993), Gouveia and Rodrigues (2005), and Guizzardi and Mazzocchi (2010) incorporate the economic cycle into the tourism demand relationship model and test the applicability of the model using Australia, Germany, Portugal and Italy as examples. The results show that the economic cycle of each country has a significant impact on tourism demand.

The relationship between the tourism cycle and economy

Existing studies explain the characteristics of the tourism cycle from different perspectives. For example, Choi, Olsen, Kwansa, and Tse (1999) analyse the fluctuation law governing cycles in the American hotel industry from 1966 to 1993 from an industrial perspective. M. H. Chen (2010, 2013) and Chen, Lin, and Chen (2015) studied the characteristics and influencing factors of the hotel industry cycle and the tourism market cycle in Taiwan from the industry and market perspectives, respectively. Similarly, Hsu (2017) uses tourism stock index data to measure the fluctuation laws governing Taiwan's travel and tourism market from a market perspective. Besides, Sui et al. (2015) use tourism income data to analyse the inbound and domestic tourism cycle in Mainland China from a macro-perspective. Relevant research results show that fluctuations of tourism cycles are affected by changes in interest rates and exchange rates, inflation, money supply, fiscal policy and other cyclical macro-factors, that is, tourism cycles are closely related to macroeconomic factors. Moreover, case studies of Malaysia (Tang & Tan, 2013), Barbados (Archer, 1984) and Portugal (Andraz, Gouveia, & Rodrigues, 2009) also find that for economies with high dependence on tourism, fluctuations in tourism business affect the macroeconomic trend to a large extent.

Linkage relationships between the tourism cycle and the economic cycle

With the increase of close relationships between tourism and economy, research on linkages between the tourism cycle and the economic cycle has become a focus of academia. According to prior research, linkages between these two cyclical variables can be divided into three aspects, which are described below.

First, the tourism cycle and the economic cycle fluctuate synchronously. Wong (1997) examines the relationship between fluctuations in Hong Kong's inbound tourism and the economic cycle, he demonstrates that the inbound tourism cycle in Hong Kong is consistent with the host country's economic cycle because the demand for international travel increases with economic expansion and decreases with economic contraction. This synchronization has been confirmed in Algarve, Portugal. Gouveia and Rodrigues (2005) find that the U.K., Germany and Finland, as the main inbound tourism markets in Algarve, all display high consistency indexes between fluctuations in inbound tourism and the economic cycle. On this basis, Smeral (2012) increases the study area to 15 EU countries and Japan, finding that the fluctuation

in the outbound tourism of each country is synchronized with its own economic cycle. He believes that the income effect and demand elasticity factors have different effects on tourism consumption expenditure in different periods, leading to the synchronization of economic growth with the expansion and contraction of tourism demand. Further, Sala, Torres, and Farré (2014) take Spain as a case and include the domestic tourism cycle into the cyclical linkage comparison, finding that both inbound and domestic tourism cycles are consistent with the fluctuation of the economic cycle.

Second, the tourism cycle and the economic cycle are not synchronized. Choi et al. (1999) develop a model to measure the hotel industry cycle and uses it to investigate the growth cycle of the hotel industry in the United States. His findings suggest that from 1966 to 1993, the hotel industry cycle in the United States was not synchronized with its economic cycle. Specifically, the peak value of the hotel industry cycle occurs 0.75 years earlier than that of the economic cycle, and its vale value is reached 0.5 years earlier than that of the economic cycle. Guizzardi and Mazzocchi (2010) test the relationship between the tourism cycle and the economic cycle in Italy and find that compared with fluctuations in the economic cycle, Italy's domestic and inbound tourism cycles both present a certain degree of lag. Smeral (2012) pointed out that the correlation between the domestic tourism cycle and the economic cycle in Japan show reverse trends in their fluctuations due to the periodic effects of economic expansion and contraction. Specifically, economic expansion stimulates outbound tourism growth and leads to insufficient domestic tourism consumption, whereas economic contraction weakens the substitution effect of outbound tourism on domestic tourism and in turn promotes increased domestic tourism consumption. This reverse fluctuation relationship also exists between the economic cycle and the domestic tourism cycle in Mainland China (Li & Ma, 2017).

Third, there is no obvious co-movement relationship between these two periodic variables. Oh (2005) investigates the relationship between tourism receipts and economic growth in South Korea, and the result suggests that between 1975 and 2001, there is no long-term relationship between tourism growth and the economy in Korea. In addition, Katircioglu (2009) analyses the relationship between Turkey's inbound tourism and economic growth and finds that regardless of which co-integration test method is adopted, the two variables are not co-integrated, that is, there is no linkage between the two periodic variables. This form of nonobvious interactive relationship has also been confirmed in studies on linkages between inbound tourism demand and the economic cycle in Australia, Canada, and India (Ghosh, 2017; Smeral, 2012).

In addition, cycle measurement methods commonly used in the tourism literature include autoregressive integrated moving average (ARIMA) model, the Kalman filter model and the linear trend method (Chen et al., 2015). Although these models have strong applicability to variable data following linear stationarity, they cannot simulate the asymmetry of expansion and contraction of periodic variables with nonlinear structure. In contrast, the Markov-switching vector autoregressive (MS-VAR) model, a cycle measurement tool that is commonly used in the economic literature, can overcome this defect (Owyang, Piger, & Wall, 2005). It uses economic variables whose states can easily change to reveal the structurally dissimilar characteristics of economic behaviour under different mechanisms and to illustrate relationships among economic behaviours during their dynamic evolution, and it can accurately describe periodic conversion procedures and growth rate transition nodes of economic variables through smooth probability curves; thus, it is more scientific than the above-mentioned models. For this reason, this method is typically used to explore the synchronization of different countries' economic cycles or industrial cycles (Kong & Xu, 2008; Owyang et al., 2005; Wall, 2006). In addition, the nonlinear simulation of the co-movement of economic cycles provided by the MS-VAR model can identify the structural adjustment process of economic variables, which has more economic significance. Due to its strong applicability, this model has been gradually introduced into the study of tourism cycles; Sui et al. (2015), and Li and Ma (2017) use the MS-VAR model to measure the linkage between the tourism cycle and the economic cycle in Mainland China. Although there are some deficiencies in these studies, such as lack of explanation of mechanisms or failure to re-test the periodic variables' relationship after eliminating the price impact, the results nevertheless reflect the strong applicability of the MS-VAR model.

In summary, current research on economic cycle linkages mainly focusses on relationships between the economic cycle and the inbound tourism cycle, while the linkages between the economic cycle and

the domestic tourism cycle, especially comparative research on periodic linkages between different types of economies, have failed to receive the necessary academic attention. Specifically, at the case study level, although linkages between the economic cycle and the domestic tourism cycle in Mainland China have been discussed, there are some problems such as insufficient explanation of mechanisms or lack of re-examination of periodic variables after excluding the price impact. Besides, the research that has been conducted in Taiwan mainly focuses on the single-cycle characteristics of tourism, while research on linkages between the economic cycle and the domestic tourism cycle is particularly deficient. Therefore, it's necessary to provide a comparative study of Mainland China and Taiwan on linkages between the economic cycle and the domestic tourism cycle based on accurate measurement methods, refined data sources and different economic types. This not only supplements and reconfirms the existing case studies but also enriches the theory of relationships between economy and tourism.

Economic development and domestic tourism in Mainland China and Taiwan

China is divided into two parts, Mainland and Taiwan Province, with the Taiwan Strait as the boundary. For historical reasons, these two regions have been under separate governance, and their developmental stages and economic institutions also show considerable differences.

Mainland China's economic development and domestic tourism

Since 1950, Mainland China has undergone a gradual process of economic reform, resulting in the establishment of a socialist market economy governed by both market and macro-control. With continued reforms, the industrial structure has been continuously upgraded and capital investment has continued to strengthen and promote economic growth. Now Mainland China has grown into a developing economy jointly led by the manufacturing and service industries, and it follows an investment-driven growth mode. Prior to 1978, Mainland China had a planned economic institution and adopted a "catch-up" strategy that prioritized the development of heavy industries, initially following a development mode that promoted economic growth mainly by

increasing capital investment (Yao, 2005). However, economic inefficiency caused by the growth mode led Mainland China to initiate its first round of economic reforms in 1978. It began to implement an economic institution based on a planned economy and supplemented with macro-control. While reducing some mandatory production, the economy began to support the development of light industry and services. Meantime, growth through investment remained the driving force and continued to strengthen (Chang, 2009).

