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國際觀光需求研究

—開放政策、匯率與世界遺產之影響

International Tourism Demand:

The Effect of the Opening Policy, Exchange Rates, and World Heritage Sites

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本論文係 蘇鈺雯 君（學號 D98323002）在國立臺灣大學經濟學系完成之博士學位論文，於民國 102 年 6 月 24 日承下列考試委員審查通過及口試及格，特此證明

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To my parents, Wen-Hsien and friends,

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Your guidance and comments contribute to this dissertation.

Su, Yu-Wen

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Chinese Abstract (中文摘要)

本論文包含三篇觀光需求的實證研究。第一篇研究台灣開放中國觀光客的政策對於台灣國際觀光需求的影響；第二篇則以可變參數模型研究實質匯率對於台灣國際觀光需求的影響；第三篇主要探討世界遺產對於國際觀光需求的影響，並討論其邊際效果的變化。

第一章

Chinese Tourists in Taiwan: Changes in Visa Requirements, Crowding Effects and Management Implications

2008 年七月，台灣開放中國觀光客來台觀光，本研究主要探討中國觀光客來台是否會排擠掉其他國家來台的觀光客。然而，由於缺少資料，我們首先使用中國觀光客到日本觀光的資料作為參考，以探討開放中國觀光客自由行對於觀光市場的衝擊。同時，在 ARIMA 模型設定下使用介入分析 (intervention analysis) 與離群值偵測 (outlier detection)，針對來台的外國觀光客旅次，分析中國觀光客的排擠效果。結果顯示，即使台灣的觀光條件已逐步改善，中國觀光客對於來台的日本以及美國觀光客有顯著的排擠效果。顯示台灣目前的觀光條件仍不足，應再加以建設或是暫緩開放的速度。

第二章

Do Exchange Rates Affect International Tourist Arrivals in Taiwan? An Empirical Study Using Time-Varying Parameter Model

匯率對於觀光需求的影響在文獻上一直沒有定論，而傳統的時間序列迴歸分析總是假設參數固定，不會隨著時間而改變，然而，此假設相當不實際。觀察日本、香港及美國來台觀光旅次的資料，不僅是資料本身，其與其他變數的關係都有結構性的變動。因此，本研究使用可變參數模型 (time-varying parameter, TVP) 探討從 1971 年第一季至 2011 年第一季之間，實質匯率與台灣國際觀光需求間關係的穩定性。估計結果顯示，唯有當觀光客來源國的經濟景氣較差，或是其所得水準接近或低於台灣時，實質匯率對於其來台觀光需求有正向且顯著的影響。

第三章

Analysis of International Tourist Arrivals Worldwide: The Role of World Heritage Sites

本研究使用 2000 年至 2009 年間 66 個國家的資料，研究世界遺產 (world heritage sites, WHSs) 對於國際觀光需求的影響，並探討其邊際效果如何隨著擁有世界遺產數目的不同而改變。研究結果顯示，世界遺產對於國際觀光的確有正向且顯著的影響，且文化遺產的正向影響稍大於自然遺產，因此擁有世界遺產對

於觀光經濟有所助益。此外，此正向影響會隨著擁有的世界遺產數目的增加而下降，但當一個國家擁有足夠多的世界遺產時，此影響又會再度增加，因此邊際影響隨著世界遺產數目的增加，呈現 U 型的影響效果。此效果雖具有地域性的差異，但是不同時間下的估計結果卻相當一致。

關鍵詞：ARIMA、介入模型、排擠效果、世界文化遺產、實質匯率、時間序列迴歸

Abstract

This dissertation includes three empirical studies on the tourism demand. The first studies the policy impact of Taiwan's opening for Chinese tourists. The second explores the time-varying parameters model of the real exchange rate on Taiwan's international tourism demand. The third investigates the piece-wise marginal effect of world heritage sites on the international tourism demand worldwide.

Chapter 1

Chinese Tourists in Taiwan: Changes in Visa Requirements, Crowding Effects and Management Implications

In July 2008, Taiwan passed legislation to allow Chinese tourists to travel to Taiwan. Even though this legislation has increased total inbound tourists, we are interested in potential crowding-out effects which may have a negative impact on Taiwan's tourism. We analyze tourist arrivals from Japan, Hong Kong, and the United States to explore the crowding-out effect. Using seasonal ARIMA models with joint estimation of intervention and outlier effects, we find that Chinese tourists significantly crowd out Taiwan's international tourists from Japan and the United States, but not those from Hong Kong, even with Taiwan's increased tourism capacity. Therefore, our results indicate that Taiwan should either further enhance tourism capacity or decelerate its opening policy to avoid severe crowding-out effects.

Chapter 2

Do Exchange Rates Affect International Tourist Arrivals in Taiwan? An Empirical Study Using Time-Varying Parameter Model

There has been a debatable effect of the exchange rate on tourism demand. Not only the significance but the sign of the effect is questionable. Traditionally, time series regression model assumes parameters are constant over time, but this assumption is restrictive. For Taiwan's time series data of international tourist arrivals from Japan, Hong Kong and the United States, not only tourist arrivals but also their relations with price factors would change structurally. Therefore, the *time-varying parameter* (TVP) approach is employed to explore the stability of influences of real exchange rates on Taiwan's international tourist arrivals between 1971Q1 and 2011Q1. Allowing parameters varying by time, the estimated results indicate that the significantly positive effect of real exchange rates. However, this effect would occur only when the economic condition declines in source countries, or for whose income levels are close to or lower than Taiwan.

Chapter 3

Analysis of International Tourist Arrivals Worldwide: The Role of World Heritage Sites

By using the panel data of 66 countries between 2000 and 2009, we study the positive effect of world heritage sites (WHSs) on the demand for international tourism,

and investigate how this effect changes according to different numbers of WHSs. Our results indicate that a country possessing WHSs would increase its international tourist arrivals, and the positive effect of natural WHSs is slightly larger than that of cultural ones. Therefore, a country possessing a WHS is able to benefit from the development of its tourism economy. Moreover, this positive effect declines as the number of WHSs rises, but when a country possesses sufficient WHSs, the effect increases instead. Thus, the marginal effect of WHSs exhibits a U-shaped pattern as the number of WHSs increases. In addition, even though the marginal effect of WHSs has a different pattern for each region, based on the time periods, the results are quite robust.

Keywords: ARIMA, Intervention analysis, crowding-out effect, World Heritage Sites, real exchange rates, time series regression,

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Chapter 1

Chinese Tourists in Taiwan: Changes in Visa Requirements, Crowding Effects and Management Implications

1.1. Introduction

As the economy develops, people put more emphasis on the quality of life; especially people in developed countries. Therefore, tourism becomes a growing economic activity. According to the World Tourism Organization, there were 629 million international tourists worldwide in 1997, and the number increased to 1,027 million in 2008 with an average 5% annual growth rate. In addition, compared with heavy industry or the manufacturing industry, which consumes energy, emits carbon dioxide, and may pollute air and water during the production process, the tourism industry is relatively eco-friendly and achieves sustainable development.

China, with a large population and tremendous potential as an economic power, has become one of the main sources of international tourism over the last decade. According to the World Tourism Organization, the number of Chinese outbound tourists steeply increased from 5 million in 1997 to 46 million in 2008 with a 68% annual growth rate, 13 times more than the average growth rate of all other countries.

In July 2008, Taiwan authorities passed legislation to allow Chinese tourists to travel to Taiwan. This controversial policy stirred up public opinion and ignited intensive debates over its economic and political impacts. Even though this policy still restricts inbound tourists from China to 4000 people per day in 2011, and further restricts inbound tourism from China to only tour groups, the policy has already increased the number of Chinese tourists and generated tremendous amounts of revenue for Taiwan. According to the statistics from the Tourism Bureau of Taiwan, monthly Chinese tourist arrivals to Taiwan were 44,000 in January 2009. This number steeply increased to 101,000 in January 2011. When Taiwan government further allows Chinese individual tourists to travel to Taiwan, this number would be much higher.

Compared with China, a large country with a population of 1.3 billion, Taiwan is just a small island with relatively limited tourism capacity. Increasing Chinese tourist arrivals is beneficial for both the tourism industry and the economy, but too many Chinese tourists may have unexpected negative impacts on Taiwan's tourism industry. More specifically, this huge increase of Chinese tourists may cause hotels and restaurants to be over-booked and may lower the quality of Taiwan's international tourism. Moreover, if Chinese tourists overwhelm Taiwan's tourism capacity and supporting facilities cannot be constructed in time, this excess demand would crowd out Taiwan's current diverse international tourists, or cause a disorder of tourism in Taiwan.

Table 1.1 shows Taiwan's international tourist arrivals from several major countries based on the Tourism Bureau of Taiwan. We can briefly compare the differences before and after Taiwan's 2008 openness policy for Chinese tourists. We find that Chinese tourist arrivals steeply rose from 329,000 in 2008 to 1.6 million in 2010, making China the largest source of international tourism for Taiwan. Hong Kong tourist arrivals also rose from 491,000 in 2007 to 794,000 in 2010. However, tourists from Japan and the United States (U.S.) decreased in the years between 2007 and 2010. In terms of proportion, tourist arrivals from Japan declined from 31.4% to 19.4%, and those from U.S. declined from 10.7% to 7.1%. Moreover, even though the number of tourist arrivals from Japan and U.S. increased slightly in 2010 compared with the prior two years (seemingly due to recovery from the global financial crisis), these numbers did not exceed the level prior to Taiwan's 2008 openness. Since the increase of international tourist arrivals into Taiwan is mainly attributed to Chinese tourists, the decline of Japanese and U.S. tourists indicates a potential *crowding-out effect* due to the steep increase of tourists coming from China.

Table 1.1. International tourist arrivals to Taiwan (2005 – 2010; Units: 1000)

	2005	%	2006	%	2007	%	2008	%	2009	%	2010	%
Japan	1124	*33.3*	1161	*32.5*	1166	*31.4*	1087	*28.3*	1001	*22.8*	1080	*19.4*
Hong Kong	433	*12.8*	432	*12.1*	491	*13.2*	619	*16.1*	719	*16.4*	794	*14.3*
United States	390	*11.5*	395	*11.1*	398	*10.7*	387	*10.1*	369	*8.4*	396	*7.1*
China	173	*5.1*	243	*6.8*	320	*8.6*	329	*8.6*	972	*22.1*	1630	*29.3*
Others	1258	*37.2*	1341	*37.5*	1661	*44.7*	1810	*36.9*	1334	*30.3*	1667	*29.9*
Worldwide	3378	*100.0*	3572	*100.0*	3716	*100*	3845	*100.0*	4395	*100.0*	5567	*100.0*

1. %, *Proportion*
2. China's data before openness (2008) are from The Mainland Affairs Council of Taiwan. The rest of data are from The Tourism Bureau of Taiwan

In this paper, our primary interest is to evaluate the impact due to the legislation of allowing Chinese tourists to travel to Taiwan in July 2008 and its further influences. To evaluate this policy impact, we employ seasonal ARIMA (*Autoregressive Integrated Moving Average*) models (Box and Jenkins, 1976) and treat the policy change as an *intervention* (Box and Tiao, 1975). Since atypical data often occur in such time series, we employ outlier detection and joint estimation methods (Chang, *et al.*, 1988; Tsay, 1988; Chen and Liu, 1993; Liu and Hudak, 1992) to automatically detect and handle the outliers. In addition, we include *moving-holiday effects* (Liu, 1980; Hillmer, 1982; Bell and Hillmer, 1983) in the intervention analysis.

Generally speaking, traditional regression models with dummy variables are often employed to evaluate one-time events or natural disasters (*e.g.* Courch *et al.*, 1992; Witt and Witt, 1995; and Wang, 2008). Such models may not be most suitable due to autocorrelations of the data as well as the impact patterns and lag structure of the event effects. Thus, ARIMA-related models are often used to study tourism data in recent years (*e.g.* Lim and McAleer, 2000; Kim and Moosa, 2001; Goh and Law, 2002; Huang and Min, 2002; Kulendran and Shan, 2002; Coshall, 2005; Gil-Alana, 2005; Min, 2005; Papatheodorou and Song, 2005; Chu, 2008). Min (2005), for example, analyzes the effect of the SARS epidemic on Taiwan's tourism; Lin *et al.* (2011) estimate calendar effects as well as detect outliers and identify associated events in Taiwan's international tourism. However, little time series tourism research uses joint estimation of intervention and outlier effects to handle one-time events and policy changes.

In this study, we construct two models. First, because data for Chinese tourist arrivals into Taiwan is rather limited, experience gained from the Japanese opening policy for Chinese tourists is used as a reference study. The Japanese opening process contains four stages: (1) openness for tour groups, (2) school trips, (3) family tours, and (4) individual tourists. Based on the result, we project the Japanese opening policy to Taiwan, and evaluate the additional increase of Chinese tourist arrivals in Taiwan due to the opening policy for individual tourists. Second, to study the crowding-out effect from Chinese tourists in Taiwan directly, we also used seasonal ARIMA models with joint estimation of intervention and outlier effects. We find significant crowding-out effects for tourist arrivals from U.S. and Japan, but not for tourist arrivals originating from Hong Kong.

In Section 2, we provide an overview of worldwide outbound tourism at the region/country level as well as Chinese outbound tourism. We also briefly describe the present situation of tourism between Taiwan and China. The methodology of

ARIMA models with joint estimation of model parameters and outlier effects is introduced in Section 3. The analysis results and their economic implications are presented in Section 4. Section 5 provides discussion and conclusions.

1.2. Tourism in China and Taiwan

Before analyzing the tourism time series data, it is important to have an understanding of the tourism in China and Taiwan. In this section, we provide an overview of the growth of outbound tourism in China, the tourism relationships between Taiwan and China, and the international tourism into Taiwan.

1.2.1. The Growth of Outbound Tourism in China

Economic development and improvement of worldwide transportation result in booming international tourism, especially in developed countries. Based on data from the World Tourism Organization, Table 1.2 lists the number of annual outbound tourists in some important regions/countries between 1997 and 2009. During this period, Europe's outbound tourists increased from 140 million to 235 million. In U.S., this number grew from 53 million to 61 million. In the ASEAN region, this number also increased from 36 million to 50 million. These figures show that the outbound tourism is growing worldwide.

Table 1.2. Outbound tourists for select countries and regions (1997 – 2009; Units: 1000)

Year	Worldwide	%	Europe	%	U. S.	%	ASEAN	%	China	%	Japan	%	Korea	%
1997	605449		140127		53229		35502		5324		16803		4542	
1998	637072	*5.2*	158148	*12.9*	55696	*4.6*	34681	*-2.3*	8426	*58.3*	15806	*-5.9*	3067	*-32.5*
1999	658718	*3.4*	159683	*1.0*	57222	*2.7*	35524	*2.4*	9232	*9.6*	16358	*3.5*	4342	*41.6*
2000	730614	*10.9*	171234	*7.2*	61327	*7.2*	40631	*14.4*	10473	*13.4*	17819	*8.9*	5508	*26.9*
2001	739845	*1.3*	172123	*0.5*	59442	*-3.1*	46485	*14.4*	12133	*15.9*	16216	*-9.0*	6084	*10.5*
2002	759873	*2.7*	192072	*11.6*	58066	*-2.3*	40560	*-12.7*	16602	*36.8*	16523	*1.9*	7123	*17.1*
2003	755639	*-0.6*	201560	*4.9*	56250	*-3.1*	43868	*8.2*	20222	*21.8*	13296	*-19.5*	7086	*-0.5*
2004	819649	*8.5*	205449	*1.9*	61809	*9.9*	44496	*1.4*	28853	*42.7*	16831	*26.6*	8826	*24.6*
2005	882562	*7.7*	224717	*9.4*	63503	*2.7*	45217	*1.6*	31026	*7.5*	17404	*3.4*	10080	*14.2*
2006	903809	*2.4*	221184	*-1.6*	63662	*0.3*	47388	*4.8*	34524	*11.3*	17535	*0.8*	11610	*15.2*
2007	961787	*6.4*	228773	*3.4*	64024	*0.6*	48706	*2.8*	40954	*18.6*	17295	*-1.4*	13325	*14.8*
2008	982699	*2.2*	232712	*1.7*	63549	*-0.7*	49838	*2.3*	45844	*11.9*	15987	*-7.6*	11996	*-10.0*
2009	961575	*-2.1*	235326	*1.1*	61419	*-3.4*	50055	*0.4*	47656	*4.0*	15446	*-3.4*	9494	*-20.9*

1. *%, Annual growth rate*
2. Source: The World Tourism Organization

To facilitate a better understanding of relative tourism growth in these regions/countries, the numbers of annual outbound tourists are indexed to 1997 levels (i.e. the numbers are set to be 100 in 1997) and displayed in Figure 1.1. The relative growth rates of outbound tourists are quite stable in most of the regions/countries, except for China. In China, the index increased to 895 in 2009, which is almost nine times of that in 1997, while Korea is around two times and the others are lower than two times. After Xiao-Ping Deng's reform in 1978, tourism of China also goes through several important reforms and promotions. Moreover, accompanying the considerable economic growth, Chinese people with higher income have more willingness to travel. This growth trend indicates that China would become one of the major home countries of international tourists in the near future (see *e.g.,* (Airey and Chong, 2011; Pan, 2003; Zhang and Heung, 2001; Lim and Wang, 2008).

