6. TESTING THE STRUCTURAL BREAK OF TAIWAN INBOUND TOURISM MARKETS

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Abstract

The aim of this paper is to investigate whether or not shocks to visitor arrivals to Taiwan from China, Japan, the USA and Hong Kong, accounting for over 80% of Taiwan's inbound tourism, are temporary or permanent. The CBL (Carrion-i-Silvestre, Barrio-Castro, and López-Bazo) with the bootstrap approach, which differs from the previous tests considering cross-section dependence and multiple structural breaks based on statistics with good statistical properties, is adopted for the Taiwan's four inbound time series. The results found that the Severe Acute Respiratory Syndrome (SARS) outbreak had an impact on Taiwan's four major inbound markets, but with transitory shocks. A global recession occurred in early 2002, but this shock only impacted the tourist arrivals from China and the USA. The deteriorating economy in 2008 and the European debt crisis in 2011 had devastating consequences on the economic growth around the world, which also impacted different source tourist markets in different time periods, but only with temporary shocks.

Keywords: tourism; time series; tourist source market; intervention shocks; structural break; unit root test

JEL Classification: C12; C33; L83

1. Introduction

The considerable growth of tourism activity clearly marks tourism as one of the most remarkable economic and social phenomena in the past few decades. It has been spurred by the rise in living standards and fuelled by growing wealth and the increased investment in tourism development by several countries. According to the latest UNWTO World Tourism Barometer (2018), international tourist arrivals grew by 84 million in 2017 to reach a record 1,323 million arrivals despite global economic challenges. This marked an increase by 6.8%

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in 2017, the highest increase since the 2009 global economic crisis and much beyond the forecast by UNWTO of 3.8% per year for the period 2010 to 2020. In terms of international tourism receipts in 2017, it also rose by 4.9% in real terms as compared to the previous year of 2016, hitting a new record of US$ 1,340 billion worldwide. For instance, the number of people working either directly in tourism or in related sectors of the economy accounts for 1 out of 10 jobs (World Tourism Organization, 2018).

Tourism is important for many countries. Destinations rely on tourism due to the income it generates in the form of money spent by tourists and taxes levied on business in the tourism industry, as well as the opportunities for employment it provides in the service industries associated with tourism. In particular, tourism is considered as a labor-intensive industry (Frederick, 1993; Narayan, 2005a). The ability of countries to attract tourists is an essential factor in national economic development and trade performance. For agencies involved in the tourism industry, it is therefore crucial to assess trends in international flow and to use this knowledge for more effective and resourceful decision-making (Coshall and Charlesworth, 2011; Song, Qui, and Park, 2019).

However, the tourism industry is highly susceptible to exogenous factors and negative situations which greatly affect many of the crucial travel decisions faced by tourists: when to travel, how to travel, where to travel, and what to do when they travel (Kim, Chun, and Lee, 2005; Min, 2008; Min, Lim, and Kung, 2011; Rittichainuwat, 2013). For instance, tourism is supported by tourism promoted government policies that work to reduce existing barriers to the expansion of the sector, such as complicated visa procedures, increased direct taxation or limited connectivity (Lee and Chien, 2008; Haque and Haque, 2018; Wu and Wu, 2019; Roudi, Arasli, and Akadiri, 2019). By contrast, negative impact comes in a variety of forms, such as terrorism, wars, natural disasters, health alarms, oil price rises, exchange rate fluctuations, environmental pollution and economic and political uncertainties (Causevic and Lynch, 2013; Zhang and Gao, 2016; Masinde and Buigut, 2018), which have had severe effects on the tourism industry (Faulkner, 2001). Without any doubt, both positive and negative events cause the mean level of the time series to change, causing increases/declines in tourist arrivals in various travel destinations and having far-reaching consequences on regional tourism. Thus, it is important for governmental tourism authorities to understand these factors in order to provide essential information for planning and decision-making, particularly given the perishable nature of tourism products and services (Song, Qui, and Park, 2019).