To further enhance economic growth, Mainland China implemented a second round of reform in 1992 in which it established a socialist market economy where market played a fundamental role in resources allocation under macro-control. Correspondingly, Mainland China began to enter a period of rapid development. From 1992 to 2000, the manufacturing industry has been occupied the dominant position and the service industry has gradually grown into a second pillar of the economy (Jian & Ye, 2011). By 2016, the three components of the industrial structure were distributed 8.6:39.8:51.6, which means Mainland China had successfully completed its structural transition from an industrial-driven structure to one driven by both manufacturing and service industries (NBS, 2016a). However, the portion of the economy represented by the service industry is still somewhat small compared with that of developed economies (i.e. 60–70%). In addition, the contribution rate of investment to economic growth was greater than 60% during the period of 2000–2016. Additionally, capital is concentrated in monopoly industries with high and rapid profits, such as the real estate, energy and heavy chemical industries.

From 1978 to 1990, Mainland China prioritized the development of inbound tourism as a means of earning more foreign exchange; on the domestic side, it adopted a policy of "not advocating, not propagating, and not opposing" during this period. Not until the early 1990s, when Mainland China entered the socialist market economy period, was domestic tourism supported. Accordingly, collection of statistics on Mainland China's domestic tourism began in 1994. Although domestic tourism had a late start, it has developed quite rapid. Since 1994, the average proportion of total tourism receipts contributed by domestic tourism reached 75%, and this proportion increased to 98% in 2015, indicating that domestic tourism now plays the leading role in tourism development in Mainland China (Li & Ma, 2017).

Taiwan's economic development and domestic tourism

Since the 1960s, Taiwan's economic institution has undergone two major rounds of transition, eventually establishing a market economic institution. With the gradual transition of its economic institution, Taiwan's industrial structure has been gradually upgraded, and its export-oriented growth mode has been continuously strengthened, resulting in the formation of an export-oriented developed economy. In the late 1950s, Taiwan had a controlled economy and the government imposed strict regulations on economic activities. However, stagnant economic growth caused by the economic institution led Taiwan to initiate the first round of economic reform. From 1958 to 1961, opportunities in the world of capitalism were booming, and the international division of labour was being adjusted; thus, Taiwan promoted the development of export industries by establishing a market economy with partial liberalization. This reform not only created conditions that support rapid industrialization and export-oriented growth but also compensated for Taiwan's limited domestic demand and its insufficient promotion of economic growth. From 1952 to 1981, the proportion of GDP contributed by manufacturing industry increased from 17.8% to 41.1%, and the proportion of total foreign trade rose from 18% to 88.89% (Li & Wu, 2009).

To improve the efficiency of economic growth by expanding the scope of market regulation, Taiwan implemented a second round of reform in 1986. Specifically, it promoted industrial upgrading and trade restructuring by establishing a fully liberalized market economy. Through which the position of Taiwan's service industry has gradually increased since the 1990s. By 2007, the service sector accounted for 71% of the economy. At this point, Taiwan's industrial structure was comparable to those of developed economies and was characterized by strong coupling between service industry development and economic growth. In addition, the value of Taiwan's total foreign trade increased from $121.9 billion to $420 billion from 1990 to 2007; accordingly, the share of GDP contributed by foreign trade increased from 74.1% to 109.2% (Li & Wu, 2009). Taiwan's export-oriented growth mode is gradually maturing and the development of foreign trade now can directly affect the prosperity and decline of economy.

Taiwan, an export-oriented developed economy, has encouraged the development of inbound tourism since 1956, while domestic tourism has never been valued. It was not until the mid-1990s that domestic tourism was supported to promote economic growth. Correspondingly, the collection of data on tourism officially began in 1997. Although domestic tourism started late, it has developed rapidly. From 1998 to 2016, the annual average proportion of domestic tourism revenue in Taiwan exceeded 55%. As the proportion of domestic demand increases, the stabilizing effects of tourism on Taiwan's economic growth will continue to increase (Wu, Ou, & Zhang, 2017).

Data and methodology

Index selection and data source

Generally, the growth rate is the most effective indicator for measuring the economic cycle (Ma, 2014). Using the growth rate to measure the relationship between two economic variables is equivalent to processing the absolute index as a first-order difference from which the interference of long-term trends can be largely extracted, which causes the measurement to be more consistent with the actual economic situation (Jia & Guo, 2008). For example, Lin and Wang (2013), and Jia and Guo (2008) use the GDP growth rate to measure the economic cycle, Zhang and Lu (2004), and Sui and Liu (2014) probe the tourism cycle using the growth rate of tourism receipts. Therefore, in this study, time-series data on the real *GDP* growth rate deflated by the consumer price index are used to describe the trend of the economic cycle; the rates of GDP growth in Mainland China and Taiwan are referred to as *MGDPG* and *TGDPG*, respectively (Table 1). At the same time, time-series data on actual domestic tourism receipts adjusted by the consumer price index are used to describe the trend of the domestic tourism cycle; the rates of tourism revenue growth in Mainland China and Taiwan are referred to as *MTRG* and *TTRG*, respectively (Table 1).

Table 1. Notations for variables.

Variable	Notation
Growth rate of domestic tourism revenue in Mainland China	*MTRG*
Growth rate of GDP in Mainland China	*MGDPG*
Growth rate of domestic tourism revenue in Taiwan	*TTRG*
Growth rate of GDP in Taiwan	*TGDPG*

The data used in this study were obtained from the China Statistical Yearbook (1993–2016), the Analysis and Prospect of the Economic Situation in Taiwan (1997–2016), the Yearbook of China Tourism Statistics and the annual report on Taiwan's sightseeing statistics. Given that domestic tourism in Mainland China officially began in the early 1990s and that the collection of domestic tourism data began in 1994. To ensure that all the economic variables are followed through at least one complete cycle, the study period ends in 2016. In fact, relevant studies demonstrate that Mainland China's economy had experienced three cycles of growth between 1991 and 2016 (W. Z. Chen, 2013; Liu, 2009, 2011), while the tourism in Mainland China had experienced four cycles of growth between 1994 and 2013 (Sheng et al., 2014). Thus, the economic variables examined in this paper complete at least two cycles over the study period (1994–2016), namely data series in this study meet the requirements for cycle measurement. Likewise, the collection of statistics on domestic tourism in Taiwan began in the mid-1990s; accordingly, the study period for Taiwan begins in 1998 and ends in 2016, spanning 19 years. We also found that Hu confirmed that Taiwan's economy experienced two cycles in 1991–1999 and 2000–2009 (Hu & Li, 2010; Sun, 2015). Thus, the time span selected for Taiwan also meets the basic requirement that the selected economic variables complete at least one cycle over the study period.

Methodology

In this paper a dichotomy is used to define phases of the economic cycle, that is, economic growth and domestic tourism growth are likely only in the contraction regime or in the expansion regime. Based on this, the MS-VAR model is then built and used to identify the linkage relationship between the two periodic variables, and the specific process is as follows:

Consider a traditional VAR model given by

$$y_t = v + \lambda_1 y_{t-1} + \ldots + \lambda_p y_{t-p} + \varepsilon_t,$$
$$t = 1, 2, \ldots, T \tag{1}$$