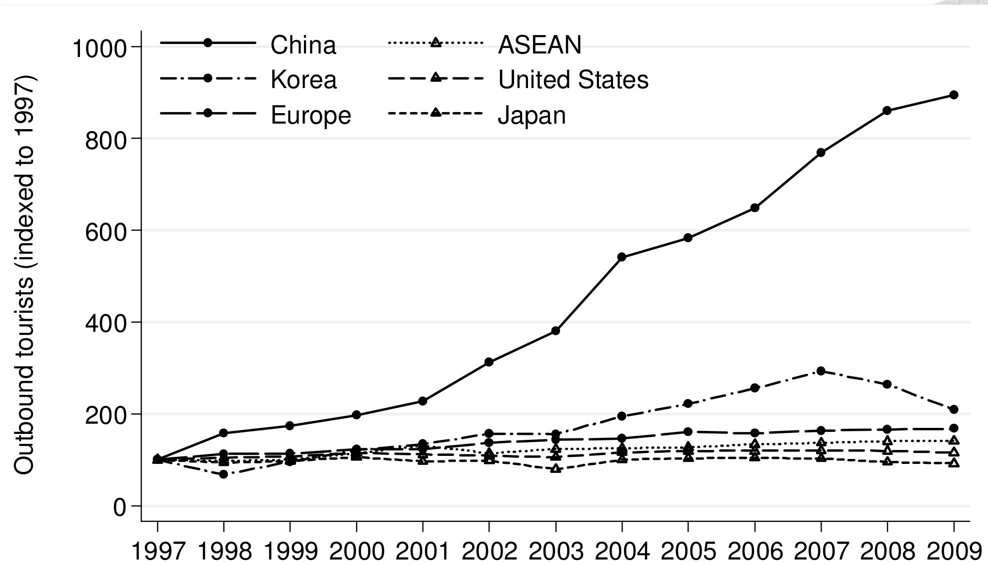

Figure 1.1. Outbound tourists for select countries and regions (Indexed to 1997)

Although China will become a major home country of international tourists, Chinese outbound tourism is highly related to policies set forth in the destination regions/countries. In Figure 1.2, we display the outbound tourism from China using the data from the World Tourism Organization. The numbers of Chinese outbound tourists reflect different degrees of restrictions in these destination regions/countries. Chinese tourist arrivals increase in less-restricted regions/countries such as Hong Kong, Macao, and ASEAN. Hong Kong, for example, which removed the quota of 1500 daily Chinese tourists in 2002 and opened for individual Chinese tourists in 2004, increased its Chinese tourist arrivals from 2 million in 1998 to 9.7 million in 2009. However, Chinese tourist arrivals stay low in highly-restricted regions/countries such as U.S., Japan, and Korea. U.S., for instance, which imposes strict qualification requirements and visa restrictions for Chinese tourists, only increased its Chinese tourist arrivals from 0.2 million in 1998 to 0.5 million in 2009.

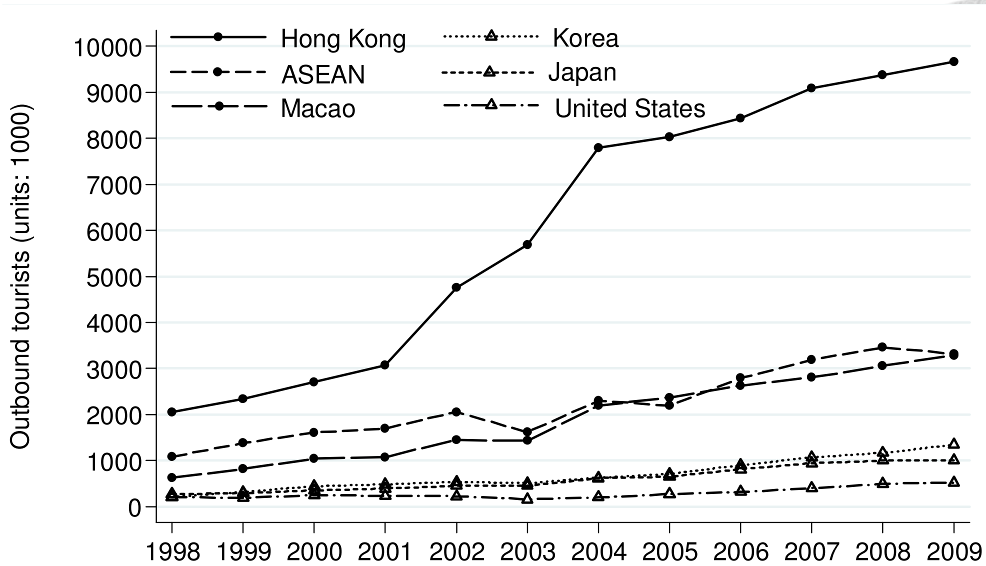

Figure 1.2. Outbound tourists from China to select destinations (1998 – 2009)

In recent years, many countries realized the benefit of tourism from China and have implemented various stages of openness policies. Japan, for instance, executed the “Inbound Travel Promotion Project (Visit Japan Project)” from 2003, which targeted 12 nations to promote Japanese tourism. Among these nations, China is the third largest home country of Japanese international tourists. Japan government conducted a four-stage opening policy to increase Chinese tourist arrivals since 2000. The monthly Chinese tourist arrivals to Japan are plotted in Figure 1.3 based on the Japan National Tourist Organization. We observe that an upward trend of monthly Chinese tourist arrivals from 21,505 in January 1996 to 92,120 in January 2010, and the average annual growth rate is 32.3%. These four-stages of the opening policy are also marked in Figure 1.3.

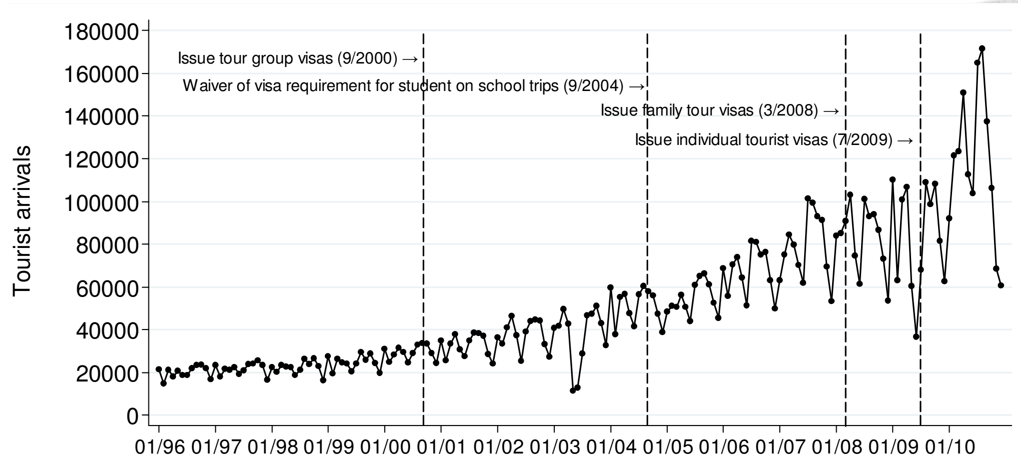

Figure 1.3. Monthly tourist arrivals from China to Japan (1/1996 – 12/2010)

In addition to Japan, some previously highly-restricted countries are also gradually open for Chinese tourists. On December 2007, U.S. and China signed a memorandum of understanding (MOU) to facilitate Chinese group tours to U.S.. The United States government is also considering passing new legislation to relax the visa restrictions of Chinese tourists according to U.S. Commercial Service. In South Korea, China has become the second largest home country of international tourists since 2001, and got much attention by the authorities. All of these policy changes suggest that the growth of the outbound tourism of China has attracted international attention. To benefit from this trend of international tourism from China, many countries, including Taiwan, are willing to change their policy to attract Chinese tourists.

1.2.2. Tourism between Taiwan and China

In 1949, the Nationalist government withdrew from mainland China to Taiwan and a prolonged confrontation began. After almost forty years of confrontation and separation, the Taiwan government changed its policy to allow Taiwan residents to visit their families in mainland China in 1987. After this epoch-making policy, the interactions across the two sides of the Taiwan Straits intensified. For instance, China’s Taiwan Affairs Office issued "Regulations for Encouraging Investment by Taiwan People" in 1988. In 2001, the “Mini Three Links” (direct postal, shipping and trade links) were implemented, and cross-strait direct flights were also set forth in 2008. After strenuous policy debates, the Taiwan government finally allowed Chinese tourists to travel to Taiwan in July 2008.

Figure 1.4 shows the tourist arrivals between Taiwan and China in the past two decades based on the data from the Taiwan National Immigration Agency. The number of tourist arrivals from Taiwan to China increased dramatically from 44,000 in 1988 to 5.8 million in 2010. On the contrary, restricted by policy, the number of tourist arrivals from China to Taiwan only increased from 386 in 1988 to 291,696 in 2008; a much slower pace. Nevertheless, after Taiwan’s opening to Chinese tourists in 2008, this number dramatically increased to 967,000 in 2009 and then 1.5 million in 2010.

Figure 1.4. Tourist arrivals between Taiwan and China (1988 – 2010)

Despite the dramatic increase in tourists from China, a more careful evaluation is required to assess the overall impact of Taiwan’s opening policy toward Chinese tourists. We should consider Taiwan's tourism capacity limitations of tourist attractions, accommodations, restaurants, transportation facilities and services, which have quite fixed supplies and take much time to maintain and expand. Opening to Chinese tourists has benefits if Taiwan's international tourism capacity can accommodate, but can also cause potential complications and serious issues if the demand overwhelms Taiwan's tourism capacity. The considerable Chinese tourists may crowd out existing international tourists or, even worse, reduce the quality of Taiwan's tourism causing the permanent loss of existing tourism sources. Therefore, whether the opening policy is beneficial or detrimental should be evaluated more cautiously.

1.2.3. International Tourism into Taiwan

Taiwan, well-known for its development and manufacturing of high-tech components and products has become a developed country. Compared with other countries, Taiwan is also rich in tourism resources, offering both natural beauty and cultural experience, but did not use them effectively in the past decades. According to the World Travel & Tourism Council, tourism contributes only 3.6% of Taiwan's GDP in 2010, while it contributes 9% in Japan and 16% in Hong Kong. Therefore, Taiwan's authorities are aggressively promoting Taiwan's tourism in recent years.

Figure 1.5 displays monthly international tourist arrivals from three major sources (Japan, Hong Kong and U.S.) and worldwide based on the data from the Tourism Bureau of Taiwan. In Figure 1.5 (A) – (C), we could see the changes of Taiwan's international tourist arrivals from Japan, Hong Kong and U.S. after the openness for Chinese tourists in July 2008. For Japan and U.S., the levels of tourist arrivals seem to shift downward, while it shifts upward for Hong Kong. Note that we focus on the level or trend changes before and after July 2008.

Figure 1.5 (D) shows that Taiwan's monthly worldwide tourist arrivals increased from 160,194 in December 1991 to 530,594 in December 2010. This number increase has almost doubled in the recent two years, mainly contributed by the surge of Chinese tourists. Using the data between July 2008 and December 2010, Figure 1.6 reveals this phenomenon in better detail. After Taiwan's openness for Chinese tourists in July 2008, tourist arrivals from China steeply increased, relative to those from Japan, Hong Kong and U.S.. In this study we shall employ more rigorous time series models in the next section to investigate whether a crowding-out effect indeed exists.

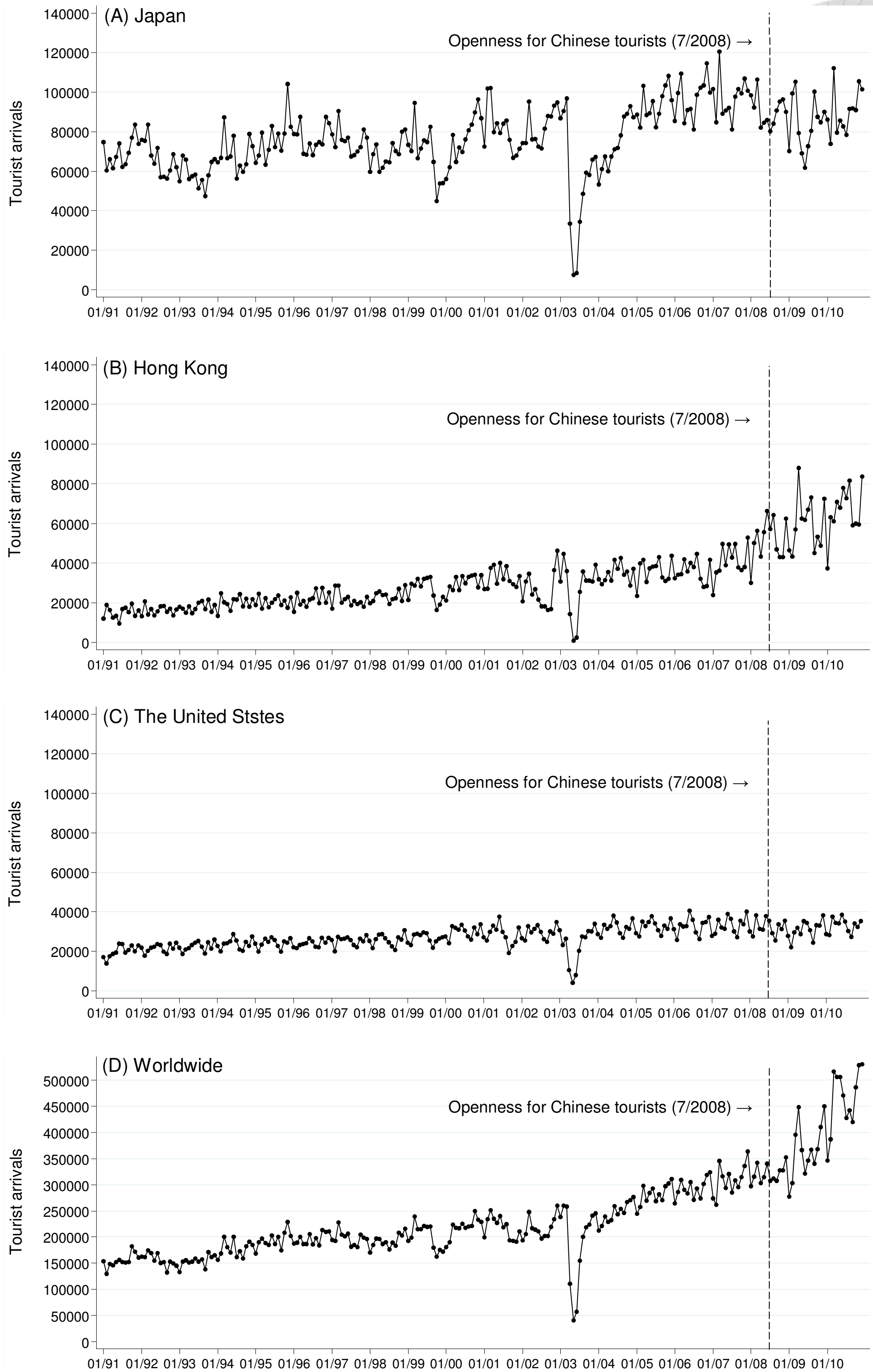

Figure 1.5. Monthly international tourist arrivals to Taiwan (1/1991-12/2010)

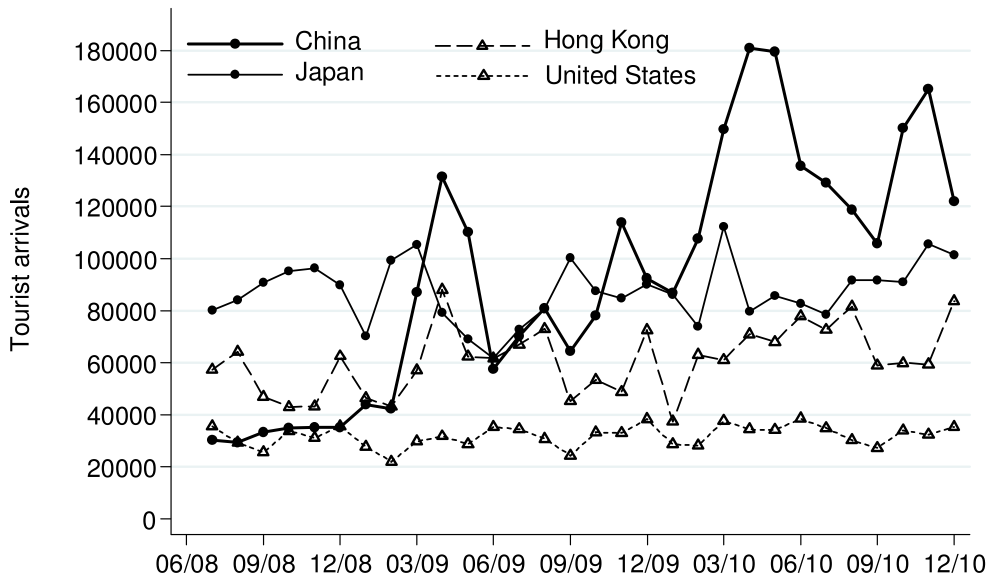

Figure 1.6. Monthly international tourist arrivals to Taiwan (7/2008-12/2010)

1.3. Data and Methodology

Between July 2008 and December 2010, we only have 30 monthly observations of Chinese tourist arrivals to Taiwan. The lack of data limits rigorous time series analysis that can be conducted. Fortunately, we can use the Japanese opening process for Chinese tourists as a reference to project future policy impact on Taiwan. The monthly Chinese tourist arrivals into Japan between January 1996 to December 2010 (180 observations) is plotted in Figure 1.3. Additionally, Figure 1.5 (A) – (C) contains the data of Taiwan's major sources of international tourist arrivals, including the monthly tourist arrivals from Japan, Hong Kong, and United States between January 1991 and December 2010 (240 observations). We use these three time series to directly analyze whether the crowding-out effect exists.