In the past, intervention has been used to study the impact of exceptional external events such as natural disasters, political or economic policy initiatives or changes, technological changes, strikes, sales promotions, advertising, and the like. Box and Tiao (1975) provided a procedure for analyzing a time series in the presence of external events known as intervention analysis. McDowall, McCleary, Meidinger, and Hay (1980) pointed out that intervention analysis measures whether an intervention has had a significant impact and investigates the form of that impact. This analysis has been applied extensively in tourism-related literature (see Min, 2008; Min, Lim, and Kung, 2011). For example, Min (2008) used dummy variables dealing with the intervention shocks to evaluate how Taiwanese inbound tourists were affected by the September 21st Earthquake and the Severe Acute Respiratory Syndrome (SARS) outbreak. Standard augmented Dickey-Fuller (1979, 1981, hereafter ADF) tests for unit root were then used, under the null hypothesis of a stochastic trend (or a unit root) against the alternative of a deterministic trend (or trend stationary).

However, intervention analysis is a useful technique when the impact of exogenous events occurs at known time points. As Perron (1989, p. 1363) argues that these kinds of

interventions are assumed to occur at a known date, however, a pre-selection bias occurs when dummy variables are used and when the break date is unknown and data-dependent. The univariate unit root tests represent low power to determine the stationarity properties of a series when the structural break is ignored (Perron, 1989; Maddala and Kim, 1998). Furthermore, a well-known weakness of the ADF unit root tests is their potential confusion of structural breaks in the series as evidence of non-stationary. In other words, there may be a failure to reject the unit root hypothesis if the series has a structural break. Subsequent extensions to the ADF test procedure and other approaches for unit root testing have been therefore recommended by several researchers, including Phillips and Perron (PP) (1988), Zivot and Andrews (ZA) (1992), Lumsdaine and Papell (LP) (1997), and Lee and Strazicich (LS) (2004), which have been popularly used in one exogenous unit root test. Narayan and Popp (NP) (2010) extended DF test regression to the break magnitude and detected the break date with higher precision. The most recent contribution to this literature is Carrion-i-Silvestre, Barrio-Castro, and López-Bazo (2005, hereafter CBL), who differ from the previous tests considering both cross-section dependence and multiple structural breaks based on statistics with good statistical properties.

Thus, the aim of this paper is to investigate whether or not shocks to visitor arrivals to Taiwan from China, Japan, the USA and Hong Kong, accounting for over 80% of Taiwan's inbound tourism, are permanent or temporary. The CBL with the bootstrap approach is adopted on the Taiwan's four inbound time series. Given the importance of the tourism industry for Taiwan, the findings should provide important policy implications. The paper is organized in the following manner: Section 1 presents the motives and objectives of the study. Section 2 presents an overview of the unit root literature. Section 3 briefly describes data used in our study. Section 4 presents the methodology that we used in the paper. Section 5 presents our empirical analysis, while the Section 6 summarizes the study and presents conclusions.

2. Literature Review

2.1. Overview of the Unit Root Structural Break Literature

It has been generally agreed that commonly used unit root tests like the ADF test have limited power in distinguishing the unit root null hypothesis from the trend stationary alternative hypothesis in the data (see also Campbell and Perron, 1991). To overcome this weakness, some approaches have been proposed, for instance, Said and Dickey (1984), Phillips and Perron (1988), and Perron (1989). The emergence of the structural break unit root hypothesis has been led by the pioneer work of Perron (1989). Perron (1989) highlighted that failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis. The ADF test was then extended by incorporating a structural break in the data series. In other words, an effort was made to increase the power of the traditional ADF model to reject the unit root null hypothesis by giving the model more information in terms of a structural change in the economy system. However, two years after Perron's introduction, Christiano (1992) and Zivot and Andrews (1992) argued against the exogenous treatment of the break date, though they did acknowledge the importance of incorporating a structural break in the ADF model. They pointed out that a bias towards an over-rejection of the unit root hypothesis is a likely result of selecting the break points a *priori* based on an *ex post* examination or knowledge of the data. The authors accordingly recommended that the structural break be endogenously determined from the data. Zivot and Andrews (1992) and Perron (1997) proposed allowing for an unknown or endogenous structural break in ADF tests, determining the break point 'endogenously' from the data.

Perron and Vogelsang (1992) allowed for two different forms of structure break, called the Additive Outlier (AO) and the Innovational Outlier (IO) models. The former is assumed to take place for a break in slop, while the latter is assumed to take place gradually. Clemente, Montañés and Reyes (1998) extended Perron and Vogelsang's (1992) statistics to the case of two changes in the mean. The Lumsdaine and Papell (1997) test considered a generalization of the endogenous break-point procedure of ZA, leading to spurious rejections of the null if a break is present. Studies by Nunes, Newbold and Kuan (1997) and Lee and Strazicich (2001) found that when there is no break under the null in endogenous tests, the test statistic diverges, which leads to significant rejections of the unit root null when the data generating process (DGP) is a unit root with break(s). Consequently, Lee and Strazicich (2004) proposed an endogenous two-break LM unit root test that is unaffected by structural breaks under the null.