Here, $y_t = (y_{1t}, \ldots, y_{kt})$ is a k-dimensional vector in which y_{kt} is the periodic variable and $t = 1, 2, \ldots, T$. Accordingly, in this paper, $k = 2$; $y_t = (GDPG_t, TRG_t)$ denotes a combination of periodic variables in which the indicator $GDPG_t$ expresses economic growth and TRG_t expresses domestic tourism growth, meeting the condition that $GDPG_t$ and TRG_t are either stationary sequences or co-integrated. T is the time span, v is the intercept or the mean of the equation according to the equation setting, λ_k is the coefficient matrix of the delay item, and $\lambda_k = (A_{k1}, \ldots, A_{kp}, B_{k1}, \ldots, B_{kp})$; p is the lag order, and $\varepsilon t \sim$ IID$(0, \sigma)$ denotes the error term. For convenience, suppose that $p = 1$ and $\varepsilon t \sim$ NID $(0, \sigma)$ is normally distributed; then Equation (1) can be converted into a VAR(1) model with an intercept, as shown below:

$$GDPG_t = v_G + A_{11}GDPG_{t-1} + B_{11}TRG_{t-1} + \varepsilon_t$$
$$TRG_t = v_T + A_{21}TRG_{t-1} + B_{21}GDPG_{t-1} + \varepsilon'_t \tag{2}$$

where v_G and v_T are both intercept items and represent the spontaneous growth of economy and domestic tourism, respectively. In this sense, the intercept item represents economic growth that occur when economic behaviours are completely determined by the law of market value under a specific economic institution, policy environment, and supply and demand level. Thus, these two parameters are key indicators for determining the cycle phase. In this model, t-period explanatory variable is implied in the error term when variables' relationships are set. This is because, as a non-restrictive econometric model, the VAR model is not based on strict economic theories. Instead, it takes each endogenous variable as a function of the lag term of all endogenous variables based on the statistical properties of data. All variables in the equation are endogenous variables, and the lag term as explanatory variables are known in the t period. Meanwhile, the predictive relational structure formed by lag terms and the dependent variable is also a pre-defined inherent form. In the case that the right side does not contain t-period variables, parameters can be estimated by the OLS method, then the long-term relationship between endogenous variables and predict variables' evolution trend can also be clarified. This can well avoid the problems existing in traditional structural models based on economic theories, including difficult identification of model parameters, complex division of endogenous and exogenous variables, and weak interpretation of the model with many restrictions due to t-period explanatory variables are added. Accordingly, the establishment of regression equation based on variables' lag term is also a common practice to explore the long-term relationship between economy and tourism (see e.g. Chingfu & Songzan, 2009; Croes & Ridderstaat, 2017; Dritsakis, 2004; Kim, Chen, & Jang, 2006;

Surugiu & Surugiu, 2013; Tang & Abosedra, 2014). In addition, the VAR model can be used closely in combination with Granger causality test. Where, if the variable y is significantly affected by the lag term of variable x, they are said to have Granger causality.

Furthermore, if Equation (2) is transformed into a VAR (1) model with a mean item, it can be expressed as follows:

$$
\begin{aligned}
GDPG_t - \mu G &= A_{11}(GDPG_{t-1} - \mu_G) \\
&+ B_{11}(TRG_{t-1} - \mu_G) + \varepsilon_t \\
TRG_t - \mu T &= A_{21}(TRG_{t-1} - \mu_T) \\
&+ B_{21}(GDPG_{t-1} - \mu_T) + \varepsilon'_t
\end{aligned}
\tag{3}
$$

where μ_G and μ_T are the two-dimensional means of the periodic variables representing the average growth levels of economy and domestic tourism, respectively. Furthermore, all parameters in the vector group $y_t = (GDPG_t, TRG_t)$ depend on the unobserved discrete variable S_t. Meanwhile, $S_t \in \{1, \dots, M\}$ represents the dominant regime at time t, following the Markov process, which is irreducible and traverses M kinds of regimes with a transition probability $P_{ij} = \Pr(S_t + 1 = j | S_t = i)$, $\sum_{ij}^{M} P_{ij} = 1$, $\forall\, i, j \in \{1, \dots, M\}$. Thus, by introducing S_t into the VAR model, a nonlinear MS-VAR model with a mean item can be established as follows:

$$
\begin{aligned}
y_t - \mu(S_t) &= A_1(S_t)(y_{t-1} - \mu(S_{t-1})) + \dots \\
&+ A_P(S_t)(y_{t-p} - \mu(S_{t-p})) + \varepsilon_t
\end{aligned}
\tag{4}
$$

In Equation (4), $\varepsilon_t \sim \text{IID}(0, \sigma(S_t))$, $\mu(S_t)$, and $A_1(S_t), \dots, A_P(S_t)$ are all parameter-transfer functions that are used to describe the dependency of time-varying parameters (i.e. μ, $A_1, \dots, A_P$ and ε_t) on the regime variable S_t. In addition, $\mu(St)$ is subject to the following conditions:

$$
\mu(St) = \begin{matrix} \mu_1 & S_t &= 1 \\ \vdots & \vdots & \\ \mu_M & S_t &= M \end{matrix}
\tag{5}
$$

Then, Equation (4) can be transformed into an MS(2)-VAR(1) model as follows:

$$
\begin{aligned}
GDPG_t - \mu_G(S_t) &= A_{11}(S_t)[GDPG_{t-1} - \mu_G(S_t)] \\
&+ B_{11}(S_t)[TRG_{t-1} - \mu_G(S_t)] + \varepsilon_t(S_t) \\
TRG_t - \mu_T(S_t) &= A_{21}(S_t)[TRG_{t-1} - \mu_T(S_t)] \\
&+ B_{21}(S_t)[GDPG_{t-1} - \mu_T(S_t)] + \varepsilon'_t(S_t)
\end{aligned}
\tag{6}
$$

In Equation (6), $M = 2$ (i.e. $S_t = 1,2$) indicates that the combination of periodic variables is switched in two regimes, including S_1 and S_2, and $\mu(S_t)$ represents the mean level of the periodic variable that varies with the regime's change; if both $\mu_G(S_t)$ and $\mu_T(S_t)$ meet the condition that their values in S_1 are greater than their values in S_2 (i.e. $\mu_1 > \mu_2$), then when GDPG and TRG switch from S_1 to S_2, their growth levels have switched from the expansion regime to the contraction regime. Furthermore, if the smoothed probability value at time t meets the condition $\Pr(S_t = i | I_t) > 0.5$ (i represents the information set of the past t periods), then the combination of the periodic variables ($GDPG_t$, TRG_t) is in regime i ($i = 1, 2$).

Similarly, when $p = 1$ and $M = 2$, Equation (6) can be converted into an MS(2)-VAR(1) model with an intercept item as follows:

$$
\begin{aligned}
GDPG_t &= v_G(S_t) + A_{11}(S_t)GDPG_{t-1} \\
&+ B_{11}(S_t)TRG_{t-1} + \varepsilon_t(S_t) \\
TRG_t &= v_T(S_t) + A_{21}(S_t)TRG_{t-1} \\
&+ B_{21}(S_t)GDPG_{t-1} + \varepsilon'_t(S_t)
\end{aligned}
\tag{7}
$$

where $M = 2$ (i.e. $S_t = 1,2$) indicates that the combination of periodic variables switches between S_1 and S_2 and $v(S_t)$ represents the spontaneous growth level of the periodic variables in S_t; if both $v_G(S_t)$ and $v_T(S_t)$ meet the condition that their values in S_1 are higher than their values in S_2 (i.e. $\mu_1 > \mu_2$), then when GDPG and TRG switch from S_1 to S_2, their growth levels have switched from the expansion regime to the contraction regime. Furthermore, if the smoothed probability value at time t meets the condition $\Pr(S_t = i | I_t) > 0.5$, then the combination of the periodic variables ($GDPG_t$, TRG_t) is in regime i ($i = 1, 2$).

Data test and model fitting

In this section, the ADF, DF and Ng–Perron tests are conducted to examine the stationarity of all variables, and the Engle–Granger (E–G) two-step method is used to test for cointegration of the periodic variables. Furthermore, if the variable data are fit for modelling, the model parameters are estimated using the OX-MS software package, which runs on the Givewin2 platform.

Data stationarity and cointegration test

The data series for the MS-VAR model must either be stationary or have a cointegration relationship. In view of this, the ADF, DF and Ng–Perron tests are employed to examine the stationarity of the data series; of these,

Table 2. Cointegration tests for periodic variables.