To choose the most adequate model, several characteristics are noticed for the series in Figure 1.3 and Figure 1.5. First, and the most obvious, is the upward trend with seasonal variation. Second, several major outliers exist, such as Taiwan's major earthquake in September 1999 (Huang and Min, 2002), the SARS epidemic in March 2003 (Min, 2005; Wang, 2008), and the H1N1 epidemic in June 2009. Thus, we need to employ the joint outlier estimation, which detect and account for the effects of outliers, and allow us to focus on the primary policy impact of interest. Third, the variance of these time series increase over time. Thus, a proper variance stabilizing transformation is needed. A logarithm transformation is employed in this study. Last but not least, the Chinese New Year is an important holiday in Chinese societies, including both in China and Taiwan (Lin *et al.*, 2011). Because the Chinese New Year occurs sometimes in January and sometimes in February of the Gregorian calendar, and cannot be captured by seasonal factors. This calendar effect, also known as *moving-holiday effect*, should be included in the model. Considering these characteristics, seasonal ARIMA models with an intervention component (openness for Chinese tourists) shall be considered.

1.3.1. Seasonal ARIMA Model

Assuming $\{Y_t\}$ is a time series of tourist arrivals, and t is the time from 1 to n, a Box-Jenkins seasonal ARIMA model can be written as

$$\phi_p(B)\,\Phi_P(B^s)\,(1-B)^d\,(1-B^s)^D\,Y_t = C_0 + \theta_q(B)\,\Theta_Q(B^s)\,a_t, \quad a_t \overset{iid}{\sim} N(0,\sigma_a^{\,2}) \tag{1.1}$$

where B is the backshift operator ($BY_t = Y_{t-1}$), C_0 is a constant term, $\phi_p(B)$ and $\theta_q(B)$ are the regular *autoregressive* (AR) and *moving average* (MA) polynomials, and $\Phi_P(B^s)$ and $\Theta_Q(B^s)$ are the seasonal AR and MA polynomials. The subscript p (and P) and q (and Q) are used to indicate the order of the associated regular (and seasonal) AR and MA polynomials, respectively. The superscript d (and D) is the regular (and seasonal) differencing order, and s is referred to as *seasonality*. The model in (1.1) is often denoted as ARIMA$(p,d,q)(P,D,Q)_s$.

The above model can also be expressed in the following alternative form

$$(1-B)^d\,(1-B^s)^D Y_t = C + \frac{\theta_q(B)\,\Theta_Q(B^s)}{\phi_p(B)\,\Phi_P(B^s)}\,a_t, \quad C = \frac{C_0}{\phi_p(B)\,\Phi_P(B^s)}. \tag{1.2}$$

In this form, the constant term C is the *mean* of the time series if both d and D are zero. The term C is the *trend* of the series if $d = 1$ or $D = 1$, and it becomes a higher order trend if $d > 1$ and/or $D > 1$. The form of the ARIMA in (1.2) is more desirable since the constant term C has an interpretable meaning.

1.3.2. Intervention Analysis with Outlier Adjustment

Given that a known external event (intervention) occurs at time T, intervention analysis can be used to estimate the impact of the post intervention period relative to the pre-intervention period. There are two primary types of interventions, $I_t^{(T)}$: The *step function*, $S_t^{(T)}$, and the *pulse function*, $P_t^{(T)}$.

If an intervention occurs at time T and its effect is persistent (or permanent), this intervention can be defined in the time series model as a step function

$$I_t^{(T)} = S_t^{(T)} = \begin{cases} 1, & t \geq T \\ 0, & t < T. \end{cases} \tag{1.3}$$

If an intervention occurs at time T and its effect does not persist after time T, this intervention can be defined in the time series model as a pulse function

$$I_t^{(T)} = P_t^{(T)} = \begin{cases} 1, & t = T \\ 0, & t \neq T. \end{cases} \tag{1.4}$$

With step functions and pulse functions, we can estimate a variety of intervention effects. For example, if an intervention occurs at time *T* and causes a pulse response, ω, after *b* time periods, the intervention model component is defined as

$$\omega B^b I_t^{(T)} \tag{1.5}$$

As another example, if an intervention occurs at time *T* causing a permanent but gradual response after *b* time periods, the intervention model component is defined as

$$\frac{\omega B^b}{1-\delta B} I_t^{(T)} \tag{1.6}$$

where $0 < \delta < 1$. Note that if $\delta = 0$, (1.6) can be reduced to (1.5).Various types of impact patterns can be examined using combinations intervention effects in (1.5) and (1.6). A time series model may also include more than one intervention component.

It is quite common for time series to have *outliers*, which may be caused by known or unknown events. Outliers may bias parameter estimates in the model, in particular, the intervention effects (Liu and Chen, 1991). Therefore, outlier detection and estimation must be an integral part of any rigorous intervention analysis (Liu, 2006). There are four basic types of outliers (Chang, *et al.*, 1988; Tsay, 1988): *Additive outlier* (AO), *innovational outlier* (IO), *level shift* (LS) and *temporary change* (TC). Other types of outliers can usually be expressed as combinations of these four basic types. Automatic outlier detection can assist researchers in discovering both known and unknown important events (Chen and Liu, 1993; Liu, 2006; Lin, *et al.*, 2011) and has been shown to be very useful in various time series analysis. To estimate an ARIMA-intervention model in the presence of outliers, model parameters and outlier effects must be jointly estimated. When conducting joint estimation of model parameters and outlier effects, the procedure consists of the following three steps: (1) detect outliers, (2) adjust the series for outliers, and then (3) estimate the model parameters based on the adjusted series. This three-step procedure is repeated until no additional outliers are found. The details of this joint estimation procedure is described in Chen and Liu (1993) and implemented in the SCA Statistical System (Liu and Hudak, 1992), which is used in this study.

1.4. Empirical Results

In this research, we are interested in whether the crowding-out effect of Chinese tourist exists in Taiwan, and whether Taiwan's government should accelerate or decelerate further openness. We employ the seasonal ARIMA model with intervention, which is coded as a step function corresponding to openness policy change, and estimate the model by using joint estimation of model parameters and outlier effects.

1.4.1. Evaluation of Japanese Policy for Chinese Tourists

Even though the lack of data of Chinese tourist arrivals to Taiwan limits rigorous analysis of such time series, the abundant data of monthly Chinese tourist arrivals to Japan (between January 1996 and December 2010) can be used as a reference to study the policy impact of tourism openness. Referring to the experience in Japan, we can obtain the benchmark of Taiwan's future tourism opening process for Chinese tourists.

The Japan government adopted four major opening policies for Chinese tourists in the following sequence: (1) issuing tour group visas in September 2000 (*OPEN*1); (2) waiver of visa requirement for students on school trips in September 2004 (*OPEN*2); (3) issuing family tour visas in March 2008 (*OPEN*3); and (4) issuing individual tourist visas in July 2009 (*OPEN*4). These four openness policies are set as four intervention variables in Model 1.1. Because these policies persist after they are initiated, the step functions are used to represent them, rather than the pulse function. In addition, because the variance of the time series increases over time, we use a logarithm as the variance stabilizing transformation.

Using rigorous model identification methods, we identify that a seasonal ARIMA$(1,0,0)(0,1,1)_{12}$ model is an adequate model for Chinese tourist arrivals to Japan. In this model identification procedure, the calendar effect of the Chinese New Year is considered. For brevity, we use ∇_{12} to represent the 12th order difference, which means $\nabla_{12} Y_t = (1 - B^{12})\, Y_t$, thus $\nabla_{12} \ln Y_t$ is equivalent to a percentage change from the same month one year earlier. With four interventions of openness policies and the calendar effect multiplied by time trend ($MH_t \times K_t$), the parameter estimates and relevant t-values are presented in Model 1.1.

Model 1.1

$$\nabla_{12}\ln(Y_t) = \underset{(\mathrm{t}=20.80)}{0.0602} + \underset{(\mathrm{t}=-0.32)}{(-0.0042)}\,\nabla_{12}OPEN1_t + \underset{(\mathrm{t}=-1.17)}{(-0.0151)}\,\nabla_{12}OPEN2_t + \underset{(\mathrm{t}=-3.02)}{(-0.0389)}\,\nabla_{12}OPEN3_t$$

$$+ \underset{(\mathrm{t}=3.95)}{0.0509}\,\nabla_{12}OPEN4_t + \underset{(\mathrm{t}=9.51)}{0.0102}\,\nabla_{12}MH_t \times K_t + \frac{1-\overset{(\mathrm{t}=6.90)}{0.4977}\,B^{12}}{1-\underset{(\mathrm{t}=2.35)}{0.1924}\,B}\,a_t, \quad \hat{\sigma}_a^{\,2} = 0.0328. \tag{1.7}$$

The outliers detected, their estimates and t-values under joint estimation of model parameters, and outlier effects are listed in Table 1.3. Major events, such as the SARS and the H1N1 epidemic, are detected and shown in the table.

Table 1.3. Outliers detected and their estimates (tourist arrivals from China to Japan)

Date	Outlier (t-value)		Events
1/1998	LS	- 0.061 (t = -6.04)	
5/2003	TC	- 0.552 (t = -22.87)	SARS epidemic in Japan
8/2003	TC	0.152 (t = 6.30)	
5/2009	TC	- 0.157 (t = -5.38)	H1N1 epidemic in Asia
6/2009	TC	- 0.230 (t = -7.73)	H1N1 epidemic in Asia
8/2009	IO	0.119 (t = 3.49)	Asian Baseball Championship held in Japan
10/2010	LS	- 0.143 (t = -6.59)	Last month of Expo 2010 Shanghai China & local peak of exchange rate (CNY/JPY)

IO: innovational outlier, LS: level shift, TC: temporary change.

In Model 1.1, the constant term (6.02%) is the annual growth rate (i.e., trend) of Chinese tourist arrivals to Japan. The moving-holiday calendar effect due to Chinese New Year indicates significant increases of Chinese tourist arrivals to Japan in a linear upward trend. According to the estimated results in Model 1.1, only the openness for individual tourists (*OPEN*4) has a significant positive effect on Chinese tourist arrivals to Japan. The effect indicates that the openness policy for individual tourists would further increase Chinese tourist arrivals to Japan by 5.09% compared with the same month in the prior year. According to the World Tourism Organization, the average of monthly tourist arrivals from China to Japan is 93,240 in 2008. Thus, this additional increase is around 4,746 Chinese tourist arrivals per month. Note that in Model 1.1, an upward trend is already captured by differencing with the inclusion of a trend parameter. Thus, this model evaluates the increase of tourists due to policy changes that is above the ongoing upward trend.

With this in mind, the other openness policies for group tours, school trips, and family tours would not influence Chinese tourist arrivals to Japan. That is, based on the upward trend, there is no additional increase in tourist arrivals due to these three openness policies. In addition, although these three openness policies are insignificant, the signs are expected to be positive. That is, even though openness policies do not significantly increase tourist arrivals in the short run, it would not decrease them, either. Thus, the negative signs of *OPEN*2 (allowing school trips in September 2004) and *OPEN*3 (allowing family tours in March 2008) are contributed by other two events, which may eliminate the effects of openness policies in Japan: First, in the spring of 2005, a series of nationwide anti-Japanese demonstrations, provoked by some historical issues, took place in China. Second, in late 2008, the global financial crisis occurred.

In Taiwan, the government had gradually deregulated for Chinese students in 2009, opened for tour groups with a limit of 3000 daily tourists in 2008 and then loosened the limit to 4000 in 2011. It also planned to open for individual tourists from specific cities in China in late 2011. Based on the data from other countries, we know that Chinese tourist arrivals, especially the individual tourists, are highly related to openness policy changes in the destination countries. Thus, Taiwan's further openness for Chinese individual tourists may result in soaring Chinese tourists and larger crowding-out effects in Taiwan's international tourism.

Referring to Japanese tourism openness in Model 1.1, the openness policy for Chinese individual tourists additionally increases Chinese tourist arrivals by 4.29% on top of the ongoing upward trend. Here we entertain to use this number to project Taiwan's potential increase of Chinese tourists in the future. In 2010, the average monthly Chinese tourist arrivals in Taiwan are 135,894 based on the Tourism Bureau of Taiwan. With 4.29% increase, Chinese tourist arrivals in Taiwan due to openness policy for individual tourists would additionally increase 5,830 tourist arrivals per month, or equivalently 69,959 per year.

Compared with Japan, which spends almost ten years of opening process for

Chinese tourists, Taiwan shortens this opening process into three years. Under present situation, openness policy for Chinese individual tourists may dramatically increase Chinese tourist arrivals. However, the soaring Chinese tourists may have unexpected impacts on Taiwan's tourism. More specifically, if the soaring Chinese tourists cause the crowding-out effect, then the further opening policy should be considered more cautiously.

1.4.2. Policy Impact of Openness for Chinese Tourists in Taiwan

Now, we employ the intervention analysis to directly investigate the crowding-out effect of Chinese tourists in Taiwan using monthly international tourist arrivals to Taiwan from Japan, Hong Kong, and United States between January 1991 and December 2010.

In July 2008, Taiwan government officially allowed Chinese tourists to visit Taiwan. This openness policy is set as an intervention (*OPEN*) in Model 1.2. Since this policy stays after its inception, the step function is used, which means the intervention variable is set to be one after July 2008 and zero prior to July 2008. We also use a logarithm as the stabilizing transformation for these time series since the variance of these time series increase over time.

With the Chinese New Year effects considered, we find that the seasonal ARIMA$(1,0,0)(0,1,1)_{12}$ model is appropriate for Taiwan's international tourist arrivals for Japan, United States, and Hong Kong. Including the intervention of openness policy in July 2008 and the Chinese New Year effect ($MH_t \times K_t$), the joint parameter estimates and outlier effects are presented in Model 1.2 and Table 1.4.

Model 1.2

Japan:

$$\nabla_{12}\ln(Y_t) = \underset{(t=3.83)}{0.0107} + \underset{(t=-2.00)}{(-0.0451)}\,\nabla_{12}OPEN_t + \underset{(t=-11.23)}{(-0.0062)}\,\nabla_{12}MH_t \times K_t + \frac{1-\overset{(t=15.89)}{0.7102}\,B^{12}}{1-\underset{(t=15.71)}{0.7249}\,B}\,a_t$$

$$\hat{\sigma}_a^{\ 2} = 0.0320$$

(1.8)

United States:

$$\nabla_{12}\ln(Y_t) = \underset{(t=10.86)}{0.0110} + \underset{(t=-4.95)}{(-0.0449)}\,\nabla_{12}OPEN_t + \underset{(t=2.03)}{0.0010}\,\nabla_{12}MH_t \times K_t + \frac{1-\overset{(t=13.31)}{0.6568}\,B^{12}}{1-\underset{(t=5.20)}{0.3297}\,B}\,a_t$$

$$\hat{\sigma}_a^{\ 2} = 0.0240$$

(1.9)

Hong Kong:

$$\nabla_{12}\ln(Y_t) = \underset{(t=9.65)}{0.0306} + \underset{(t=2.87)}{0.0627}\,\nabla_{12}OPEN_t + \underset{(t=7.63)}{0.0073}\,\nabla_{12}MH_t \times K_t + \frac{1-\overset{(t=8.02)}{0.4912}\,B^{12}}{1-\underset{(t=5.69)}{0.3868}\,B}\,a_t$$

$$\hat{\sigma}_a^{\ 2} = 0.0495.$$

(1.10)

The outliers detected, their estimates and t-values are listed in Table 1.4 for each model. Major events, such as Taiwan's earthquake, the SARS epidemic, and terrorist attacks in U.S., are detected and shown in the table.

Table 1.4. Outliers detected and their estimates (Taiwan's international tourist arrivals)

Date	Japan Outlier (t-value)	Hong Kong Outlier (t-value)	United States Outlier (t-value)	Events
1/1993		AO 0.135 (t = 3.38)		
4/1997		LS - 0.079 (t = -3.81)		
9/1998		LS 0.079 (t = 3.77)		
10/1999	TC - 0.181 (t = -6.13)	TC - 0.201 (t = -5.07)		Major earthquake in Taiwan
1/2000			LS 0.035 (t = 4.49)	
9/2001			TC - 0.130 (t = -6.60)	Terrorist attacks in U.S.
4/2002		IO - 0.216 (t = -4.35)		Air China airline crash
6/2002		TC - 0.243 (t = -5.96)		
8/2002		TC - 0.209 (t = -5.06)		
11/2002		TC 0.271 (t = 6.76)		
2/2003			TC - 0.089 (t = -4.33)	
4/2003	TC - 0.360 (t = -12.13)	TC - 0.402 (t = -9.38)	IO - 0.439 (t = -17.82)	SARS epidemic
5/2003	TC - 0.767 (t = -25.88)	TC - 1.338 (t = -30.79)	TC - 0.732 (t = -32.98)	SARS epidemic
6/2003	AO - 0.259 (t = -8.75)		TC - 0.079 (t = -3.38)	SARS epidemic
7/2003	TC 0.150 (t = 4.11)	TC 0.713 (t = 17.41)	TC 0.236 (t = 10.14)	Taiwan was declared free of SARS
8/2003			TC 0.129 (t = 5.91)	
2/2004	TC - 0.125 (t = -4.23)			
4/2004			IO 0.120 (t = 4.98)	
4/2005		AO - 0.156 (t = -3.88)	IO 0.084 (t = 3.51)	
4/2008		AO - 0.184 (t = -4.58)		Violent typhoon Neoguri attacks Hong Kong

AO: Additive outlier, IO: innovational outlier, LS: level shift, TC: temporary change.