In short, the ZA test which applied to a case of an endogenous structural break was further extended to allow for two endogenous structural breaks by LP and LS. In applied research, the LP and the LS tests have become more popular in cases where a sufficiently long time series data is used. Narayan and Popp (2010) differ from LP and LS in their use of a Dickey-Fuller-type test regression, as well as in their treatment of break date selection. The authors selected the break dates by maximizing the significance of the break dummy coefficient. NP shows that their test is invariant to the break magnitude and is able to detect the break date with higher accuracy. In the most recent contribution to this literature, Carrion-i-Silvestre, and German-Soto (2009) differed from the previous tests considering both cross-section dependence and multiple structural breaks based on statistics with good statistical properties.

Different structural break unit root tests have been widely used to assess the impact of shocks on macroeconomic variables such as GDP (see Romero-Ávila, 2012, 2009; Narayan and Smyth, 2008; Lee and Lee, 2009; Ben-David, Lumsdaine, and Papell, 2003; Chang, Chiang, and Zhang, 2009; Ceylan and Abiyev, 2016) and real exchange rates (Cushman and Michael, 2011; Chang, Li, Lu, and Lee, 2011; Degirmen and Saltik, 2017).

2.2. Application of the Unit Root Structural Break in the Tourism Literature

While fluctuation in tourism is recognized, several studies have directly examined the time path of tourist arrivals to test if events have permanent or transitory effects. Aly and Strazicich (2004) used a two-break minimum LM unit root to investigate annual data on tourist night visits for Egypt (1955-1997) and Israel (1971-1997), both countries that have suffered from terrorist activities, war and regional instability but largely depend on tourism as an important national income. According to the findings, there are two break points for Egypt in 1979 and 1992, and two for Israel in 1986 and 1992. In terms of the Gulf War for both countries, the results support the alternative hypothesis that time series of tourist arrivals are stationary, implying the shock has a transitory effect on both countries. In Narayan (2005a), Sen (2003) F-test statistic, extending the Perron (1989) and ZA approaches on one unit root structural break was applied to examine whether or not shocks to visitor arrivals to Fiji from Australia, New Zealand and the USA, which represent Fiji's main tourist source markets, have a permanent or transitory effect on visitor arrivals. The findings indicate that visitors from the above three countries were stationary, implying that shocks to tourists' arrivals have only transitory effect. The same author (Narayan, 2005b) employed Vogelsang's structural break test to investigate whether the military coups instigated by Major General Sitiveni Rabuka in 1987 had a permanent effect or a transitory effect on tourist

expenditures in Fiji. The results reject the unit root null, revealing that the coups had a transitory effect on tourist expenditures in Fiji.

A study by Karagoz (2008) examined the effects of terrorism and other events on Turkey's tourism based on annual data of 1961-2006, using unit root tests for known structural break points (1973, 1982, 1988 and 1999). The empirical results reject the unit root hypothesis and are indicative that shocks of terrorist activities to the series only have a transitory effect. One study conducted by Lee and Chien (2008) analyzed whether regime changes have broken down the stability of the relationship between tourism development and economic growth in Taiwan from 1959-2003, with the unit root tests and the cointegration tests allowing for a structural break. According to their results, the breakpoint in 1992 was for real GDP, due to the collapse of Taiwan's bubble economy in 1990. As Japan relaxed its ban on overseas travel in 1964, followed by the US ending its aid program in Taiwan in 1965, tourism development variables reached a breakpoint in 1965 and 1966. A breakpoint of the real exchange rate occurred in 1987 as a result of Taiwan's government easing controls on foreign exchange and changing its foreign exchange rate system. Smyth, Nielsen and Mishra (2009) examined whether the Bali bombings have had a permanent or transitory effect on international tourist arrivals in Bali by analyzing the time-series properties of data visitor arrivals. Two unit roots were employed, namely univariate and panel LM, with one and two structural breaks to test the unit root null hypothesis. The results showed that the unit root null hypothesis was rejected while the panel LM unit root test was applied; on the other hand, the effects of the Bali terrorist acts on the growth path of tourist arrivals from major markets appeared to be transitory, which suggests that Bali's tourism sector is sustainable in the long term. One study conducted by Charles, Darne and Hoarau (2019) adopted univariate unit root procedures with structural breaks to examine whether international tourist inflows (over the period 1981-2015) in the French La Réunion Island were affected by permanent or transitory effects of external shocks. These are the September 11 terrorist attacks, the Chigungunya crisis in 2005-2006, the international financial crisis in 2008, and shark attacks since 2012. The empirical analysis rejected the null of a unit root, indicating that external shocks have only a transitory effect on tourist arrivals, with the exception of the Chigungunya crisis. However, the authors cautioned that due to the small sample size of the study, the results should not be considered conclusive.