Name	Variable	Ng–Perron test				ADF test	DF test	Conclusion
		MZa	MZt	MSB	MPT			
Original sequence	MTRG	−10.1	−2.23	0.22	9.10	−1.9*	−1.54	Not stationary
	MGDPG	−4.35	−1.38	0.32	20.03	−1.22	−1.66	Not stationary
	TTRG	−8.99**	−2.11**	0.23**	2.76**	−4.32***	−4.4***	Stationary
	TGDPG	−7.71*	−1.93*	0.25*	3.27*	−2.80***	−2.68***	Stationary
First-order difference	△MTRG	−7.71*	−1.96*	0.25*	3.19*	−17.0***	−5.40***	Stationary
	△MGDPG	−27.1***	−3.67***	0.14***	3.39***	−5.14***	−3.53***	Stationary
Unbalanced error	e_t	−10.2**	−2.25**	−0.22**	2.43**	−1.97**	−1.96**	Stationary

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

the Ng–Perron test is the most powerful and reliable for small data sets. As shown in Table 2, TTRG and TGDP are both stationary sequences at the 10% significance level, whereas MTRG and MGDPG are not stationary at the 10% significance level. However, after taking the first difference, both △MTRG and △MGDPG are stationary and integrated sequences of order 1 at the 10% significance level, indicating that there may be a cointegration relationship between these two variables. Furthermore, the E–G two-step method is used to determine whether there is a cointegration relationship between MTRG and MGDPG. First, cointegration regression is performed for MTRG and MGDPG using OLS to obtain the nonequilibrium error e_t. Second, the unit root of e_t is tested; if e_t is stationary, then there is a cointegration relationship between the two periodic variables. Finally, the result shows that e_t is stationary at the 5% significance level and MTRG and MGDPG indeed have a cointegration relationship, meeting the requirements for the MS-VAR model.

Model fitting and stability test

When it has been confirmed that the data are fit for modelling, the optimal model is selected. The lag order of variables is determined based on the smallest value of the Akaike information criterion (AIC) (Dielman, 1986) and Schwarz's Bayesian criterion (SBC, Schwarz, 1978). The stability of the model is then judged according to the resulting chart of the unit root test, and the model's applicability is judged according to the results of its linear fitting.

The results show that for the combination of MTRG and MGDPG, the AIC and SBC values of the MSIAH(2)-VAR(1) model are the smallest, indicating the best fit. In this model, the regime number is 2, the lag term is 1, and the coefficient of the intercept, the lag term, and the variance all change with the regime changes. Meanwhile, two unit roots of the model all fall within the unit circle (Figure 1), indicating that the stability of the model is high. Furthermore, the linear fitting test value is 90.70, and the value of the chi-square statistic is less than 1%; thus, the null hypothesis that a linear relationship exists between the two periodic variables is rejected, and MSIAH(2)-VAR(1) is suitable for measuring the relationship between MTRG and MGDPG.

For TTRG and TGDPG, the AIC and SBC values for the MSIAH(2)-VAR(2) model are the smallest. In this model, the lag term is 2, and the coefficient of the intercept, the lag term, and the variance all change with the regime changes. In addition, four unit roots of the model all fall within the unit circle (Figure 2), which means that the stability of the model is very high. Furthermore, the linear fitting test value is 80.33, and the value of the chi-square statistic is less than 1%; this means that the null hypothesis that a linear relationship exists is rejected and MSIAH(2)-VAR(2) is suitable for measuring the relationship between TTRG and TGDPG.

Empirical results and analysis

Preliminary results of model parameters

The parameter estimates of the MS-VAR model are summarized in Table 3. The intercept values of MTRG in S_1 and S_2 are 18.9% and −9.4%, respectively; the former is higher than the latter, indicating that S_1 and S_2 are the expansion and contraction regimes, respectively, of the domestic tourism cycle of Mainland China. In addition, the intercept values of MGDPG in S_1 and S_2 are 3.6% and 3.8%, respectively; the former is lower than the latter, indicating that S_1 and S_2 are the contraction and expansion regimes of the economic cycle respectively. The above test results show that S_1 is the state in which domestic
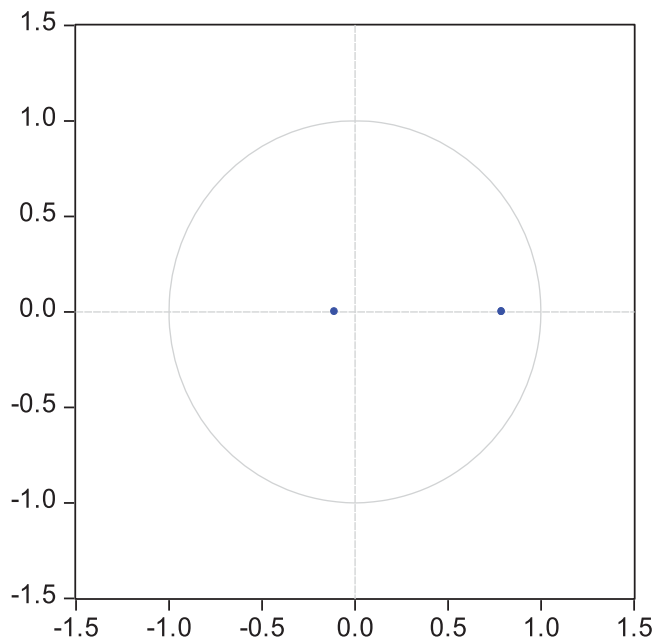
Figure 1. Unit root test of MSIAH(2)-VAR(1).

tourism expands and economy contracts and that S_2 is the state in which domestic tourism contracts and economy expands. That is, the domestic tourism cycle and the economic cycle in Mainland China show opposite trends. Furthermore, the standard deviation of *MTRG* in S_1 (0.042) is significantly smaller than that in S_2 (0.126), which indicates that the phase of domestic tourism expansion exhibits less volatility and stronger resistance to external shocks than the phase of tourism contraction.
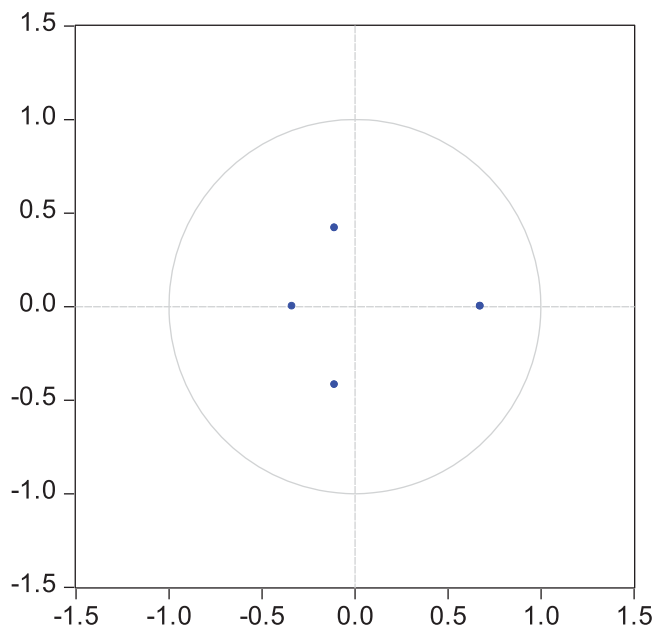

Figure 2. Unit root test of MSIAH(2)-VAR(2).

Table 3. Estimated results for parameters based on the MS-VAR model.

Parameter	MTRG	MGDPG	TTRG	TGDPG
v_1	18.9%	3.6%	−9.7%	−0.4%
v_2	−9.4%	3.8%	16.6%	5.5%
$A_1^{P=1}$	−0.088**	0.46***	−0.743***	0.313***
$B_1^{P=1}$	−0.366***	−0.003	0.510***	−0.021*
$A_2^{P=1}$	−0.244*	0.796***	0.292***	−0.368***
$B_2^{P=1}$	2.521***	−0.02*	0.433***	−0.143***
$A_1^{P=2}$	–	–	−0.385***	−0.043*
$B_1^{P=2}$	–	–	1.747***	0.115***
$A_2^{P=2}$	–	–	−0.586***	0.485***
$B_2^{P=2}$	–	–	−2.566***	−0.061***
σ_1	0.042	0.008	0.086	0.025
σ_2	0.126	0.016	0.043	0.019

Notes: (1) v_j represents the intercept item on regime j. (2) A_j^P represents is the coefficient of the lag term of the dependent variable on regime j when its lag order is p; for example, when TTRG is the dependent variable, $A_1^{P=1}$ and $A_2^{P=1}$ are coefficients of $TTRG_{t-1}$ at regime 1 and regime 2 respectively; $A_1^{P=2}$ and $A_2^{P=2}$ are coefficients of $TTRG_{t-2}$ at regime 1 and regime 2, respectively. B_j^P represents the coefficient of the second explanatory variable on regime j when its lag order is p; for example, when TTRG is the dependent variable, $B_1^{P=1}$ and $B_2^{P=1}$ are coefficients of $TGDPG_{t-1}$ at regime 1 and regime 2, respectively; $B_1^{P=2}$ and $B_2^{P=2}$ are coefficients of $TGDPG_{t-2}$ at regime 1 and regime 2, respectively. In addition, *, **, and *** represent coefficients at 10%, 5%, and 1% significant levels, respectively. (3) σ_j represents the standard deviation of the periodic variable on regime j.