According to the parameter estimates in Model 1.2, the estimated effects of the openness policy are negative for U.S. and Japan (significant at 1% and 5% levels respectively), but positive for Hong Kong (significant at 1% level). Therefore, the crowding-out effects of Chinese tourists on Taiwan's international tourist arrivals may exist for Japan and U.S., but not for those from Hong Kong. The effect implies that Taiwan's openness policy for Chinese tourists would decrease the tourist arrivals from Japan by 4.51% and from U.S. by 4.49% in comparison with the same month in the prior year. Based on the Tourism Bureau of Taiwan, Taiwan's average monthly tourist arrivals from Japan and the United States are 90,558 and 32,266 in 2008, and the average expenditure are 1,218 and 3,385 USD per person respectively in Taiwan. Thus, these two percentages imply that tourist arrivals decrease 4,084 from Japan and 1,449 from U.S. per month. The associated decrease of Taiwan's tourism income is around 5 million USD from Japan and 4.9 million USD from U.S. per month.

It is interesting to note that in equation (1.10) of Model 1.2, Taiwan's openness policy for Chinese tourists does not crowd out Hong Kong tourists into Taiwan, which increases instead. This estimated effect implies that Taiwan's openness policy for Chinese tourists would increase the tourist arrivals from Hong Kong by 6.27% compared with the same month in the prior year. This percentage implies an increase of 3,232 tourist arrivals from Hong Kong to Taiwan per month, which increases Taiwan's tourism income by around 3.5 million USD (Taiwan's average monthly tourist arrivals from Hong Kong is 51,555 in 2008, and the average expenditure is 1,070 USD per person in Taiwan according to the Tourism Bureau of Taiwan.)

The increase of tourist arrivals from Hong Kong to Taiwan may be caused by two other reasons unrelated to the openness to Chinese tourists. First, is the advertisement of Taiwan's tourism in Hong Kong in recent years; and second, is the political unrest in Thailand between 2008 and 2009. According to the Tourism Bureau of Taiwan, the Taiwan government spent considerable money advertising tourism in both China and Hong Kong in recent two years, thus further increasing the tourist arrivals from these two areas. Regarding Thailand's political unrest, Thailand and Taiwan are the two main destinations for outbound tourists from Hong Kong in the past, but the violent political conflict in Thailand drove Hong Kong tourists to switch their destination from Thailand to Taiwan. According to the World Tourism Organization, before the political crisis in Thailand, the numbers of Hong Kong's outbound tourists were 448,057 to Thailand and 469,224 to Taiwan in 2007. However, after the political crisis, the number to Thailand reduced to 343,896 and the number to Taiwan rose to 590,820 in 2008. These figures changed further to 378,948 and 690,993 respectively in 2009.

1.4.3. More evidences for the Crowding-out Effect of Chinese tourists

In this subsection, we discuss further evidence to support our findings in Model 1.2, which indicate the existence of a crowding-out effect from Chinese tourists in Taiwan. The crowding-out effect could be an artifact since the time of inception of Taiwan's openness policy for Chinese tourists (from July 2008) which occurred during the period of the global financial crisis (from September 2008 to June 2009 according to the National Bureau of Economic Research of United States). To delineate the effects of these two events, we provide additional evidence to distinguish these two effects and support our findings in Model 1.2.

First, Table 1.5 shows the changes of the total outbound tourists for Japan, U.S. and Hong Kong from 2006 to 2009. For Japan, the total outbound tourists decreased by 3.39% in 2009, which may be caused by the global financial crisis. However, the outbound tourists from Japan to Taiwan decreased by 8.41% in 2009. The additional decrease may be caused by the crowding-out effect of Chinese tourists. For U.S., the total outbound tourists decreased by 3.35% in 2009, but the outbound tourists from U.S. to Taiwan decreased more than 5.85% in 2009. Even though the global financial crisis impacted worldwide international tourism industry, the disproportional decrease of Taiwan's international tourist arrivals from Japan and U.S. supports the findings that there is indeed a crowding-out effect due to Chinese tourists in Taiwan. As for Hong Kong, the shock of the global financial crisis decreased its total outbound tourists by 4.4% in 2009, but the outbound tourists from Hong Kong to Taiwan increased by 16.2% instead in 2009. This positive effect is also consistent with the estimated results in equation (1.10) of Model 1.2. The reason for the increase was explained earlier.

Table 1.5. Change of outbound tourism in Japan, U. S. and Hong Kong (2006 – 2009; Units: 1000)

Year	**Japan**		**United States**		**Hong Kong**	
	Total	To Taiwan	Total	To Taiwan	Total	To Taiwan
2006	17535	1128	63662	363	75812	432
2007	17295 (-1.37%)	1139 (+0.99%)	64024 (+0.57%)	364 (+0.17%)	80682 (+6.4%)	491 (+13.7%)
2008	15987 (-7.56%)	1065 (-6.45%)	63549 (-0.74%)	362 (-0.42%)	81911 (+1.5%)	619 (+26.1%)
2009	15446 (**-3.39%**)	976 (**-8.41%**)	61419 (**-3.35%**)	341 (**-5.85%**)	78336 (**-4.4%**)	719 (**+16.2%**)

Moreover, we can take a look at the present situation of Taiwan's tourism accommodation industry as a reference of the tourism capacity in Taiwan. Figure 1.7 shows Taiwan's monthly tourism accommodation statistics, including the monthly numbers of rooms and the respective occupancy rates as reported by the Tourism Bureau of Taiwan. In the past four years, occupancy rates are rather constant, whose average is 65.6%, while numbers of rooms rose from 21,093 in July 2008 to 24,527 in December 2010. The annual growth rate of the number of rooms was 0.05% before Taiwan's openness for Chinese tourists in July 2008, and steeply increased to 6.51% after the openness. This result indicates that Taiwan's tourism capacity has been increased substantially in anticipation to meet the considerable Chinese tourists' needs and maintain a constant accommodation occupancy rate. Without the substantial increase of hotel rooms after July 2008, the crowding-out effects for the United States and Japan would be much more substantial.

However, combining the results of Model 1.2 with Figure 1.7, we see that a net crowding-out effect still exists, even though the government and private enterprises have enhanced the tourism capacity in Taiwan. The result means either the opening process for Chinese tourists is too fast to be well-prepared or the enhancing of the tourism capacity is inadequate in Taiwan.

Figure 1.7. Monthly tourism accommodation statistics in Taiwan (1/2007 – 12/2010)

In addition, the estimated results are quite robust. We try different lagged interventions of policy changes and obtain similar results to zero lagged interventions in Model 1.2. However, to separate the effects between Taiwan's opening policy and the global financial crisis, the effects of zero lagged interventions are more significant than the effects of lagged interventions.

1.5. Conclusion and Discussion

In summary, after Taiwan's openness policy for Chinese tourists in July 2008, Chinese tourists significantly crowd out Taiwan's international tourists from Japan and U.S., but not those from Hong Kong. The crowding effect occurs even with Taiwan's increased tourism capacity. Taiwan's further openness for Chinese individual tourists would additionally increase Chinese tourist arrivals in the near future, which may enlarge and broaden the crowding-out effect. Thus, the opening policy should be made cautiously.

Due to lack of time series data of Chinese tourist arrivals into Taiwan, we first study the Japanese opening process for Chinese tourists. This serves as a reference of the impacts due to such policy changes. We found that only the policy of opening for individual tourists further increased Chinese tourist arrivals. Using Taiwan's monthly international tourist arrivals data between January 1991 and December 2010 and ARIMA-intervention models, our estimated results indicate that the soaring number of Chinese tourists would crowd out Taiwan's existing and diverse international tourists. The effect is a decrease of 4,084 tourist arrivals from Japan and 1,449 from U.S. per month, even with Taiwan's increased tourism capacity.

According to the Tourism Bureau of Taiwan (2009 Annual Survey Report on Visitors Expenditure and Trends in Taiwan), the average expenditures are 1218 and 3385 USD per person for Japan and United States tourists. Using these numbers as a guide, the crowding-out effect would result in a decrease of Taiwan's tourism revenue by around 5 million USD and 4.9 million USD respectively. However, Taiwan's openness policy for Chinese tourists increases tourist arrivals from China by 53,351 per month in average based on the Tourism Bureau of Taiwan. This results in an increase of Taiwan's tourism revenue by 47.7 million USD per month. Therefore the openness policy for Chinese tourists does increase Taiwan's international tourism revenue substantially.

Although in the short run, increased numbers of Chinese tourists bring in large and immediate tourism revenue to Taiwan, we cannot ignore the crowding-out effect of Chinese tourists in the long run. Compared with China, a continental country with large territories, Taiwan is a small island with limited tourism capacity. Even though Taiwan's tourism capacity has improved in recent years, the crowding-out effect of Chinese tourists still exists. That means, to maintain the quality of tourism, the Taiwan government should either actively enhance tourism capacity or slow down the opening policy. Regardless of the policy Taiwan government decides, policy makers cannot be too hasty and must allow Taiwan time to adapt and adjust to this new tourism environment. Otherwise, the overloaded tourism capacity would disrupt Taiwan's tourism industry and damage Taiwan's tourism reputation in the long run.

More information will be gained from time series analysis after extending the time span of available data associated with the evolution of Taiwan's opening policy. Furthermore, the univariate time series methods could be extended to multivariate methods to reveal the dynamic relationships between these series. However, there is always a trade-off between a succinct but limited model and a general but complex one. Except for the international tourism in Taiwan, we are also interested in how the 2008 openness policy for Chinese tourists affects Taiwan's domestic tourism. More specifically, whether the crowding-out effect of Chinese tourists exists for domestic tourists in Taiwan as well. These topics are both important and interesting for further research.

Chapter 2

Do Exchange Rates Affect International Tourist Arrivals in Taiwan? An Empirical Study Using Time-Varying Parameter Model

2.1. Introduction

Because of the development of the global economy and improvement of transportation technology, the international tourism blooms around the world. Based on the United Nations World Tourism Organization (UNWTO), the number of total international tourist arrivals increased from 538 million in 1995 to 940 million in 2010, with around 4% annual growth rate. This number is forecasted to reach 1.8 billion by 2030. Moreover, the total expenditure of international tourism rose from 459 billion USD in 1995 to 987 billion USD in 2010 according to the UNWTO. With more disposable income, more people spend more money to travel abroad. International tourism has become a more and more important economic activities to this day.

To better understand the factors which affect international tourist arrivals, estimating an adequate tourism demand function is common in previous research. Finding the key factors is helpful to manage a country's tourism environment, and to forecast future international tourism demand. Lim (1997) reviewed 124 tourism-related studies and marshaled several commonly used explanatory variables, such as price factors, income, transportation cost, time trend, economic activity indicators, marketing and promotion, as well as various qualitative factors. Among these variables, the price factor, such as the *exchange rate* and the *relative price*, between tourists' origin country and their destination are often considered in estimating an international tourism demand function (*e.g.* Little, 1980; Loeb, 1982; Quayson and Var, 1982; Martin and Witt, 1988; Lee *et al.*, 1996; Tan *et al.*, 2002; Naude and Saayman, 2005; Patsouratis *et al.*, 2005, Lin *et al.*, 2011).

Traditional tourism demand models always assume that parameters remain constant over the sample period, but this assumption is quite restrictive. For time series data of international tourist arrivals, not only tourist arrivals but also their relations with other variables change structurally over time. Because of the transformation of policies, environments or preferences, this structure change would affect the stability of estimated results, especially when the time period is long.

Moreover, in some research of constant parameters, demand functions yield the elasticity for price factors from 0 to 12 (*e.g.* Gunadhi and Boey, 1986; Trembly, 1989; Divisekera, 1995; Webber, 2001; Tan *et al.*, 2002; Naude and Saayman, 2005), which is still a wide range without a universal conclusion. Under the assumption of constant parameters, the estimated result represents an averagely overall effect of price factors on international tourism demand. However, when parameters are not stable, which means they fluctuate overtime, the traditional average effect with constant parameters would reveal little information about the relation between price factors and the international tourism demand. That is, if the parameter of a regression is not constant, the one-valued estimated parameter and the corresponding forecasting would become meaningless. Therefore, the *time-varying parameter* (TVP) approach, which obtains a series of parameters and captures its pattern by time, should be considered in estimating tourism demand function.

In recent research, the TVP methods, which is also known for the Kalman filter or the state space method (Kalman, 1960), is used to study international tourism demands (*e.g.* Song and Witt, 2000; Witt *et.al.*, 2003) for Hong Kong (Song and

Wong, 2003) and Denmark (Song *et.al.*, 2003). After that, these models are expended to fancy and complex TVP-related models, such as TVP-ECM[1] (Li, Wong *et.al.*, 2006), TVP-LAIDS[2] model (Li, Song *et.al.*, 2006) for tourism demand form U.K. or TVP-STSM[3] (Song *et.al.*, 2011) for tourism demand in Hong Kong. With the simple TVP methods of *Autoregressive Integrated Moving Average* (ARIMA) model, the pattern of time-dependent parameters could also be captured and explained. However, little research did this.

In this paper, we are interested in the relationship between price factors and international tourist arrivals to Taiwan. We basically examine the Box and Jenkins' (1976) *seasonal ARIMA model*, and extend this model to *time series regression model*, and further allow parameters change over time. Using the time-varying parameter approach, we explore the stability of influences of exchange rates and relative prices on Taiwan's international tourist arrivals. Note that the TVP method we used is methodologically different from the state space method. Our TVP method is revolute from the seasonal ARIMA model directly, and captures the instability pattern of parameters.

The mean contribution of this paper is exploring the time varying parameter of price factors on international tourism demand in Taiwan. The estimated results indicate that real exchange rates do affect Taiwan's international tourism demand. However, this effect is not constant but varies over time. In previous research, the exchange rate had controversial effects on tourism demand because of the wide range of parameters. In the view of time varying parameters, it will not be a problem. Moreover, the methodology is valuable to apply to other countries or other

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1 The time varying parameter-error correction model (TVP-ECM)
2 The time varying parameter-linear almost ideal demand system (TVP-LAIDS) model
3 The time varying parameter-structural time series model (TVP-STSM)

explanatory variables.

In Section 2.2, we provide an overview of exchange rates and relative prices, and use time series graphs to briefly explore the relation between price factors and international tourist arrivals to Taiwan. The methodology of seasonal ARIMA models and TVP models is introduced in Section 2.3. The analysis results and their economic implications are presented in Section 2.4. Section 2.5 provides discussion and conclusions.

2.2. Exchange Rates and Relative Prices

The price factors include the (nominal) exchange rate, the relative price, and the real exchange rate. The quarterly data of the former two come from the Directorate General of Budget, Accounting and Statistics (DGBAS) of Taiwan, and the latter is calculated by the product of the former two. In addition, Taiwan's international tourist arrivals mainly come from Japan, Honk Kong (H.K.) and the United States (U.S.) based on the Tourism Bureau of Taiwan. Thus, these three regions are chosen as the targets of analysis in this paper. Moreover, the quarterly data of international tourist arrivals from these three regions is based on the Tourism Bureau of Taiwan.

To measure the relative prices, the consumer price index (CPI) ratio between the origin and destination countries are often used. However, because of limited knowledge, some research indicates that tourists respond to the well-informed exchange rates when they decide to travel, instant of the relative prices which are hard to obtain in advance (*e.g.* Gray, 1966; Artus, 1970; Lin *et al.*, 2011). Some studies also argue that relative prices and exchange rate should be considered together (*e.g.* Crouch, 1994; Witt and Witt, 1995). The main reason is that international tourists are likely to know more about exchange rates in the short run, while relative prices represent long-run information. Nevertheless, considering both relative prices and exchange rates as two explanatory variables may lead to the problem of multicollinearity (because the exchange rate is somehow one of the measurements of relative price). To fix this problem, some research employ the *real exchange rate* (*e.g.* Rosensweig, 1986; Webber, 2001), the nominal exchange rate adjusted by the CPI ratio, to measure the effective prices considering the impacts of both inflation and exchange rate at the same time. We also employ this informative variable as the price factor in this paper.

In addition, the quarterly data is used because of the *calendar effect*, which is proved to have significant effects on Taiwan's international tourism demand (e.g. Lin *et al.*, 2011; Su *et al.*, 2012). In Chinese society, the traditional Chinese holidays are set based on the Chinese lunar calendar. The Chinese New Year, for example, is always on January first of the Chinese lunar calendar; however, it may fall in January or February of the Gregorian calendar. While the international tourism demand is affected by the Chinese New Year, the observed time series will vary, according to this holiday is included in January or February. This "moving" holiday effect is so-called the calendar effect. Thus, to avoid dealing with the calendar effect, the quarterly data is used. In this way, the Chinese New Year is always in the first quarter (Q1), no matter which months it falls in.

The relation between price factors and international tourist arrivals to Taiwan are discussed in the following three subsections.