3. Data

In the tourism industry, tourist flows from a source to a destination represent a statistical time series adopted monthly, quarterly, or yearly. This time series measures the numbers of visitor arrivals, which are defined as persons traveling in a certain area (not their usual residence) for at least twenty-four hours and for a period not exceeding 12 months. Tourists to Taiwan are mainly from Asia, representing more than three-fourths of total international tourist arrivals. Because of the limited availability of monthly observations obtained from the Advanced Retrieval and Econometric Modeling System (AREMOS) of visitors from China, which represents the top source market for Taiwan since 2010, the sample period of panel data for the four countries under consideration is 2001Q1-2013Q4. The data includes the countries of China, Japan, the USA, and Hong Kong. This study chooses inbound tourism as its indicator and the set of data obtained from the database of AREMOS, published by the Taiwan Economic Data Center. All data was analyzed by Eviews 8 software and Census X-12 procedure to conduct seasonal adjustments. Table 1 represents the descriptive statistics results. Because the results from Table 1 show that Japan has the highest mean inbound tourism of 274,762 persons, followed by China of 228,251 persons, followed by

Hong Kong of 156,432 persons, and then followed by the United States of 95,297 persons. Jarque-Bera test also indicate that inbound tourism is all non-normal, the variables are therefore represented by the natural logarithms in our analysis.

Table 1

The Descriptive Statistics Results for Quarterly Visitors from Hong Kong, China, Japan and the USA (2001-2013)

Countries	Mean	Maximum	Minimum	Skewness	Kurtosis	Jarque-Bera	Observations
Hong Kong	156432	318223	20308	0.739	2.835	4.7881*	52
China	228251	828217	30943	1.075	2.687	10.2290***	52
Japan	274762	388466	57806	-0.956	5.563	22.1652***	52
United States	95297	109462	22889	-3.880	22.635	965.7986***	52

*Source: AREMOS Taiwan Economic Statistical Databank. *and ***indicate critical values at 10% and 1% level of significance, respectively.*

4. Methodology

An event (or intervention) is usually used to describe a change in a variable or in the value of the error terms at a particular time period. The effect of an event will die out gradually in a stationary system, whereas the effect of a shock is permanent in a non-stationary system. If the series is non-stationary and the first difference of the series is stationary, the series contains a unit root. The commonly used methods to test for the presence of unit roots are the ADF tests (Dickey & Fuller, 1979, 1981).

In this study, the convergence of Taiwan's tourism markets will be investigated to provide a basis of tourism competitive strategies or shocks/interventions. The idea of the convergence hypothesis for tourism markets was established by Narayan (2006), who investigated whether Australia's tourism markets were converging or not. The term of tourism convergence as a reduction in tourist arrivals' differential is defined, this is calculated as follows:

$$y_{it} = \ln \frac{\mathrm{VA}_{\mathrm{t,Taiwan}}}{\mathrm{VA}_{\mathrm{it}}} = \ln \mathrm{VA}_{\mathrm{t,Taiwan}} - \ln \mathrm{VA}_{\mathrm{it}} \qquad (1)$$

y_{it} is the natural log of the tourist arrivals ratio, where $\ln$ shows natural logarithm, $\mathrm{VA}_{\mathrm{it}}$ and $\mathrm{VA}_{\mathrm{t,Taiwan}}$ denotes visitor arrivals to Taiwan from origin country i at the time t and total international visitor arrivals to Taiwan at the time t, respectively. We can test whether tourism markets are converging by examining the stationarity behavior of y_{it}, which means that the markets will not drift too far apart.