However, the standard deviations of MGDPG in both S_1 (0.008) and S_2 (0.016) are small, showing that economy exhibits a steady "microwave." Notably, these results are consistent with those of Lin and Wang (2013).

The intercept value of TTRG in S_1 and S_2 are −9.7% and 16.6%, respectively; the former is lower than the latter, indicating that S_1 and S_2 are the contraction and expansion regimes, respectively, of the domestic tourism cycle. The intercept value of TGDPG in S_1 and S_2 are −0.4 and 5.5%, respectively; the former is lower than the latter, also indicating that S_1 and S_2 are the contraction and expansion regimes of the economic cycle, respectively. The above test results show that S_1 is the contraction state of Taiwan's domestic tourism and economy and that S_2 is the expansion state of domestic tourism and economy. That is, the domestic tourism cycle in Taiwan is synchronized with its economic cycle. Furthermore, in terms of the economic behaviour reflected by the standard deviation, the standard deviation of TTRG in S_1 (0.086) is larger than the standard deviation of S_2 (0.043),

indicating that Taiwan's domestic tourism expansion phase exhibits little volatility. However, the standard deviations of TGDPG in S_1 (0.025) and S_2 (0.019) are both small, showing that economic fluctuations in Taiwan also exhibit a "microwave."

In the model, the regime transfer probability and the state duration are used to reflect the probability and frequency, respectively, of periodic variables in different regimes. Table 4 shows the relevant results for Mainland China. First, the maintenance probability of S_1 (0.822) is higher than that associated with switching to S_2 (0.178), and the maintenance probability of S_2 (0.770) is higher than that associated with switching to S_1 (0.230); this indicates that both S_1 and S_2 exhibit high stability. Second, the average durations of S_1 and S_2 are 5.62 and 4.34 years, respectively. Obviously, the duration of S_1 is longer than that of S_2.

The results for Taiwan are shown in Table 5. First, the maintenance probability of S_1 (0.885) is higher than that of switching to S_2 (0.115), and the maintenance probability of S_2 is higher than that of switching to S_1, indicating that the stability of S_1 and S_2 are both high. Second, the average durations of S_1 and S_2 are 8.69 and 8.54 years, respectively.

Periodic phase division and analysis

Periodic phase and analysis of Mainland China

In the model, switching of the economic cycle phase is depicted by a smoothed probability curve in the form of a probability distribution. The value of the probability distribution is the direct basis for the division of cycle phases, which is subject to the following rules: if the probability of a periodic variable falling in the expansion regime is greater than 0.5, the periodic variable is in the expansion phase at that time; otherwise, it is in the contraction phase (Liu, 2011; Wang & Ai, 2010).

As shown in Figure 3, the smoothed probability curve of MTRG and MGDPG circulates in and out of different regimes, reflecting the cyclical characteristics of economy and domestic tourism of Mainland China and indicating that these economic variables alternate between expansion and contraction regimes. In addition, over the periods of 1994–1999, 2008–2009,

Table 4. Transition probabilities and state durations of the regimes (MGDPG, MTRG).

	Regime 1	Regime 2	Sample size	Frequency	Average duration	Corresponding years
Regime 1	0.822	0.178	12.6	0.564	5.62	1994–1999, 2008–2009, 2012–2016
Regime 2	0.230	0.770	10.4	0.436	4.34	2000–2007, 2010–2011

**Table 5.** Transition probabilities and state durations of the regimes (*TGDPG, TTRG*).

	Regime 1	Regime 2	Sample size	Frequency	Average duration	Corresponding years
Regime 1	0.885	0.115	10	0.506	8.69	2000–2009
Regime 2	0.117	0.883	9	0.496	8.54	1998–1999, 2010–2016

and 2012–2016, the smoothed probability of S_1 is greater than 0.5, which means that these three periods are phases of economic contraction and domestic tourism expansion. For the periods of 2000–2007 and 2010–2011, the smoothed probability of S_2 is greater than 0.5, which means that these two periods are phases of economic expansion and domestic tourism contraction. Between 1994 and 2016, Mainland China's domestic tourism and its economy experienced 3 growth cycles; 1994–2007, 2008–2011, and 2012–2016 represent the first, second, and third growth cycles, respectively, of domestic tourism. Accordingly, 1995–2007, 2008–2011, and 2012–2016 represent the first, second and third growth cycles of economy, respectively. Moreover, the regularity of the reverse fluctuation of the two variables can be revealed by further analysis of the time-varying characteristics of economic operations, as described below.

First, by tracing the typical economic facts of S_1, it can be found that from 1994 to 1999, a period that was affected by the special national conditions of the "soft landing," the economic growth rate of Mainland China exhibited an obvious tendency to contract (Zhou & Wang, 2006). In 1998, the economic growth rate decreased to 7% under the influence of the Asian financial crisis. In 2008, the Wenchuan earthquake had a negative impact on regional economic growth (Kong & Xu, 2008). Subsequently, the onset of the global financial crisis directly interrupted the economic expansion period, and economy shifted into a contraction phase. From 2012 to 2016, the problems of oversupply and overall decreases in investment and exports became increasingly serious. During this period, a downward trend in economy is evident, and its growth rate fell from 7.6% to 5.8% (NBS, 2016b).

In contrast, domestic tourism exhibited an upward trend during the same period. In the early 1990s, to counteract the economic recession caused by underinvestment, the government promoted tourism as an important means by which to boost the economy, and a series of incentives were introduced. The effects of these policies appeared gradually; in 1995, domestic tourism entered an expansion phase
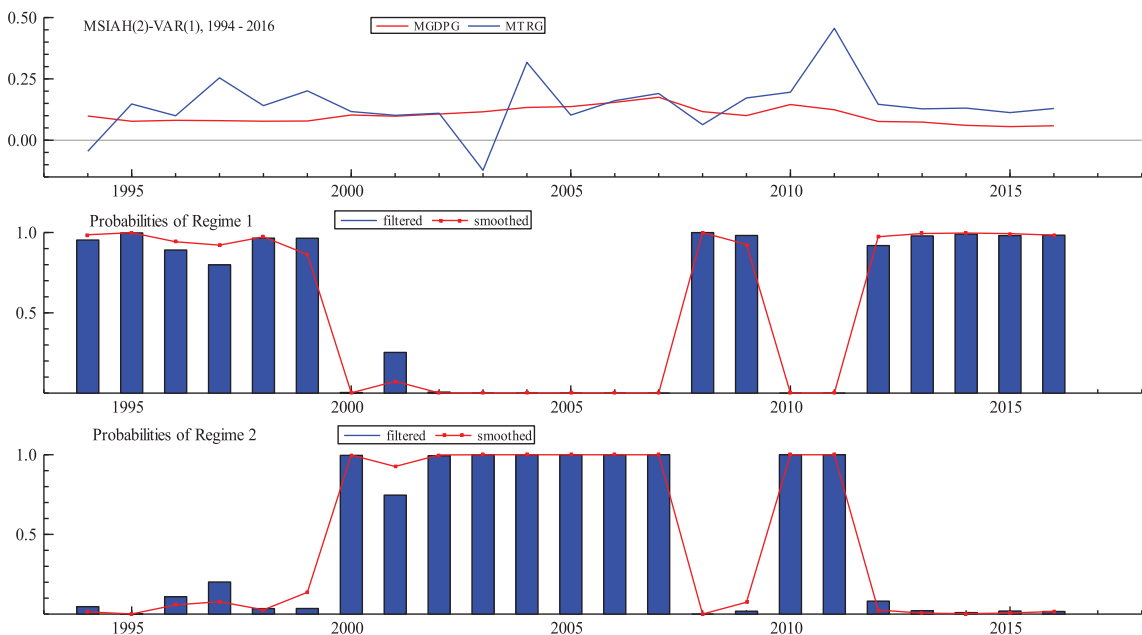
Figure 3. Smoothed probability curves showing the growth trends and located regimes of *MGDPG* and *MTRG*.

and experienced a high growth rate of 14.8% (Zhang & Wang, 2016). In 1999, in response to the financial crisis, a strategy of intervening in endogenous demand was adopted to stabilize the economy. One part of this strategy included implementing the Golden Week to boost holiday tourism, and this facilitated a boom in tourism consumption. In 2012, the tourism industry entered a phase of soft expansion, and its growth rate was approximately 13% (NBS, 2016b). As noted, during three sub-periods (1994–1999, 2008–2009 and 2012–2016), Mainland China experienced economic contractions and domestic tourism expansions; i.e. the two economic cycles in S_1 are operating in opposite directions.