2.2.1. Exchange Rates and International Tourist Arrivals in Taiwan

The (nominal) exchange rate is the most widely published price index so that it is always introduced to tourism demand models. Moreover, because of the availability, the exchange rate is often used to represent the short-term price factor. Figure 2.1 shows the exchange rates between Taiwan and foreign countries (including Japan, Hong Kong, and the U.S.), and their corresponding international tourist arrivals from 1971Q1 to 2011Q1. Note that the exchange rate is measured by the Taiwan dollar (TWD) per foreign dollar. Thus, the increasing of the exchange rate means that the purchasing power in Taiwan for a foreign country rises. Theoretically, that would be an incentive for international tourists to travel to Taiwan and increase Taiwan's tourism demand.

Even though the international tourist arrivals have seasonal variation and some outliers, the overall simultaneous trend of the international tourist arrival and the exchange rate is quite obvious. Figure 2.1 (A), the Japan case, shows these two series simultaneously increased in 1970s, late-1980s, mid-1990s, early- and late-2000s, and simultaneously decreased otherwise. Figure 2.1 (B) also shows the simultaneous trend for Hong Kong. However, the U.S. case, Figure 2.1 (C), is a little different because Taiwan implemented the flexible exchange rate policy in 1987. After that, the exchange rate could float under the market power. The simultaneous trend only happened in late-1990s and late-2000s; while it was unclear in other years.

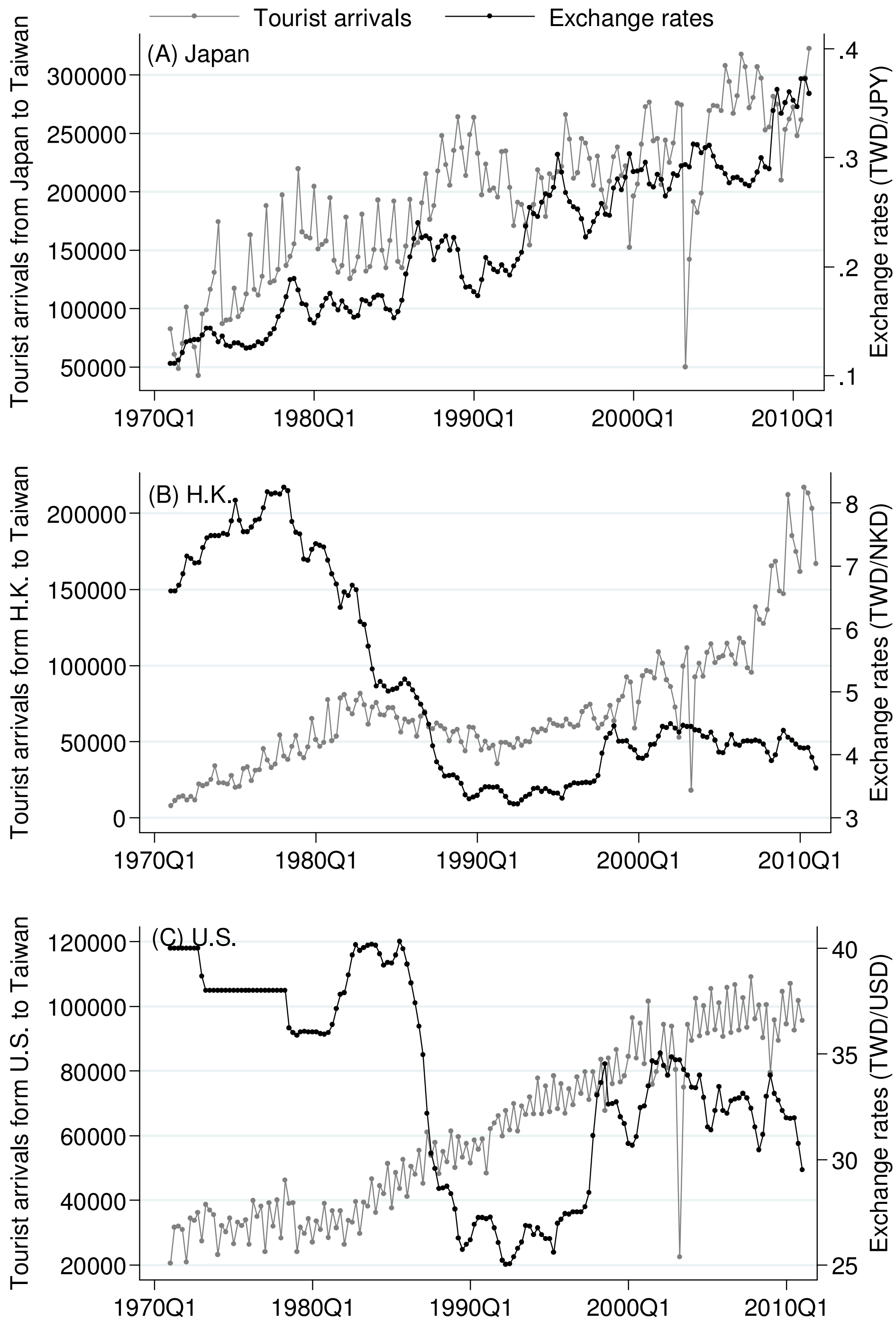

Figure 2.1. Taiwan's international tourist arrivals and exchange rates (1971Q1 – 2011Q1)

2.2.2. Relative Prices and International Tourist Arrivals in Taiwan

Another common price factor is the relative price. To measure the relative price of tourism, the consumer price index (CPI) ratio between the origin and destination countries are used as a proxy variable since the tourist price indices (TPI) are usually unavailable. Because of limited knowledge, some research indicates that relative prices are hard to obtain in advance. Unlike the short-term exchange rate, the relative price, which is the CPI ratio, capture the long-term pattern of the price factor. Figure 2.2 is the time series data of Taiwan's international tourist arrivals and relative prices between 1971Q1 and 2011Q1. The simultaneous trend between these two time series is quite obvious for Japan and Hong Kong, but for the U.S., it is not clear at first glance.

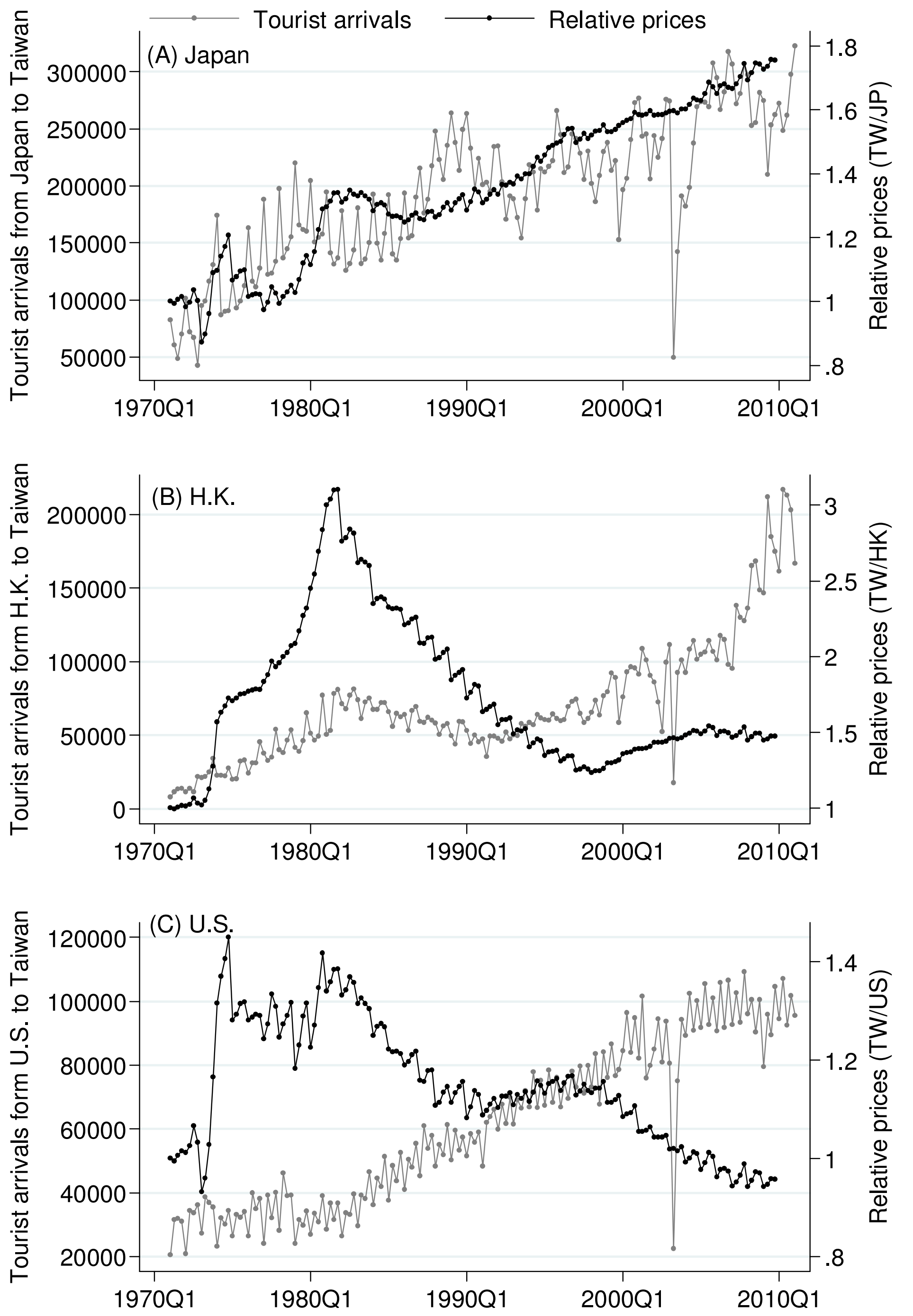

Figure 2.2. Taiwan's international tourist arrivals and relative prices (1971Q1 – 2011Q1)

2.2.3. Real Exchange Rates and International Tourist Arrivals in Taiwan

To consider the impact of both short-term and long-term price factors (i.e., the exchange rate and the inflation rate) at the same time, and also avoid the multicollinearity problem, the real exchange rate, e, is specified as

$$e = E \cdot \frac{P^*}{P} \tag{2.1}$$

where E is the nominal exchange rate between Taiwan and foreign country, and P and P^* are the price index in Taiwan and foreign country relatively. That is, the real exchange rate is the nominal exchange rate adjusted by the CPI ratio. In this war, we could avoid the effect of nominal price and be focus on the real one. The time series of Taiwan's international tourist arrivals from three main tourist source countries and corresponding real exchange rates from 1971Q1 to 2011Q1 are drew in Figure 2.3. It should be noted that the real exchange rate is indexed to 1971Q1 to see the relative trend.

The simultaneity of the real exchange rate and Taiwan's international tourist arrival still exist, although the scale of the price factor is changed. At first glance, the real exchange rate is more fluctuant than the international tourist arrival, and in the overall plot, the data seems to be independent with each other. However, when we narrow the time period into a smaller window size, the simultaneous trend of these two time series could still be observed in some time periods. In Figure 2.3 (A), the time trend of the real exchange rate between Taiwan Dollar and Japan Yan increases; while the international tourist arrival from Japan to Taiwan seems to decrease in recent forty years. Nevertheless, when the window size is reduced to around 10 years (40 observations), the simultaneous trend of these two time series is observable in some time periods. For example, between 1990 and 2000, the trend decreased, then increased, and then decreased again. In Figure 2.3 (B), for instance, the upward trend could be easily observed in some time periods, such as 1970s or 2000s. Moreover, in

Figure 2.3 (C), the same pattern happens for the U.S. in mid-1970s, 1985 – 1995, and 2000s.

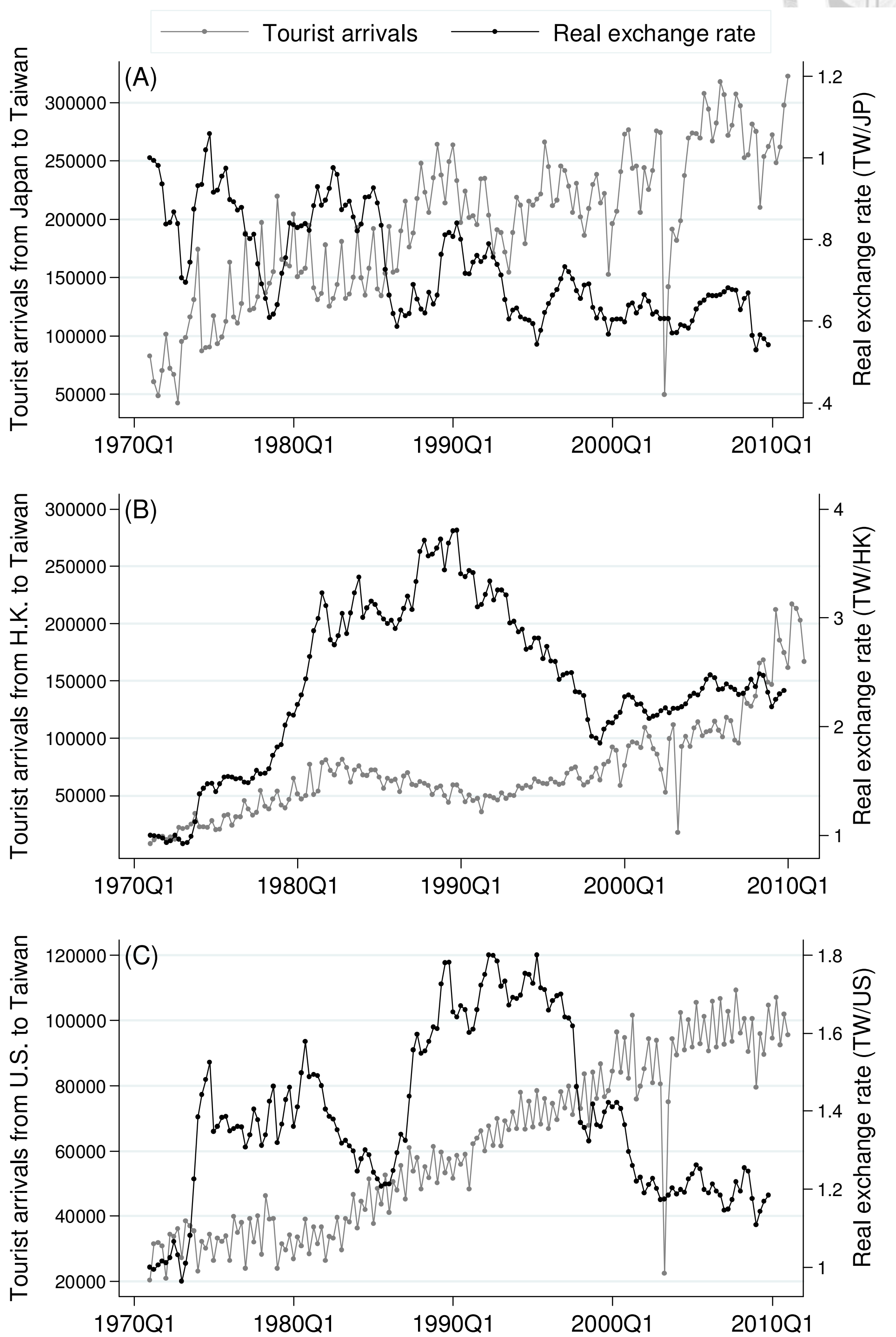

Figure 2.3. Taiwan's international tourist arrivals and real exchange rates (1971Q1 – 2011Q1)

To briefly sum up, from Figure 2.1 to Figure 2.3, it seems that there is a positive relation between Taiwan's international tourism demand and corresponding price factors, but it only exists in some time periods. The theoretical positive effect may not occur all the time. That is, the correlation between these two variables may not be a constant. Therefore, to focus on the precise effect of price factors on international tourism demand in Taiwan, we will employ a more rigorous method, the TVP model, in next section. This method would consider seasonal variations and time trend, remove outliers, and then analyze the multivariate time series data by allowing parameters varying by time.

2.3. Methodology

In this section, the methodology of Box and Jenkins' seasonal ARIMA model, as well as the time series regression model with joint outlier estimation, are provided. To deal with the problem of instable parameters, the time-varying parameter model based on the seasonal ARIMA model is also introduced.

2.3.1. Seasonal ARIMA Model

The time series model introduced in Box and Jenkins (1976) is a simple but powerful method to analyze time series data, especially when the unobservable or omitted explanatory variables exist. Assuming $\{Y_t\}$ is a time series of international tourist arrivals, and t is the time from 1 to T, a seasonal ARIMA model can be specified as

$$\phi_p(B)\,\Phi_P(B^s)\,(1-B)^d\,(1-B^s)^D\,Y_t = C_0 + \theta_q(B)\,\Theta_Q(B^s)\,a_t, \quad a_t \overset{iid}{\sim} N(0,\sigma_a^{\ 2}) \qquad (2.2)$$

where B is the backshift operator (i.e., $BY_t = Y_{t-1}$). In addition, $\phi_p(B)$ and $\theta_q(B)$ are the regular *autoregressive* (AR) and *moving average* (MA) polynomials, $\Phi_P(B^s)$ and $\Theta_Q(B^s)$ are the seasonal AR and MA polynomials, and C_0 is a constant term. The subscript p and q are used to indicate the order of the associated regular AR and MA polynomials; while P and Q are for the order of the associated seasonal AR and MA polynomials, respectively. The superscript d is the regular differencing order, D is the seasonal differencing order, and s is referred to *seasonality*. The model in (2.2) is often denoted as ARIMA(p,d,q)(P,D,Q)$_s$, and also can be expressed in an alternative form

$$(1-B)^d\,(1-B^s)^D Y_t = C + \frac{\theta_q(B)\,\Theta_Q(B^s)}{\phi_p(B)\,\Phi_P(B^s)}\,a_t, \quad C = \frac{C_0}{\phi_p(B)\,\Phi_P(B^s)} \tag{2.3}$$

where the constant term C is the *trend* of the series if $d = 1$ or $D = 1$.