The panel and univariate versions of Carrion-i-Silvestre *et al.* (2005) stationarity test will be employed in this study. This test extended the Hadri (2000) test and allowed multiple structural breaks. The general formulations of the CBL technique can be written as:

$$y_t = \alpha + \beta t + \sum_{k=1}^{m} \theta_{ik} DU_{k,t} + \sum_{k=1}^{m} \rho_{ik} DT_{k,t} + \varepsilon_{it} \qquad (2)$$

$DU_{k,t} = 1$ if $t > TB_k$, 0 otherwise

$DT_{k,t} = t - TB_k$ if $t > TB_k$, 0 otherwise

where: α , t, and m are intercept, linear trend and the optimal number of breaks, respectively. The univariate test statistic is computed as the Kwiatkowski *et al.* (1992) test with multiple breaks:

$$LM(\lambda_i) = N^{-1}\sum_{i=1}^{N}\left(\widehat{\omega}_i T^{-2}\sum_{t=1}^{T}\widehat{S}_{it}^2\right) \tag{3}$$

where: $\widehat{S}_{it}^2$ is the partial sum of the estimated OLS residuals and $\widehat{\omega}_i$ denotes a heteroskedasticity and autocorrelation consistent estimate of the long-run variance of ε_{it} . λ_i is the location of the breaks relative to the entire time period (T). CBL recommended using the Bai and Perron (1998) procedure, which computes the global minimization of the sum of squared residuals (SSR). Using the limit distribution of $LM(\lambda_i)$ and its mean and variance, CBL calculated the test statistic for the null of a stationary panel with multiple breaks as follows:

$$Z(\lambda) = \frac{\left(\sum_{i=1}^{N} LM(\lambda_i) - N\overline{\mu}_{LM}\right)^{0.5}}{\sigma_{LM}} \xrightarrow{d} N(0,1) \tag{4}$$

where: $\overline{\mu}_{LM}$ and σ_{LM} are the mean and standard deviation of $LM(\lambda_i)$. The empirical distribution of $Z(\lambda)$ using bootstrap techniques is computed in this study.

5. Empirical Results

Table 2 shows the average number of visitors and its growth rate in each half decade for the period 2001-2013. Figure 1 illustrates the time series plots of tourists from Hong Kong, China, Japan, and the USA to Taiwan. If we look at the dynamics of the visitor datasets over the years 2001, 2005, 2009 and 2013, one may see that Hong Kong and China had the highest growth rates over most half-decade periods. According to Figure 1, there is a clearly observable upward trend from the year 2008, which is due to the many marketing efforts made in these two markets. For example, diverse information sources were integrated to create added value as an incentive for repeat visitors in the Hong Kong market. “Time for Taiwan” was used as the main focus to develop food, romance, and shopping themes to target different tourist groups in Hong Kong. In July 2008, Taiwanese authorities passed legislation allowing Chinese tourists to travel in Taiwan, and the growth of tourists from China has been particularly impressive since then. In addition, the travel restrictions were further loosened in June 2011 to allow more Chinese visitors as individual tourists to visit Taiwan. Therefore, the high growth is likely to be responsive to government strategies, policies and messages.