Second, by tracing the economic facts of S_2, it can be found that due to high demand for investment and exports, economy entered a new round of expansion from 2000 to 2004, resulting in an average annual growth rate of approximately 12%. In 2007, the economy maintained a high level of growth of 17.5% over the previous year. The period of 2010–2011 represents the post-crisis era; during this period, economy not only did not show the trend of the Great Recession but also showed an expansion trend, which benefitted from the government's $4 trillion investment plan and loose monetary policy. These policy incentives led to a dramatic increase in the investment rate and promoted rapid expansion of economy (Lin & Wang, 2016).

In contrast, domestic tourism showed a contraction trend during the same period. In 2003, domestic tourism witnessed negative growth for the first time due to the SARS epidemic. In 2010, which represented the beginning of the post-crisis era, the growth of domestic tourism slowed due to the impact of lower consumption. In 2011, although unconventional regulation stimulated domestic tourism growth to a certain extent, it did not fundamentally alter its contraction trend. On one hand, from 2010 to 2011, the spontaneous growth of domestic tourism fell to its lowest value since 2008 (3.6%). On the other hand, domestic tourism experienced short-term growth and high volatility, distinctly different from the expansion phase of longer duration and lower volatility. During two sub-periods (2000–2007 and 2010–2011), Mainland China experienced economic expansion and domestic tourism contraction. That is, in S_2, the two different economic cycles operated in opposing directions.

Periodic phase and analysis of Taiwan

The smoothed probability curve of Taiwan's economic cycles is shown in Figure 4. During the period of 2000–2009, the smoothed probability of TTRG and TGDPG in S_1 is greater than 0.5, indicating that this is a phase of economic contraction. During the periods of 1998–1999 and 2010–2016, the smoothed probabilities of periodic variables in S_2 are greater than 0.5, indicating
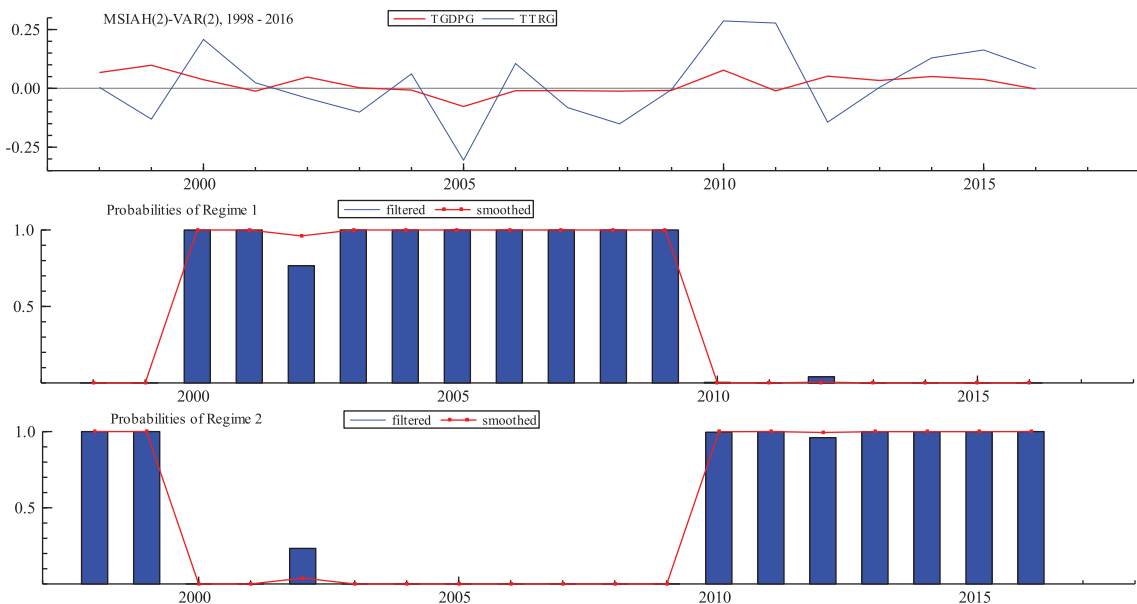

Figure 4. Smoothed probability curves showing the growth trends and located regimes of TGDPG and TTRG.

that these periods are phases of economic expansion. Between 1998 and 2016, Taiwan's domestic tourism and economy experienced two growth cycles. The periods of 1998–2009 and 2010–2016 represent the first and second growth cycles, respectively, of both economy and domestic tourism. By focusing on realistic characteristics of Taiwan's economy, the regularity of the synchronous fluctuation of the cycles of its two variables can be revealed as described below.

First, by tracing the economic facts in S_1, it is found that from 2000 to 2006, Taiwan's economic growth showed a tendency to contract. In 2001, economy suffered its first period of negative growth (−1.2%) caused by cross-strait tensions and a collapse in exports resulting from the September 11 attacks in the United States. From 2002 to 2005, economy was depressed, a condition that was mainly manifested by persistently weak consumption and investment, high unemployment and deflation; moreover, private investment grew at a low rate of 3% (Wu et al., 2017). From 2007 to 2009, Taiwan's real GDP experienced constant negative growth due to a downturn in the international economic situation and a slump in exports. The most serious recessions occurred in 2007 and 2008; in these years, economy experienced negative growth of −8.2% and −15%, respectively.

Domestic tourism also showed a tendency to contract during the same periods. Between 2000 and 2009, the average growth of tourism in Taiwan fell to −2.9% due to insufficient consumption and a downturn in investment (Shao, Ruan, & Kong, 2016). During the SARS epidemic in 2003, the growth of domestic tourism decreased further to −10.1%. Beginning in 2000, domestic manufacturing was relocated (Shao et al., 2016). However, the proportion of tourism accommodations and other leisure services stagnated over the same period. Thus, during the period of 2000–2009 Taiwan's economy and domestic tourism were in a contraction phase; in S_1, the two economic cycles operated synchronously.

Second, by tracing the process of economic development in S_2, it can be found that in 1998 there was a significant improvement both in exports and in domestic demand; for example, the growth rates of consumption and investment reached 5.72% and 16.59%, respectively (Hu & Li, 2010). In 1999, economy benefitted from a rebound in the global economy; due to an expansion in exports and an increase in domestic demand, Taiwan's economic growth increased to 9%. Between 2010 and 2015, economy gradually recovered from the financial crisis; this was manifested mainly by relatively stable growth in domestic consumption and investment and a gradual expansion of exports. In 2010, growth in foreign trade and investment increased significantly, and these economic sectors ultimately became the "twin engines" of economic expansion. From 2014 to 2015, driven by economic improvement in the United States and Europe and by sustained economic cooperation with Mainland China, Taiwan's economic growth actively increased at an average rate of 5.1%.

Consistent with the state of economic development, Taiwan's domestic tourism also showed an expansion trend during the same period. From 1998 to 1999, the average growth rate of domestic tourism was 8.1%. Then, from 2010 to 2016, its average annual growth rate increased to 11.5%. In 2010, the tourism industry was listed as one of the six major emerging industries in Taiwan. Subsequently, due to the status of tourism development and the implementation of supportive industrial policies, domestic tourism showed rapid growth, reaching 28.7% during one period. From 2014 to 2015, the authorities emphasized the improvement of facilities and services at scenic areas; this contributed to the rapid development of domestic tourism, and the average growth rate of domestic tourism reached 14.6%. In conclusion, over two sub-periods (1998–1999 and 2010–2016), Taiwan experienced the expansion of both its economy and its domestic tourism. In S_2, these two economic cycles operated synchronously.