In addition, a time series Y_t is sometimes related not only to its own past and exogenous shocks, but also the current or past values of other time series. Thus, other explanatory variables of interest, says X_t, should be added into (2.3). Assuming $\{X_t\}$ is a time series of price factors, and t is the time from 1 to T, seasonal ARIMA model with explanatory variables can be written as

$$(1-B)^d\,(1-B^s)^D Y_t = C + T(B)\,(1-B)^d\,(1-B^s)^D X_t + \frac{\theta_q(B)\,\Theta_Q(B^s)}{\phi_p(B)\,\Phi_P(B^s)}\,a_t \tag{2.4}$$

where $T(B)$ is the transfer function of X_t, which could be in simple or multiplicative form. Thus, the model in (2.4) is also called the *time series regression model*, or the *transfer function model.* More details about this kind of models could be referred to Box and Jenkins (1976) and Liu and Hanssens (1982).

2.3.2. Time-varying Parameter Exploration

When the time period is extended, the time-varying parameter should be considered. In (2.4), we assume that parameters are constant and do not change by time. This stability assumption could be true when the time period is short. However, if the time period expands, and most of the time series data does, not only the time series of interest itself but also its relation with other time series, may contain some structure changes. Thus, parameters capture the relation between two time series become unstable, and the constant parameter model reveals little information form data. For example, the truly varying parameters are 3 and –3 at period 1 and 2, respectively. Under the assumption of constant parameter, the averagely overall parameter would become 0 for period 1 to 2. This means, there is no significant effect for the explanatory variable we are interested in. It is obvious that the insignificant overall effect is misleading, because parameters cancel out with each other. If the window size is narrowed down to one period, the true parameters would be unveiled. Therefore, for an extended time period, allowing parameters varying by time is a must.

The window size, w, which should be smaller than the sample size T, is employed to obtain the time series of varying parameters based on the model in (2.4). For example, with w, parameters are estimated according to subsamples between $t = 1$ and $t = w$, and then subsamples between $t = 2$ and $t = w + 1$, and so forth. Until all observations are used (the last subsamples are between $t = T – w + 1$ and $t = T$), the time pattern of parameters within the window size could be obtained. From this data of time-varying parameters, we could observe how the effect of the explanatory variable changes by time.

2.3.3. Structural Change Test

After obtaining the data of time-varying parameters (β), we could test whether the time series of parameters are stable or not. Even though the time series graph of β would demonstrate the stability condition itself, the structural change test can provide a more rigorous proof. The most important tests on structural change are the tests from the generalized fluctuation test framework (Kuan and Hornik, 1995), such as the *cumulative sums of residuals* (CUSUM) (Ploberger and Kramer, 1992) and the *moving sums of residuals* (MOSUM) (Chu *et al.*, 1995). For the data of time-varying parameters, β_t ($t = w, w+1, \dots T$), a sample regression is established as

$$\beta_t = \beta + \varepsilon_i \qquad (2.5)$$

where ε_i is the residual. If the β_i is stable, the ε_i would be a white noise after controlling for the constant term, β. That is, the model could be reduced to the constant parameter one, which means for all i

$$\beta_i = \hat{\beta} \qquad (2.6).$$

Under the null hypothesis (H_0), the time series are stable as equation (2.6), the significance test with empirical fluctuation processes will follow a F distribution (*e.g.* Andrews, 1993; Andrews and Ploberger, 1994) and can also be tested by the p-value method (Hansen, 1997). The test also could find the time points that structural changes happened. In this paper, because the moving window is employed to explore the time-varying parameters, the MUSUN test with moving sums of residuals is used to test the stability of the parameters, instead of the CUSUM test, which is calculated by the recursive method. If the null hypothesis is rejected, structural changes of the time series of parameters exist. Thus, the constant parameter estimation should be avoided, because parameters will vary by time.

2.4. Empirical Results

In this section, using the data of Taiwan's international tourist arrivals and real exchange rates, we first estimate basic models with constant parameters. Second, time-varying parameters are explored under different window sizes. After obtaining the time-varying parameters, we lastly test the stability of these time series of parameters to support our models, in which time-varying parameters should be considered when time periods are extended.

2.4.1. Constant Parameters

Using Box and Jenkins' (1976) model identification methods, the basic seasonal time series regression models of Taiwan's international tourist arrivals (from Japan, Hong Kong, and the U.S.) (Y_t) on real exchange rates (X_t) are specified as

Japan :

$$(t=14.08)$$

$$\nabla_4 ln\, Y_t = 0.0118 - 0.0591\,\nabla_4 ln\, X_t + \frac{1-0.7402\,B^4}{1-0.7708\,B}\,a_t \qquad (2.7)$$

$$(t=2.27)\;(t=-0.34) \qquad\qquad (t=14.65)$$

$$\sigma_a^2 = 0.0499$$

Hong Kong :

$$(t=-3.18)$$

$$\nabla\, ln\, Y_t = 0.0077 - 0.0210\,\nabla\, ln\, X_{t-1} + \frac{1+0.2461\,B^4}{1+0.3718\,B+0.3708\,B^2}\,a_t \qquad (2.8)$$

$$(t=1.99)\;(t=-0.10) \qquad\qquad (t=-4.93)\;(t=-4.88)$$

$$\sigma_a^2 = 0.0662$$

United States :

$$(t=8.87)$$

$$\nabla_4 ln\, Y_t = 0.0137 - 0.0117\,\nabla_4 ln\, X_{t-1} + \frac{1-0.5896\,B^4}{1-0.6709\,B}\,a_t \qquad (2.9)$$

$$(t=4.50)\;(t=-0.10) \qquad\qquad (t=10.89)$$

$$\sigma_a^2 = 0.0287$$

where ∇ represents the first order difference, that is, $\nabla Y_t = Y_t - Y_{t-1}$; while ∇_4 represents the fourth order difference, which means $\nabla_4 Y_t = Y_t - Y_{t-4}$. Thus, $\nabla_4 lnY_t$ is equivalent to a percentage change from the same quarter one year earlier. The number in parentheses is the t-value of the estimated parameter. The basic models of Taiwan's international tourist arrivals is a seasonal ARIMA $(1,0,0)(0,1,1)_4$ model for Japan, seasonal ARIMA $(2,1,0)(0,0,1)_4$ model for Hong Kong, and seasonal ARIMA $(1,0,0)(0,1,1)_4$ model for the U.S.

Based on the constant parameter models, equation (2.7), (2.8) and (2.9), when real exchange rates increase by 1%, the effects (elasticity) on Taiwan's international tourist arrivals are all negative: –5.91% for Japan, –2.1% for Hong Kong, and –1.17% for the U.S.. However, they are all insignificant. This estimated result is worth discussing. If we believe the constant parameter model, this result would lead to the conclusion that real exchange rates have little effect on Taiwan's international tourist arrivals. Or, the loose conclusion that the real exchange rates have negative effect on

Taiwan's international tourist arrivals may be inferred. No matter which results is concluded, it would contradict the demand theory or the data we have mentioned in section 2 in this paper. Therefore, this constant parameter model may not be good enough to capture the relation between real exchange rates and the international tourism demand, so the time-varying parameter model must be investigated.

2.4.2. Time-varying Parameters

As time goes on, international tourists may consider differently when they travel abroad. More specifically, the influence of the price factor may change by time since the global economy and the consumption behavior continuously change. Sometimes the real exchange rate would affect international tourism demand; while sometimes it would not. Furthermore, the real exchange may have a positive effect on international tourism demand as our prediction, but this effect may not continue permanently. When the constant parameter is estimated, we have assumed that the effect of the real exchange rate is constant over time, which is an overall effect across all time periods. Thus, the effect may offset with each other, and end up with insignificant estimated results.

The influence of the price factor on tourism demand may change, and the constant parameter model would reveal little information. Thus, we should allow the effect (parameter) varying by time, and study the pattern of time-varying parameters under different window sizes. Allowing parameters varying over time, Figure 2.4, 2.5 and 2.6 are the estimated results of the effects of real exchange rates on Taiwan's international tourist arrivals, under window sizes equal to 40 (10 years) and 60 (15 years), respectively. The shadow areas in these figures indicate the time periods that real exchange rates have significant effects on Taiwan's international tourism demand at 10% significant level. Like we mentioned earlier, these effects are not always significant, and both positive and negative are possible. Therefore, the time-varying parameter model reveals more information than the constant parameter one.

In Figure 2.4, 2.5 and 2.6, four key points are worthy discussing. First, it is obvious that the effects of real exchange rates on Taiwan's international tourist arrivals are not always as positive as the theory predicts. The significantly positive effect almost shows up in the late period, especially the latest 20 years. Starting from 1989, Taiwan government withdrew its control over exchange rates. Since then, the price function between Taiwan and foreign countries has finally worked. Therefore, when studying the effect of the exchange rate in Taiwan, our research suggests that if the time-varying parameter model is not employed, at least the data before 1989 should be eliminate to avoid the severe structure change.

Second, the significantly positive effect is more common in countries whose income levels are close to or lower than Taiwan. This phenomenon is quite straight forward. For a tourist living in a developed country, everything in a less developing country is relatively cheaper. Thus, the effect of price factor would not be significant because the price standard in the destination country is relatively low. The Big Mac prices in 2009, for example, are 2.26, 1.72, 3.46 and 3.57 USD in Taiwan, Hong Kong, Japan and the U.S., respectively. This price index is frequently used to compare the real price level across different countries, according to the Big Mac Index of the Economist. Among Taiwan's top three tourist source countries (Japan, Hong Kong and the U.S.), the price level in Hong Kong is the closest to Taiwan; while in Japan and the U.S., it is much higher. Therefore, Figure 2.4, 2.5 and 2.6 show that the significantly positive effect is more obvious for Hong Kong than other two countries. However, in recent years, the significantly positive effect also emerges for the U.S.

because of the economic downturn.

Third, the empirical result indicates that the effect of real exchange rates becomes more significant when the economic condition declines. Which means, for an international tourist who travels to Taiwan, the price factor matters only when his/her budget is tight. The different pattern of parameters for each country reveals different information so that we could discuss it country by country. Note that we focus the time period on the one after 1989, because of Taiwan's deregulation of the exchange rate.

For Japan, the economy slowed remarkably in the late 1990s, which is so-called the Lost Decade. And then, the economy hit the bottom in March 1999 when the Bank of Japan announced its zero interest rate policy. After that, Japan's economy started to recover slightly, and the zero interest rate policy was ended in July 2006. Thus, in Figure 2.4, because of the economic condition, the time varying parameter of Japan increased after the mid 1990s, reversed in 2000, and went back to zero in 2006. This parameter also rose up again when the global financial crisis occurs in 2008. Even though the effects are insignificant in some time periods, the overall trend of parameter still exists with different window sizes.

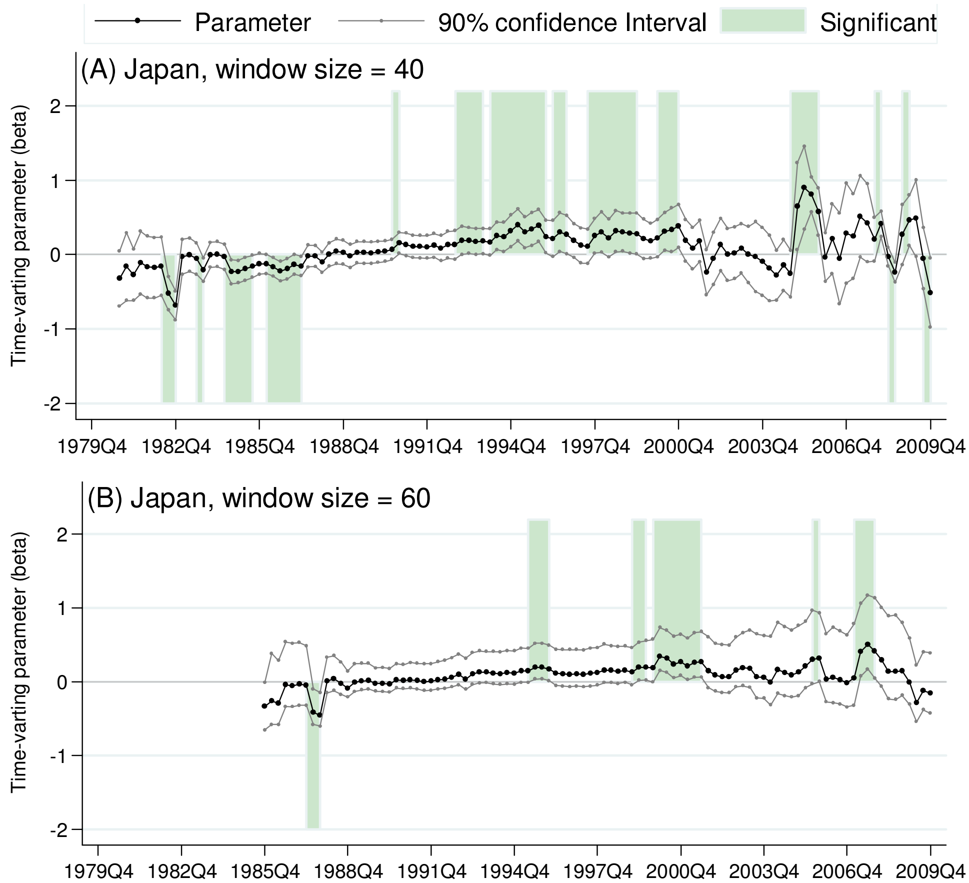

Figure 2.4. Time-varying parameters for Japan

For Hong Kong, the economy grew up from 1989, because of the industrial transformation from manufacturing to financial industry. This growing ended up with the Asian financial crisis in 1997, which inflicted heavily the trade-relying Hong Kong. Thus, in Figure 2.5, the parameters decreased slightly between 1989 and 1996, but increased in 1997. After this crisis and the return to the developing China, Hong Kong successfully upgraded its industries to the service sector, and further maintained the role of Asian financial hub. Thus, for a tourist in Hong Kong, the effect of real exchange rates between Hong Kong and Taiwan becomes insignificant in recent years, because the economy blooms and the traveling budget is slack. Meanwhile, these figures also indicate that the effect of real exchange rates for Hong Kong does not obviously influenced by the global financial crisis in 2008.

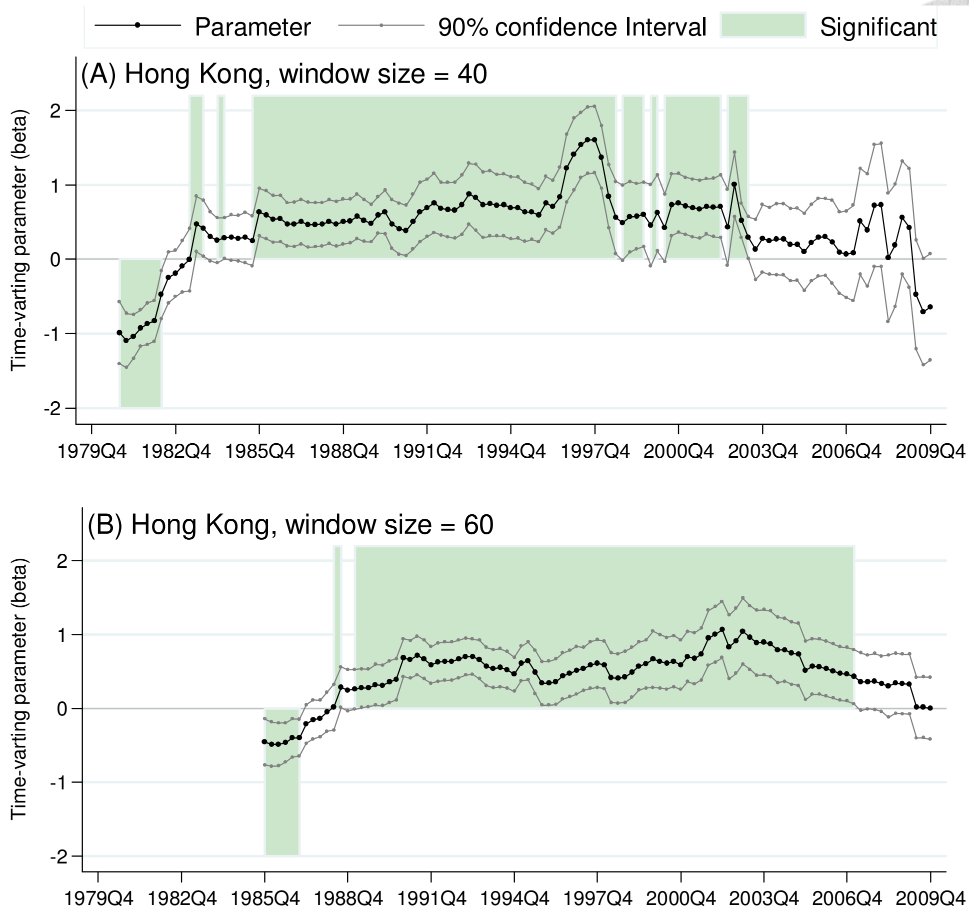

Figure 2.5. Time-varying parameters for Hong Kong

For the U.S., the economic superpower in the world, the price standard in Taiwan is relatively low. Therefore, for an American tourist who plans to travel to Taiwan, it is reasonable that the real exchange rates would not have the positive effect of the tourism demand. However, the influence of real exchange rates becomes relevant along with two economic downturns: the dot-com bubble and the global financial crisis. Starting from March 2000, the dot-com bubble made the economy to stagnate and caused severe unemployment in the U.S.; while the subprime mortgage crisis in 2008 inflicted the economy heavily in the U.S. and further spread around the globe. Thus, in Figure 2.6, the parameter of real exchange rates started to climb up in 2001, and further increased in 2008. Because the economy is in a slump, people care more about the budget when they travel overseas. Note that the positive effect seems to draw back in the late 2009 because of the recovery of the economy.