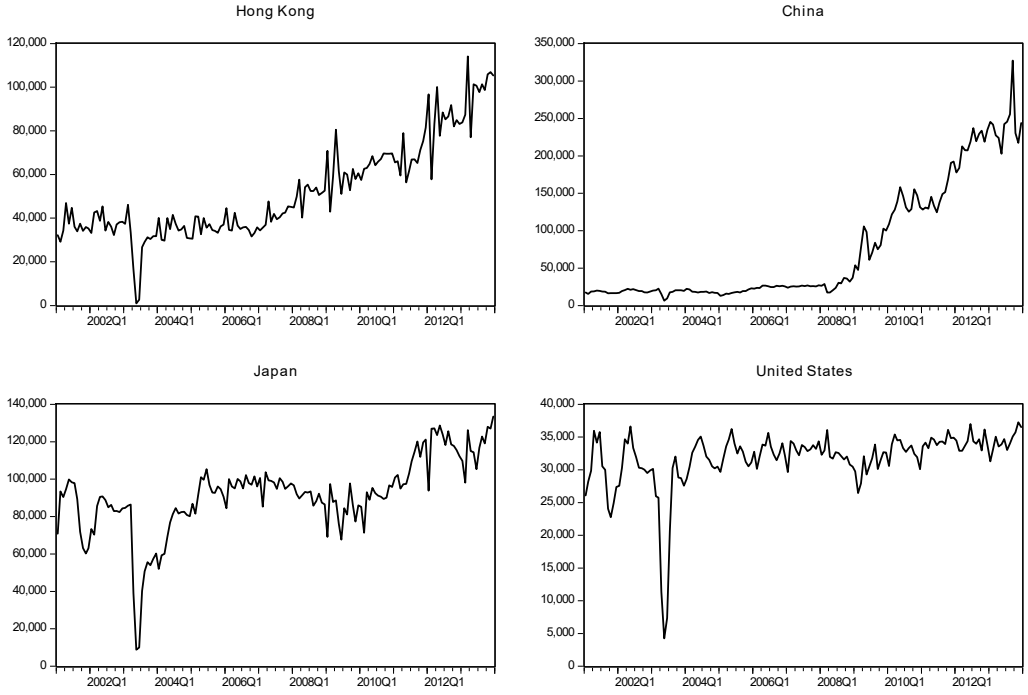
Table 2

Average Number of Visitors and Its Growth Rate in Any Half Decade

Country	Average visitors for each half decade (person)					Average growth rate of visitors for each half decade (%)				
	2001	2005	2009	2013	2001-2013	2001	2005	2009	2013	2001-2013
Hong Kong	109446	101864	141328	237849	156432	5.40%	17.60%	3.70%	3.80%	8.20%
China	52921	54592	118684	555309	228251	-0.60%	4.80%	12.20%	6.60%	7.40%
Japan	248109	228454	276265	326231	274762	-8.20%	11.60%	-0.60%	3.00%	3.90%
USA	87371	89093	96701	102077	95297	-1.80%	13.50%	0.40%	0.80%	4.50%
Source: AREMOS Taiwan Economic Statistical Databank.										

Figure 1

Time Series Plots on Hong Kong, China, Japan, and USA Tourists to Taiwan (2001-2013)



The CBL test extended the Hadri (2000) test allowing for two different types of multiple structural breaks and used the Pesaran (2004) cross sectional dependence test to avoid the estimated bias[4]. Additionally, we computed the empirical distribution of panel statistics of CBL stationary test using Bootstrap techniques according to Maddala and Wu's (1999) proposal. The critical values for panel statistics were computed with 20,000 replications.

[4] Details about CBL test, interesting readers can refer to Chang, Chiang, and Zhang (2009) or Chang, Li, Lu, and Lee (2011).

Table 3 Panel A shows the value of 11.293 with *p*-value 0.000, which indicates that we are able to reject the null hypothesis of cross-sectional independence at the 1% significance level, that both homogenous and heterogeneous long run variances are lower than the critical values at the 10% significance level, and that we are not able to find any evidence to reject the null hypothesis. Table 4 Panel B displays the individual time series, and from this we can see that the null of stationary can not be rejected at 10% significance level for any of the countries.

Table 3

The Results for Catching Up of Countries of Origin of Visitors to Taiwan

Panel A: Panel Carrion-i- Silvestre *et al*. (2005) stationarity test						
Pesaran (2004) cross sectional dependence test	Test			p-Value		
	11.293			0.000		
Carrion -i- Silvestre *et al*. (2005) stationarity test	Test	Critical values				
		90	95	97.5	99	p-value
Homogenous long run variance	-0.191	4.026	5.152	6.311	8.019	0.576
Heterogeneous long run variance	-0.316	2.979	3.540	4.126	4.802	0.624

Panel B: Univariate Carrion-i- Silvestre *et al*. (2005) stationarity test					
Countries	Bartlett	90%	95%	97.5%	99%
Hong Kong	0.0237	0.0301	0.0348	0.0389	0.0448
China	0.0222	0.0244	0.0287	0.0329	0.0384
Japan	0.016	0.0218	0.0253	0.0288	0.0347
USA	0.0286	0.0714	0.0892	0.1072	0.1315

Notes: The finite sample critical values are computed by Monte Carlo simulation using 20,000 replications. Maximum break was fixed at 6.