Causal relationship between the domestic tourism cycle and the economic cycle

Granger test results

Since the variable data in this study meet the conditions of the Granger test, which are that the data must be either stationary or in the same integrated order with a cointegrated relationship (Balaguer & Cantavella-Jordá, 2002; Gao, 2009; Kim et al., 2006; Tang & Jang, 2009), Granger tests are used to determine the causal relationships between the periodic variables and to illustrate the essence of the economic phenomena. As shown in Table 6, for Mainland China and Taiwan, there is a one-way causal relationship between economic fluctuations and domestic tourism fluctuations at the 5% and 10% significance levels, respectively. However, the reverse is not supported. Based on the test, it is necessary to clarify the causal relationships in different regimes. The test

Table 6. Causality tests of the periodic variables.

Null hypothesis	Number of variables	F-value	P-value	Conclusion
MTRG is not the cause of MGDPG	19	2.460	.123	MTRG is not the cause of MGDPG
MGDPG is not the cause of MTRG	19	5.101	.021**	MGDPG is the cause of MTRG
TTRG is not the cause of TGDPG	15	0.533	.767	TTRG is not the cause of TGDPG
TGDPG is not the cause of TTRG	15	16.279	.059*	TGDPG is the cause of TTRG

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

rules are as follows. Taking Equation (7) as an example, when *GDPG* is the dependent variable and the coefficient of *TRG* is not 0, *TRG* is the Granger cause of *GDPG* in the given regime. Likewise, when *TRG* is the dependent variable and the coefficient of *GDPG* is not 0, *GDPG* is the Granger cause of *TRG* in the given regime (Ma, 2013).

As shown in Table 3, when *MGDPG* is the dependent variable, the coefficients of $MTRG_{t-1}$ in S_1 (−0.003) and S_2 (−0.02) are close to 0; this means that neither S_1 nor S_2 has unidirectional Granger causality through which fluctuations in domestic tourism result in reverse fluctuations in economy. When *MTRG* is the dependent variable, the coefficients of $MGDPG_{t-1}$ in S_1 (−0.366) and S_2 (2.521) are not 0; this indicates that both S_1 and S_2 have unidirectional causality through which economic fluctuation results in reverse fluctuation in domestic tourism of Mainland China. Second, when *TGDPG* is the dependent variable, the coefficients of $TTRG_{t-1}$ and $TTRG_{t-2}$ in S_1 (−0.021, 0.115) and S_2 (−0.143, −0.061) are close to 0, indicating that neither S_1 nor S_2 has unidirectional Granger causality through which tourism fluctuations result in economic fluctuations. When *TTRG* is the dependent variable, the coefficients of $TGDPG_{t-1}$ and $TGDPG_{t-2}$ in S_1 (0.51, 1.747) and S_2 (0.433, −2.566) are not 0; this means that both S_1 and S_2 have unidirectional Granger causality through which economic fluctuations result in fluctuations in domestic tourism of Taiwan. That is, the test results show that fluctuations in economy of Mainland China are the actual causes of reverse fluctuations in its domestic tourism and that fluctuations in the economic cycle are the actual causes of synchronous fluctuations in domestic tourism of Taiwan.

It is necessary to explain the above results in terms of business cycle theories. The basic logic of business cycle theories is that supply and demand shocks can explain both economic fluctuations and their impact on a single industry's economic growth (Liu & Su, 2014; Yu & Liu, 2014). In terms of this study, changes in supply and demand act as triggers of the economic cycle and are the root causes of the domestic tourism cycle. In addition, tourism supply and demand are mainly influenced by economic fluctuations; this leads to unidirectional causality of domestic tourism fluctuations by economic fluctuations. Furthermore, the in-depth effects of economic fluctuations on domestic tourism fluctuations, which can be either inverse or the same, should be explained by changes in both the state of development of a specific economy in different periods and their consequences, which are changes in the supply and demand for domestic tourism.

Process of MTRG's reverse fluctuation caused by MGDPG's fluctuation

For Mainland China, the proportion of tourism is low and vulnerable to capital crowding-out effects; thus, tourism development has not been in sync with economic growth. However, Mainland China's economy is subject both to market forces and to macro-control, and the latter can guide capital flows reasonably and stabilize the growth of tourism. This feature leads domestic tourism development to be closely related to macro-control.

During periods of economic expansion, given that profit-driven investment and utilitarian market regulation are not controlled, capital elements are more likely to flow to real estate, energy and other high-profit and efficient industries, which will crowd out tourism investments. In fact, tourism projects generally have longer investment and payback periods and are less attractive than the above industries. In addition, tourism industries are faced with excessive dependence on the money market, which will further increase the funding gap in tourism industries when investments flow uncontrollably to high-profit industries. However, as the core supporting element of expanding reproduction of tourism products and upgrading of services, tourism investments involve various aspects including the construction and operation of tourism special facilities such as scenic spots, hotels, restaurants and entertainment places and public facilities such as transportation and network, etc. (Franck, 1990; Li, Liu, Xu, Zhu, & Yu, 2017). When the investment is insufficient, it will slow down the progress of resource

development, product innovation and marketing promotion in tourism, resulting in a lag of updating speed of tourism products compared with that of demand and a relative decline of tourism supply (Su & Sun, 2017). In addition, insufficient investment will also block or even cut off the continuous source of funds needed to maintain tourism service facilities and upgrade the functions of equipment, which will lead to a decrease in the tourism service quality and an absolute decline in the scale of tourism supply. Over the sub-periods of 2003–2004, 2007, and 2010–2011, investments in the real estate and energy sectors accounted for more than 65% of total investment, which was 10% higher than that observed in conventional years (NBS, 2003–2011). Among them, investments in real estate reached peak growth in 2003, 2007 and 2011. The resulting crowding-out effect on tourism is also significant; investment growth in tourism declined to its lowest values of 2.4%, 8.6% and 3.8% in 2003, 2007 and 2011, respectively (NBS, 2003–2011).

In addition to the above supply side effects, since national income mainly includes capital income and labour remuneration, high-intensity investment causes the capital output to continuously increase while the proportion of labour remuneration in GDP continuously declines under the investment-driven growth mode of Mainland China. That is, as the economic pie gets bigger, the share of big capital owners (i.e. governments and entrepreneurs) keeps growing, while the share of the public keeps shrinking. This process resulted that capital accumulation and economic growth were very fast, but the proportion of labour remuneration was decreasing, and the growth rate of residents' income lagged behind that of economy and high-profit industries, which further led to the decline of residents' purchasing power and consumption demand. Before 2000, the proportion of workers' remuneration to GDP remained above 50%. However, this index began to decline in 2002, and by 2007 it had dropped to 39.4%, with a total decline of more than 10% (Li, 2010; Xu & Yuan, 2018). Accordingly, in 2001–2007, the consumption rate continued to shrink and fell by nearly 13% and the average consumption level was only 49.4%, which was much lower than the world average level of 75%. Insufficient consumption further restricted the upgrading of consumption structure, which increased the budgetary constraints of tourism demand and lead to insufficient tourism consumption. During the periods of 2007 and 2010–2011, tourism

consumption was at least 4% lower than its normal level (Li & Ma, 2017).

During periods of economic contraction, both investments and exports are depressed, and expanding domestic demand becomes the key focus of macro-control efforts to boost the economy. Accordingly, a consumption guidance mechanism was gradually introduced to optimize the income distribution and promote consumption; through this mechanism, both upgrading of consumption and rapid growth in tourism consumption were realized. From 1994 to 1997, the government promoted an increase in income and guided consumption transition of by expanding transfer payments. Because of these efforts, the annual growth rate of tourism consumption expanded at an average annual rate of 25% (NBS, 2016b). For the period of 1998–1999, the government optimized the investment-consumption structure by means of interest regulation, promoting both the expansion and the upgrading of consumption successfully; during this period, the growth rate of tourism consumption increased from 15.8% to 19.1% (Li & Ma, 2017). In 2008, the government strengthened its consumption-guiding policy, and the growth rate of tourism consumption peaked at 24% (NBS, 2003–2011). Moreover, to stimulate economic growth, optimize the industrial structure and make the flow of capital more reasonable, the industrial regulatory mechanism is frequently used by the government to guide elements to strategic industries that can drive economic transition. Accordingly, the tourism industry is strategic due to its ability to expand domestic demand and create jobs; thus, it's able to introduce capital and other elements into the development and optimization of preferred projects under the influence of regulatory mechanisms. Between 2001 and 2002, the strategic position of domestic tourism was formally established and was supported by preferential policies that introduced funds for the industry and increased consumption. In 2012, "Some Opinions on Financial Support for the Accelerated Development of the Tourism Industry" was introduced; it focused on providing support for tourism development by diversifying financing channels and successfully promoting the expansion of tourism (Sheng et al., 2014).