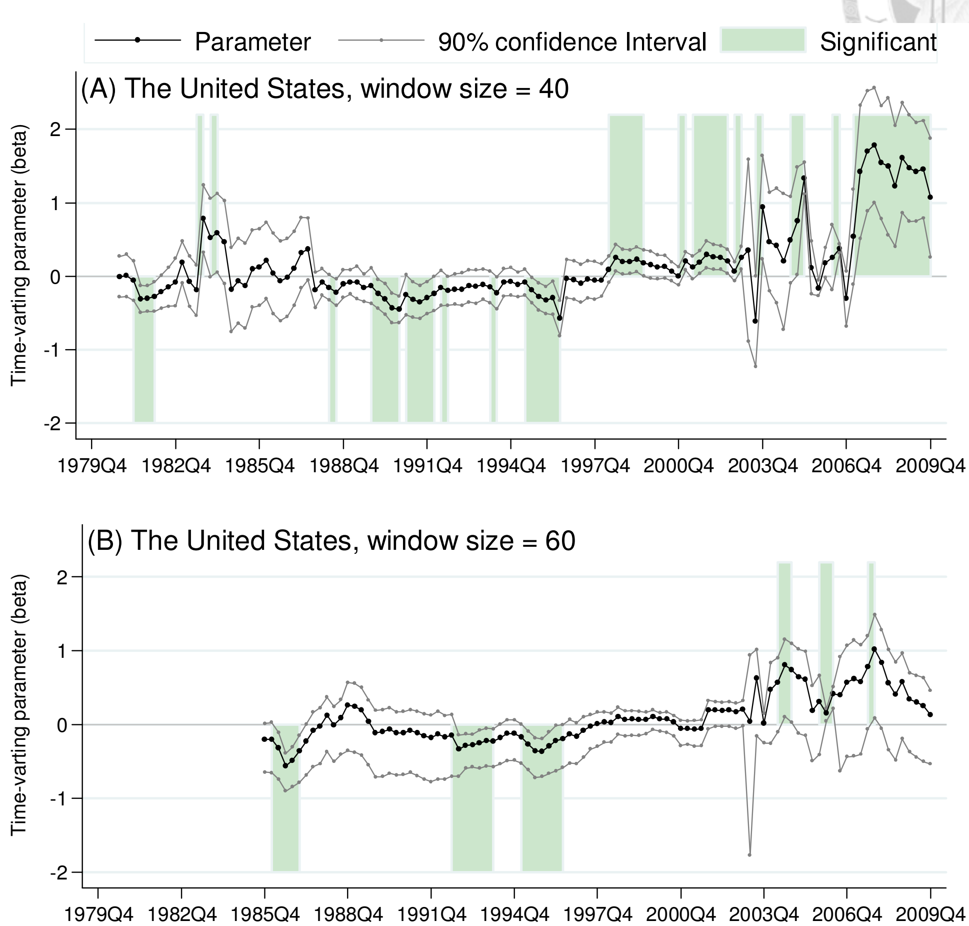

Figure 2.6. Time-varying parameters for the U.S.

Last but not least, while the window size is extended, the fluctuation of parameters becomes less violent. Because the variation revealed from data would offset mutually, the pattern of parameters would become smoother as the time period increases. That is, the international tourism demand would become less sensitive to the price factor when time periods are extended. When the window size covers all observations, the smoothest, or the least sensitive, parameter would be reduced to the one in the constant parameter model. There are always a tradeoff between the smooth and the sensitive parameters. The main question is how large the window size should be. Even though different window sizes reveal different information, one thing for sure is that the constant parameter model is definitely inadequate.

2.4.3. Effect of real exchange rate in economic downturn

In this subsection, we investigate further the relationship between the time-varying parameter (β) and the economic condition. The positive effect of the real exchange rate in economic downturn will be proved rigorously. We run the regression of β on the economic growth rate with robust variance estimation. The estimated results are showed in Table 2.1. Initially, we use all observations, and the significantly negative relation is showed in the first row in Table 2.1, except Hong Kong which is negative but insignificant. The negative effect means that β will be larger when the economic growth rate in the destination country decreases.

To emphasis effects in different conditions, two threshold regressions, distinguished by the sign of β, are separately run. When β is positive, effects of the economy condition are all negative, and coefficients become more significant. That is, under economic downturn (i.e., the economic growth rate decreases), β would increase. The positive β means that the real exchange rate (Taiwan dollar over foreign dollar) has a positive effect on the international tourism demand in Taiwan. Meanwhile, when β is negative or zero, this effect is not obvious. This means, there are some other reasons, but not the economy condition, causing the unintuitive and negative β. For example, the exogenous promotion for airline tickets or accommodations, locally holidays, or new famous attractions may reduce the effect of the price factor.

Table 2.1. Effect of economic growth rate on beta (β)

	(A) Japan		(B) Hong Kong		(C) The United States	
Overall	–0.0293***	(t = –5.13)	–0.0031	(t = –0.39)	–0.0607**	(t = –2.04)
$\beta > 0$	–0.0237***	(t = –6.88)	–0.0100**	(t = –2.64)	–0.0987***	(t = –4.47)
$\beta \leq 0$	0.0034	(t = 0.47)	–0.0188	(t = –0.94)	0.0214**	(t = 2.06)

1. t statistics are in parentheses. 2. *, ** and *** are significance at 10%, 5% and 1% statistical levels. 3. n = 113.

In addition, the scatter plot of economic growth rates and β's and threshold regression line are showed in Figure 2.7. Distinguished by the sign of β, two different patterns, above and below the horizontal of that β equals to zero, could be observed. Above this horizontal, the negative slope of the regression line is significant; while the effect is not consistent below the horizontal.

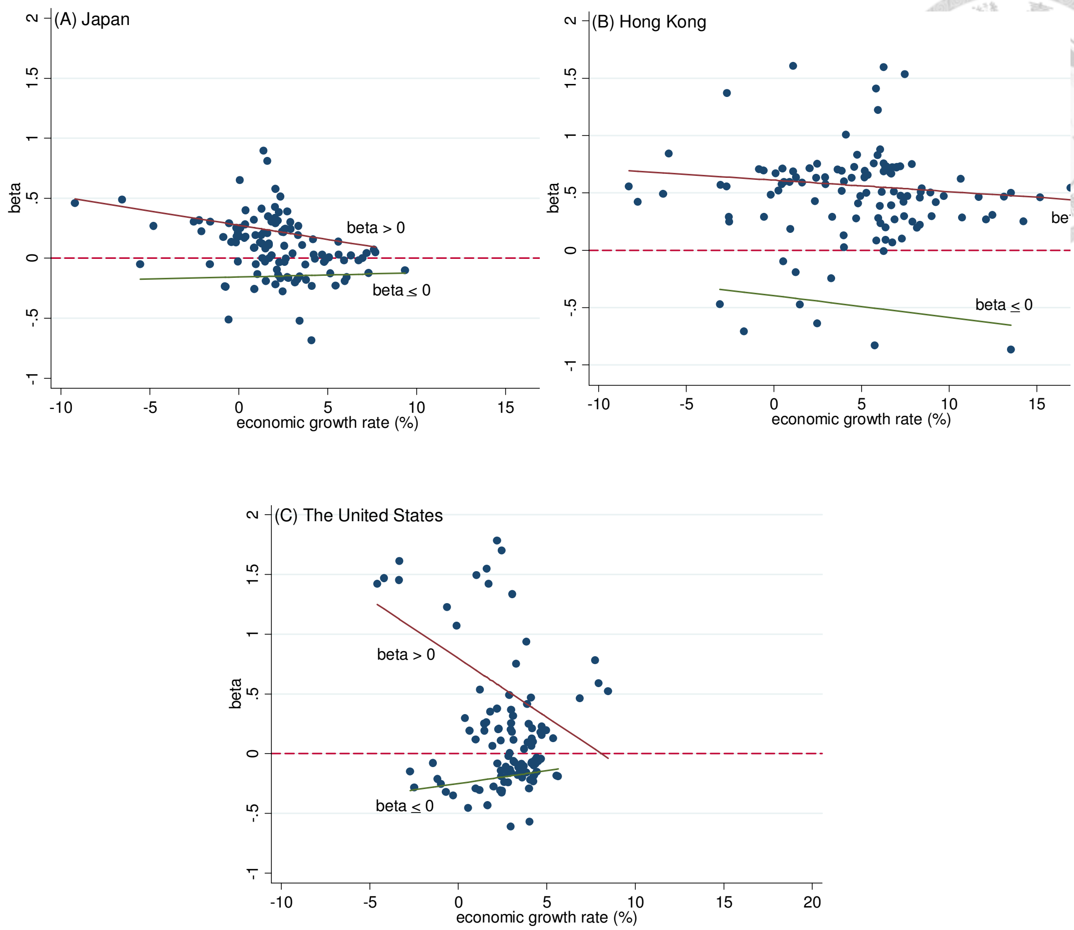

Figure 2.7. Scatter plot of economic growth rate and beta (β)

2.4.4. Testing for Stability of Parameters

Even though the figures have obviously indicated that the parameter of real exchange rates on Taiwan's international tourist arrivals is unstable. To prove this fact rigorously, the MOSUM test is employed to support our time-varying parameter model. In this test, we analyze moving sums of residuals. That is, the empirical fluctuation process contains the sum of a fixed number of residuals in a data whose window size is determined and moved over the whole sample period. The MOSUM test results are showed in Table 2.2 and Figure 2.8. The time-varying parameters of real exchange rates on Taiwan's international tourist arrivals from Japan, Hong Kong and the U.S. are all unstable, whether the window size is 40 or 60. This result firmly proves that again the effect of price factors on Taiwan's international tourism demand would change over time. Therefore, the traditional assumption of the constant parameter should be avoided or used carefully.

Table 2.2. MOSUM test for beta (β)

Region	Window size	MOSUM	P-value	Unstable
Japan	40	2.653	0.00	Yes
	60	2.518	0.00	Yes
Hong Kong	40	2.422	0.00	Yes
	60	2.552	0.00	Yes
U.S.	40	3.058	0.00	Yes
	60	3.368	0.00	Yes

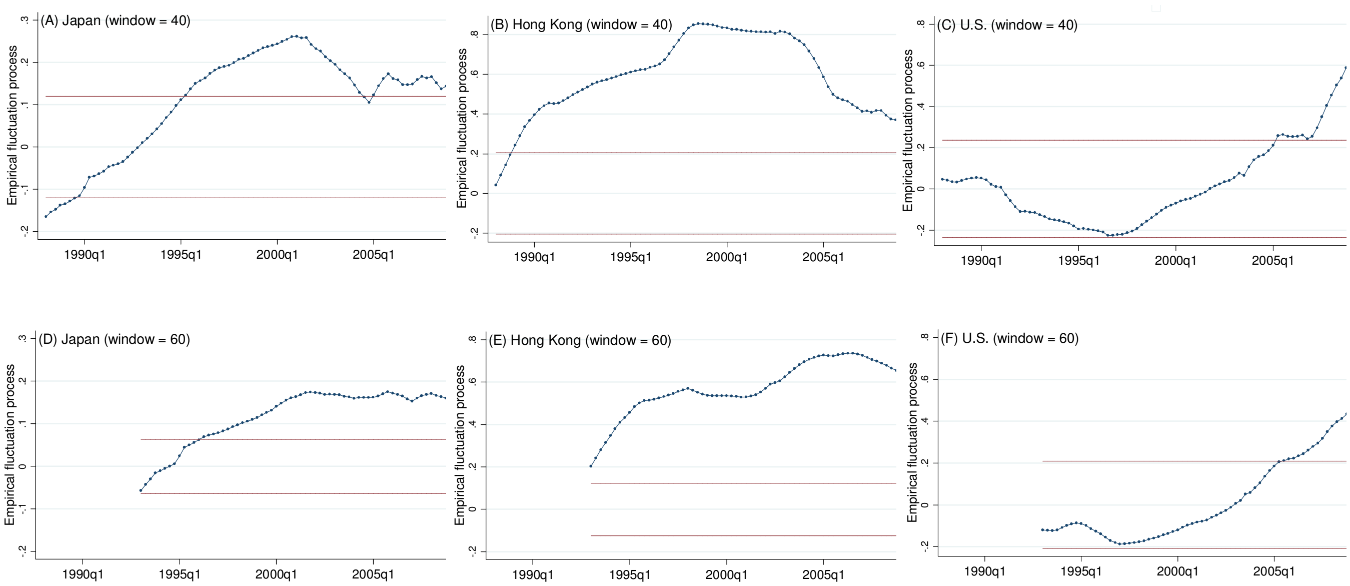

Figure 2.8. MOSUM test for structural change with 90% confidence interval

2.5. Conclusion and Discussion

In this paper, we are interested in the relationship between price factors and Taiwan's international tourism demand from Japan, Hong Kong and the U.S.. The time series data ranges from 1971Q1 to 2011Q1. Using the time-varying parameter model, we explore the stability of influences of real exchange rates on Taiwan's international tourist arrivals. The estimated results indicate that real exchange rates do affect Taiwan's international tourism demand. Furthermore, this effect is not constant but varies over time.

Our study starts from estimating constant parameter models. To consider the impact of both short-term and long-term price factors (i.e., the exchange rate and the inflation rate) at the same time, and also avoid the multicollinearity problem, the real exchange rate is used as the explanatory variable. According to the original time series data, there may exist some positive relations between Taiwan's international tourism demand and corresponding price factors, but they only exist in some time periods. However, assuming that effects of real exchange rates are constant over time would let these effects offset with each other, and end up with insignificant estimated results. Just like some previous research, the effect of the price factor was controversial. Thus, a different approach is necessary.

Therefore, we allow the parameter varying by time, and study the pattern of time-varying parameters under different window sizes (10 and 15 years). For Taiwan's international tourist arrivals, not only tourist arrivals but also their relations with price factors would change structurally. Based on estimated results, four points could be concluded. First, the significantly positive effect almost shows up in the late period, especially the latest 20 years after Taiwan's deregulation of exchange rates. Second, the significantly positive effect is more common in countries whose income levels are close to or lower than Taiwan, such as Hong Kong. Third, the effect of real exchange rates becomes more significant when the economic condition declines. Which means, for an international tourist who travels to Taiwan, the price factor matters only when his/her budget is tight. Last but not least, while the window size is extended, the fluctuation of parameters becomes less violent, and the international tourism demand would become less sensitive to the price factor.

In this paper, we reveal more information by exploring the time varying parameter of price factors on the international tourism demand in Taiwan. In previous research, the exchange rate had controversial effects on tourism demand because of the wide range of parameters. In the view of time varying parameters, this wide-range parameter just supports the unstable price effect. For further research, extending the data will make the analysis more meaningful and reliable. But note that even though extending the time span would gain more information, the constant parameter model will still reveal little information, so the time-varying parameter model is more suitable. Furthermore, this analysis method could be employed for different source or destination countries if we have detailed data. In this way, the effect of price factors could be checked for robustness or having regional effects. In addition, more explanatory variables, such as income or traveling cost, could be considered. These topics are thus both important and interesting for further research.

Chapter 3

Analysis of International Tourist Arrivals Worldwide: The Role of World Heritage Sites

3.1 Introduction

Tourism is one of the leading economic sectors in the world, and represents a major source of income, employment, exports and taxes. According to the World Travel and Tourism Council (WTTC), the tourism sector (domestic and international) in 2011 contributed almost 5,992 billion USD to the global economy. With confirmed strong linkage effects, the tourism industry also provides almost 260 million job opportunities, accounting for nearly 9% of global employment. In addition, compared with heavy industry or the manufacturing industry, which consume energy, emit carbon dioxide, and pollute air and water during the production process, the tourism industry is relatively eco-friendly and achieves more sustainable development, according to the World Bank Carbon Finance Unit (CFU). Therefore, many countries have put more emphasis on developing tourism to drive their 'green' economic growth.

With more disposable income and awareness of leisure, consumers have increased their tourism demand (Lim, 2006). Based on statistics compiled by the World Tourism Organization (WTO), Figure 3.1 shows the growth of international tourist arrivals (the x-axis on the right-hand side) between 1995 and 2011. The number of international tourist arrivals increased from 538 million in 1995 to 940 million in 2010, with an average annual growth rate of 4.7%. Meanwhile, the total number of World Heritage Sites (WHSs) has risen steadily, according to the World

Heritage Centre of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Figure 3.1 also shows that the number of WHSs (the x-axis on the left-hand side) increased from 468 in 1995 to 936 in 2011, with an average annual growth rate of 6%. Thus, under the growing trend of both WHSs and international tourists, if the positive effect of WHSs on international tourism is proved, possessing WHSs would bring in many international tourist arrivals and much expenditure, and would benefit the economies of the destination countries. However, there have been few studies on this subject.