Due to the time series data only having 52 observations, we set the maximum break points at six during our testing procedure. The results for F statistics and its critical values using Monte Carlo simulations were computed with 20,000 replications, as shown in Table 4 and the results indicate that trend breaks should be included in the estimated model. After a grid-search, we found there are 3 breaks for Hong Kong, 5 breaks for China, 4 breaks for Japan, and 2 breaks for the United States. A total of 14 breaks occurred in our 4 sample countries. If we analyze the results in another way, these results show that only one sharp drift occurred in the year of 2005 and 2008, two sharp drifts occurred in the year of 2002, 2004, 2009, and 2011, and three sharp drifts occurred in 2003.The break dates experienced single sharp drifts in 2002 for both China and the United States, in 2003 for all 4 countries, in 2004 for both Hong Kong and Japan, in 2005 for Japan, in 2008 and 2009 for both Hong Kong and China, and in 2011 for both China and Japan.

Table 4

Estimation Results for the Trend Function

Countries	Number of Break Dates		1	2	3	4	5
Countries			Break dates				
Hong Kong	3		2003Q1	2004Q2	2009Q2		
China	5		2002Q1	2003Q2	2008Q1	2009Q2	2011Q3
Japan	4		2003Q1	2004Q2	2005Q3	2011Q4	
USA	2		2002Q1	2003Q2			

Notes: Maximum breaks were fixed at 6.

6. Conclusion

This paper has examined the structural breaks of visitor arrivals in Taiwan from Hong Kong, China, Japan, and the USA using CBL with the bootstrap approach. The results indicate that there were three break dates shown in the Hong Kong market, which are corresponding to 2003Q1, 2004Q2, and 2009Q2. Five break dates were found in the China market, which are corresponding to 2002Q1, 2003Q2, 2008Q1, 2009Q2, and 2011Q3. In the Japan market, four break dates were located at 2003Q1, 2004Q2, 2005Q3, and 2011Q4. Finally, two break dates were revealed in the USA, in 2002Q1 and 2003Q2.

Apparently, our empirical results found that the SARS outbreak had an impact on Taiwan's four major inbound markets, but with transitory shocks. These may contribute to the strong tourism efforts and promotions made by Taiwan's government and practitioners after the WHO lifted Taiwan from its SARS travel advisory list in June of 2003. A global recession occurred in early 2002, but this shock only impacted the tourist arrivals from China and the USA. The deteriorating economy in 2008 and the European debt crisis in 2011 had devastating consequences on the economic growth around the world, which also impacted different source tourist markets in different time periods, but only with temporary shocks.

Our results are consistent with those of Narayan (2005a) in terms of the rejection of the hypothesis of non-stationarity and the findings that external shocks have only a transitory effect on tourist arrivals. By applying the Sen (2003) test for on unit root structural break, the author investigated whether or not shocks to visitor arrivals to Fiji from three main inbound markets (Australia, New Zealand and the USA) have a permanent or transitory effect. Narayan (2005a) concluded that inbound tourism from these markets are finally trend reverting. However, the current findings showing that SARS undermined four main source markets of the island are contrary to the study by Lim, McAleer, and Min (2009), which indicated that the SARS outbreak did not have a significant effect on Japanese tourist arrivals to Taiwan.

The significant effect of natural and manmade events on international tourism flows is well documented. Given the tourism sector's particular vulnerability to disruptions from internal and external environmental factors, it is important that destination governments thoroughly research both the temporary and permanent effects on tourism of such events (Cakar, 2018). The contribution of the current study would be to use the CBL with the bootstrap approach to evaluate whether or not shocks to visitor arrivals to Taiwan from China, Japan, the USA and Hong Kong, accounting for over 80% of Taiwan's inbound tourism, are permanent or temporary. The empirical findings of this study provide important policy implications on tourism planning and management for Taiwan's government. For instance, if a shock (such as one tourism competitive strategy) has a permanent effect, this implies that volatilities of

visitor arrivals will increase permanently, because tourism policy has a positive impact on visitor arrivals. However, if tourism policy has a transitory effect, this implies that, despite the tourism strategy, visitor arrivals will return to their equilibrium path after a certain amount of time while the shock quickly dies out. Moreover, the method used here is one of the techniques which may be confidently applied to evaluate after negative shocks for other countries. Tourism authorities can use the model to make operational and strategic decision which can lead to more sophisticated planning to promote and increase tourism activities.

Certain limitations of this study should be noted and provide avenues for future research. This study used only limited data points, and it is recommended to undertake future research when more data will be available. Other related variables such as exchange rate, cost of accommodation, or GDP, which might have cast an impact on the rebound, could also be considered for further study.

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