Process of TTRG's synchronous fluctuation caused by TGDPG's fluctuation

For Taiwan, the development of service industries, a leading sector, is bound up with economic growth.

However, in the case of that Taiwan's economic growth is highly dependent on external markets, the impact of its domestic demand regulation is limited and the development of service industries is greatly influenced by the export situation.

In the economic contraction phase, the global economic downturn and sharp declines in exports seriously weakened the driving force of Taiwan's economy, leading to fundamental economic recessions during which any attempts to boost economic growth by regulating domestic demand do not work. From 2000 to 2009, the export recession caused a sustained downturn in Taiwan's economy; the real income growth of residents was either zero or negative at the same time and consumption grew by less than 6% over the same period (Sun, 2015). However, downturn in consumption also impeded the upgrade of consumption, so that leisure consumption is considered less important and thus is generally at lower levels. Although Taiwan authorities implemented a series of policies to stimulate domestic demand, most of them were weak and unemployment and consumption did not improve. In 2008, when the economic crisis hit hardest, consumption and domestic tourism consumption declined by 0.29% and 15%, respectively. Meanwhile, due to the economic downturn and weak employment, both the investment intentions and the capital expenditures of service enterprises constantly decrease. From 2001 to 2009, the average annual growth rate of investment in services was only 2.98% (Sun, 2015); during this period tourism investment slowed down synchronously, decreasing by 2/3 compared with the period of 1998–2000 and limiting the construction of service facilities and the increase of product supply scale in the tourism industry (Li & Wu, 2009). When tourism demand and supply are both at low levels, tourism experiences downward fluctuations.

During the economic expansion phase, increased foreign trade and an improved global economic situation fundamentally enhance Taiwan's economic growth and domestic demand levels, effectively supporting the domestic demand regulation mechanism. On the one hand, the economic boom will rapidly increase domestic demand, which will in turn lead to the continuous expansion of investment and consumption in Taiwan and further boost the capacity of tourism supply and demand. In 2014, Taiwan's export expansion led to the recovery of economic growth and the expansion of domestic demand, yielding growth rates of consumption and investment of 2.62% and 4.83%, respectively; domestic tourism consumption grew by 2.9%, and investment in key tourism projects increased to $720 million, indicating a clear expansion of tourism (TB, 2014). On the other hand, during this period the regulation of domestic demand has played a positive role. From 2012 to 2015, the report "Medium Distance Planning for the Construction of Important Tourist Attractions" was promulgated to guide improvements in tourism supply and demand (Shao et al., 2016). The related policies effectively boosted the growth of tourism investment and consumption in Taiwan, and this eventually contributed to the rapid growth of tourism business.

Conclusion and recommendations

This paper explores relationships between the domestic tourism cycle and the economic cycle of Mainland China and Taiwan by using the MS-VAR model. The result shows that the domestic tourism cycle and the economic cycle of Mainland China fluctuate with opposite trends, with economic fluctuations leading to reverse fluctuations in domestic tourism. During phases of economic expansion, investment-driven economic growth spontaneously generates an imbalance in investments and the investment-consumption structure. This internal contradiction restrained tourism growth by decreasing its supply and demand scale. During phases of economic contraction, macro-control included industrial regulation and demand guidance was introduced to optimize the industrial structure and guide the upgrading of consumption, which eventually promoted tourism expansion by increasing its supply and demand scale. In contrast, the domestic tourism cycle in Taiwan is synchronized with the economic cycle, which is controlled by economic fluctuations that lead to synchronous fluctuations in tourism. During phases of economic expansion, significant increases in foreign trade fundamentally enhance economic growth. This upward momentum in economy stimulates tourism growth through the supply and demand transmission mechanism, ultimately promoting synchronous growth in both domestic tourism and economy. During phases of economic contraction, global economic conditions are depressed and foreign trade decreases dramatically; this quickly impacts the service industry and causes a decline in the supply and demand of tourism. In addition, weak regulation of domestic demand and downturns in

tourism consumption and investment cannot be effectively reversed, eventually causing economy and tourism to synchronously trend downward.

Findings contribute to the literature on relationships between the domestic tourism cycle and the economic cycle of economies with different development stages and economic institutions. Specially, linkages between economy and domestic tourism of Mainland China, a developing economy with an investment-driven growth mode, is jointly affected by market forces and macro-control. However, as for Taiwan, a developed economy with exported-oriented growth mode, linkages between its economy and domestic tourism is mainly regulated by market mechanisms and is closely related to external demand. It can be seen that similar to linkages between the international tourism cycle and the economic cycle, relationships between the economic cycle and the domestic tourism cycle in the two economies are also different due to different types of economies. However, linkages between the former two periodic variables are mainly affected by exchange rate fluctuations, income level of destination country and price elasticity (Ghosh, 2017; Gouveia & Rodrigues, 2005; Katircioglu, 2009; Smeral, 2012; Wong, 1997), whereas linkages between the latter two periodic variables are mainly related to economic institutions (including export-orientation degree, degree of macro-control and responsiveness), economic structure, etc. At the same time, together with Li and Ma's study, this paper confirms that linkages between the economic cycle and the domestic tourism cycle of Mainland China still follow the trend of reverse fluctuation after excluding the price impact. This study also provides some recommendations for both economies in achieving the efficient development of domestic tourism based on improving the stability of economic growth and optimizing economic structure.

Firstly, given the empirical outcome about Mainland China, it may be inferred that to ensure the stable operation of economy, policy-makers should mainly start from the regulation of economic system rather than from a particular industrial sector (e.g. the tourism industry). Specially, it is necessary to improve the efficiency of capital allocation, optimize economic structure, increase labour income and expand consumption by introducing industrial regulation mechanism and demand guidance mechanism, while seeking an economic growth mode driven by investment, consumption and export. In addition,

special attention should be paid to guard against the adverse effects caused by excessive investment to reduce the unsustainability of economic development. Based on this, the government also needs to consciously guide the rational flow of production factors to the tourism industry, and actively promote the upgrading of consumption structure and tourism consumption expansion. For tourism managers, they should pay more attention to the possible adverse effects of industrial "crowding out effect" and weak consumer demand in the period of economic expansion, and try their best to develop financing channels and launch positive tourism marketing measures to ensure the smooth development of tourism.

Secondly, with the information about Taiwan generated from the above empirical research, it could be inferred that policy-makers should start from boosting the domestic demand market and stabilizing external demand markets to ensure the stable operation of economy. On the one hand, domestic consumption and investment should be given full play to the driving force of economic growth by improving residents' salary and optimizing domestic investment environment. On the other hand, the stability and sustainability of external demand markets should be enhanced by actively seeking stable trade partners and establishing good cooperative relations. Furthermore, the steady development of domestic tourism can be promoted based on realizing steady economic development, improving investment environment and expanding domestic consumption. For tourism managers, they should pay attention to the possible adverse effects on tourism brought by such factors as sluggish demand or deteriorating investment environment during the period of economic contraction and take effective measures to promote the steady development of tourism.

Limitations and further research

Although this study is a comparative study of relationships between economic cycles and domestic tourism cycles in different economies, types of economy used for comparison each contain only one representative case. In the future, we should verify the validity of cyclical linkages of specific economies in similar economies and analyse the possible alienation phenomena. At the same time, a possible short-run causality between variables and its difference from the long-run relationship, and the influence of regional differences should also be further considered. For

example, increasing the comparative study of linkages between the economic cycle and the domestic tourism cycle of sea-island economies and inland economies. Notably, although the MS-VAR model directly quantifies the variable relationship between periodic variables, it also weakens the expression of intermediary factors. In the future, a comprehensive quantitative model covering risk factors, consumption level, tourism investment, policy factors and other intermediary variables should be constructed and used to examine the causes of results in an extended and more refined way.

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