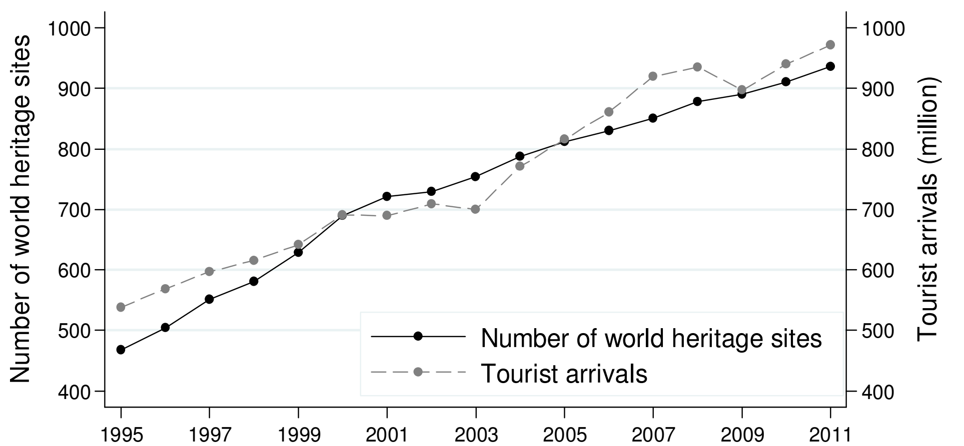

Figure 3.1. Numbers of WHSs and international tourist arrivals (1995 – 2011)

In this paper, we investigate the relationship between the world heritage sites and tourism demand not only for specific countries but also on a worldwide level. First, by using data on the number of world heritage sites in 66 countries between 2000 and 2009, we explore the positive influence of world heritage sites on international tourist arrivals (international tourism demand). Second, we divide our sample into several groups according to the number of WHSs and study the different effects of WHSs on international tourism demand across these groups. Third, with panel data, the pooled, fixed and random effects models are explored. In addition, the number of countries is increased to eliminate the problem of time-invariant variables, or rarely changing variables, in the panel data model.

In Section 2, we provide the literature review and the analytical framework of WHSs and international tourism worldwide. The model setting and the methodology of the panel data are introduced in Section 3. The results of the analysis and their economic implications are presented in Section 4. Section 5 provides a discussion and conclusions.

3.2. World Heritage Sites and International Tourists

In this section, we provide a literature review and describe the analytical framework of WHSs and international tourism worldwide. In addition, their current situation is briefly described to provide the background to better understand our paper.

3.2.1. Literature Review

Due to the increase in tourism demand around the world, governments and private enterprises are eager to promote the expansion of tourism. Thus, many studies examine the key elements affecting tourism demand (e.g., Payne and Mervar, 2002; Tan *et al.* 2002; Dritsakis, 2004; Dhariwala, 2005; Naude and Saayman, 2005; Patsouratis *et al.*, 2005; Dougan, 2007). Among the many elements affecting tourism demand, tourism destinations with typical cultural or natural elements constitute one of the chief attractions for international tourists (*e.g.*, Deng *et al*., 2002; Bonet, 2003; Dritsakis, 2004; Bille and Schulze, 2008; Cooke and Lazzaretti, 2008). That is, for a potential tourist who is planning to travel abroad, a destination with famous or special (cultural or natural) attractions could always appeal to him/her.

Possessing cultural or natural attractions would increase tourism demand, especially for those sites that are officially authenticated. Thus, attractions inscribed on the list of WHSs by UNESCO should be relatively appealing to international tourists. In some of the extant research, WHSs have been found to have significantly positive effects on the promotion of domestic or foreign tourism in some specific countries, such as England (*e.g.*, McIntosh and Prentice, 1999; Herbert, 2001), China (*e.g.*, Li *et al.*, 2008; Yang *et al.*, 2010) and Germany, Hungary and Romania (Light, 2000). Nevertheless, studies on the positive effect of WHSs on tourism are limited to a single country, and little research has been done to expand this effect to a worldwide level.

In addition, in terms of the methodology adopted, some studies employ the panel data model (e.g., Ledesma-Rodriguez *et al.*, 2001; Naude and Saayman, 2005; Garin-Munoz and Amaral, 2000; Maloney and Montes-Rojas, 2005; Yang *et al.*, 2010), because of the availability of the data. However, in the panel data model, the problem of time-invariant variables, or rarely changing variables, is widely discussed (Cellini, 2011; Yang and Lin, 2011). In this paper, we also use the panel data model, and the number of countries is increased to eliminate the problem of time-invariant variables.

3.2.2. Research Background

With the increasing trend in terms of the number of WHSs (see Figure 3.1), the geographical distribution of heritage sites is relatively unbalanced. Based on data collected by the World Heritage Centre, UNESCO, Figure 3.2 shows the pie chart of WHSs by region in 2009. WHSs are mainly concentrated in Europe, which accounts for 42% of the total amount, followed by the Asia Pacific with 20%, and the Americas with 17% (the sum of the North and the South Americas). Other areas, that is, Africa and the countries of the Middle East, each account for around 10%. Overall, European countries, which have highly developed tourism, possess rich cultural and historical attractions, including almost half of all WHSs.

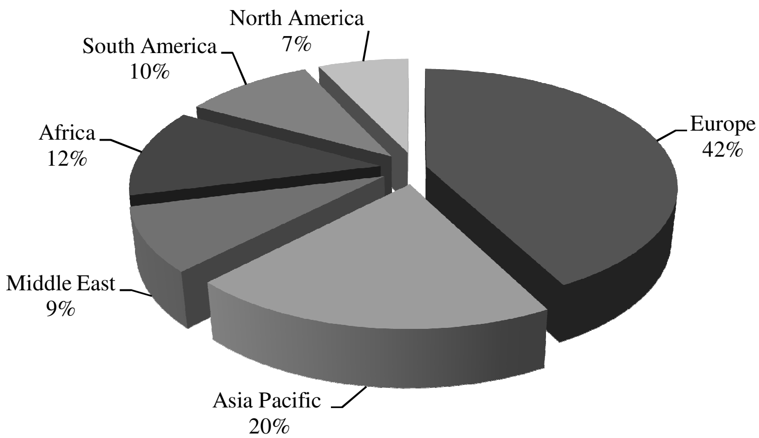

Figure 3.2. Number of WHSs by location in 2009

To reveal this phenomenon in better detail, Figure 3.3 shows the top 20 countries according to the numbers of WHSs in 2009 provided by the World Heritage Centre, UNESCO. The total number of WHSs is the summation of three kinds of sites: cultural, natural and mixed sites. Half of these countries are located in Europe. Italy, the country with the most WHSs, possesses 44 WHSs, including 42 cultural sites and 2 natural sites. The country with the second most WHSs, Spain, has 41 WHSs (36 cultural, 3 natural and 2 mixed sites), and China has 38 WHSs (27 cultural, 7 natural and 4 mixed sites). In addition, a large proportion of WHSs are cultural sites, which account for around 80% of all sites. Some countries even possess only cultural sites, such as Iran and the Czech Republic, each of which has 12 cultural sites. However, in a minority of natural resource-abundant countries, such as the United States and Australia, there are more natural sites. The U.S. has 12 natural sites among 20 WHSs (60%), and Australia has 11 natural sites among 17 WHSs (65%).

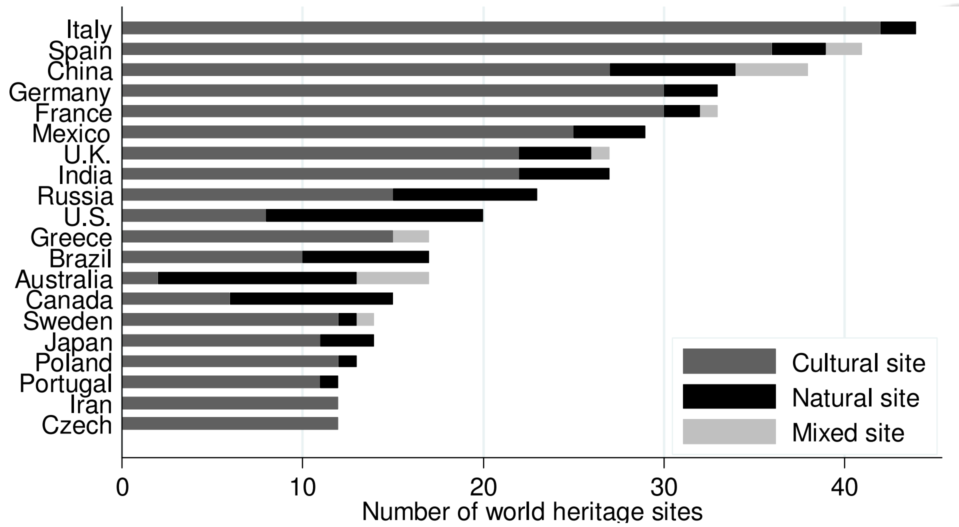

Figure 3.3. Top 20 countries in terms of WHSs in 2009

Now, we can take a look at the demand for tourism side. Figure 3.4 shows the top 20 countries ranked by international tourist arrivals in 2009, based on the World Tourism Organization. France, the most popular country for tourism, received 76.8 million international tourists in 2009. Inbound tourist arrivals in the United States, Spain and China were 54.9 million, 52.2 million and 50.9 million, respectively, while Italy received 43.2 million inbound tourists, which is about 60% of the number France received. International tourist arrivals in other countries were all less than 30 million in 2009.

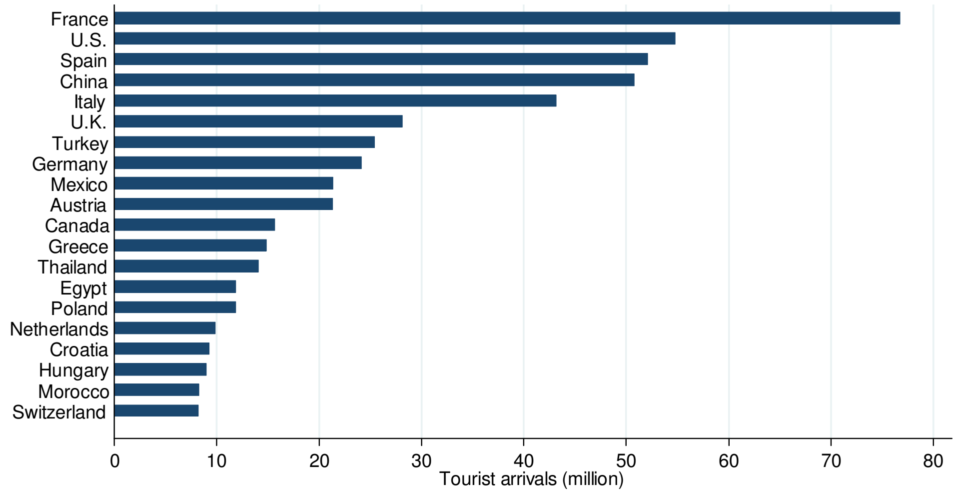

Figure 3.4. Top 20 countries in terms of international tourist arrivals in 2009

Among the 20 countries in Figure 3.4, a total of 11 countries possess rich world heritage sites, which are also ranked in the top 20 countries according to the number of WHSs (see Figure 3.3). In fact, among 194 countries around the world, the other 9 countries in Figure 3.4 are also ranked in the top 40 according to the number of WHSs, apart from Thailand, which is ranked the fiftieth. Meanwhile, the simultaneous growth trends in both WHSs and international tourists are also shown in Figure 3.1. Therefore, the data reveal that under the growing trend of both WHSs and international tourism, a large proportion of countries popular with tourists are those which are abundant in cultural or natural world heritage sites.

3.2.3. Analytical Framework

There are at least two possible reasons why being inscribed on the WHS list would increase the demand for tourism (Yang *et al.*, 2010). First, the WHSs are widely used to promote or advertise the tourism in destination countries, not only by travel agencies, but also by governments. Because of the officially strict application and examination processes, being successfully inscribed on the WHS list would increase the global visibility of the destination countries. Since WHSs attract the attention of international tourists, the demand for international tourism will rise. Second, in regard to conservation, UNESCO is prepared to assist those developing countries which lack the resources or ability to repair and maintain their WHSs. For a destination country, using such aid well will improve tourism conditions and further attract international tourists.

Moreover, the main purpose behind listing WHSs is to “raise awareness” and “mobilize sustainable resources for long-term conservation” (according to the World Heritage Centre, UNESCO), and is not the development of tourism. However, if WHSs have positive effects on tourism demand and further on tourism economies, this additional benefit could also raise awareness and help fund the conservation efforts. Since the government plays an important role in administering resources, it is essential to study the economic effects of WHSs. In spite of this, there has been little research that has done just that. Therefore, under the growing trend of both WHSs and international tourism, the main purpose of our paper is to confirm the positive effect of WHSs on the demand for international tourism. Furthermore, we study how this positive effect has changed.

3.3. Methodology and Data

In this section, we introduce the methodology, the panel data model that is widely used, and briefly introduce the data we employ.

3.3.1. Modeling the International Tourism Demand

To investigate the determinants of international tourist arrivals worldwide, especially the effect of world heritage sites, a tourism demand function is estimated in this study. The demand model is specified as

$$y_{it} = f(x_{it}, z_{it}) + q_i + \varepsilon_{it} \tag{3.1}$$

where y_{it} is the quantity of tourism demand, and the subscripts i and t denote the destination country and time period, respectively. The x_{it} are the main explanatory variables in which we are interested, the z_{it} are control variables which also affect the demand, and ε_{it} is a normally distributed error term. Meanwhile, f (.) is a function, which is set to be linear in this paper. Note that q_i is the unobserved country-specific variable that varies across countries but is invariant within a country over time.

More specifically, the linear international tourism demand model is specified as

$$\begin{aligned} ARRI_{it} = \alpha + \delta\, WHS_{it} + \beta_1\, GDP_{it} + \beta_2\, POP_{it} + \beta_3\, EX_{it} + \beta_4\, RAIL_{it} + \beta_5\, FREEDOM_{it} \\ + \beta_6\, HEALTH_{it} + \beta_7\, EDU_{it} + \sum_{j=1}^{6} \gamma_j AREA_{jit} + \sum_{k=1}^{10} \gamma_k YEAR_{kit} + q_i + \varepsilon_{it} \end{aligned} \tag{3.2}$$

where the dependent variable, *ARRI*, is the international tourist arrivals in country i at time t, which is often treated as the tourism demand in the literature (*e.g.*, Lim, 2006; Song and Li, 2008). *WHS* represents the number of world heritage sites, which is the main explanatory variable (x_{it}) we are interested in. If the sign of its coefficient, δ, is positive, we could say that possessing WHSs would enhance international tourism after controlling other variables. In addition, we have replaced *WHS* by *CULTURAL* and *NATURAL*, the numbers of cultural and natural WHSs, to differentiate the effects of cultural and natural WHSs on international tourism demand.

The other explanatory variables (z_{it}), are regarded as control variables capturing some possible factors which would influence the demand. The gross domestic product

(*GDP*) variable represents the income level, which also captures the degree of economic development in the destination country. The population (*POP*) variable controls the size of the destination country. After considering *POP*, the effect of the GDP and other explanatory variables could be measured accurately under the same scale of population. Moreover, *EX* denotes the official exchange rate between the local currency unit (LCU) and the U.S. dollar, which represents the price factor in the demand function. If *EX* goes up, the traveling price (cost) increases, in which case the number of international tourist arrivals would decrease based on the law of demand.

In addition, the total railway lines (*RAIL*) in terms of kilometers in destination countries is employed as a proxy variable for the availability of infrastructure. A country that possesses more railway lines is a country in which it is more convenient to travel, and this will attract more international tourists. The *FREEDOM* variable is the index of political rights and civil liberties, which is measured on a one-to-seven scale. Theoretically, a smaller value of *FREEDOM* represents a freer political and civil environment that would make international tourists feel more secure without red tape and increase their willingness to travel. Moreover, the *HEALTH* variable is the percentage of health expenditure in GDP, and is used as a proxy variable for the environmental sanitation in destination countries. If a country spends more money caring for its residents' health, the sanitary condition in the country will be further improved. To measure the health quality of residents and the educational environment in destination countries, the percentage of expenditure on education in GDP (*EDU*) is also used as a proxy variable. In addition, to control the time and regional factors, *YEAR* and *AREA* are dummy variables denoting the time from 2000 to 2009 and the geographical position of 6 areas, respectively.

However, there is a potential simultaneous relationship between tourist arrivals and some explanatory variables, such as GDP, and so variables in the form of a lag of one period enter the equation. The results turn out to be quite consistent with those without the lag term. Thus, to keep the sample size as large as possible (using the lag term will reduce the sample size by 66 observations), we choose the original models without lag terms. Other possible explanatory variables, such as FDI (measuring the openness level), WHSs in danger, global infectious diseases, or interaction terms, have also been considered but have turned out to be insignificant and can not improve the model, so they are omitted from the model. More details about our variables are shown in Table 3.1, which provides the definitions and descriptive statistics of the variables.

Table 3.1. Definitions of variables and basic statistics

Variable	**Description**	**Mean**	**S.D.**	**Min**	**Max**
ARRI	International tourist arrivals	5355096.00	11000000.00	3000.00	80900000.00
WHS	Number of world heritage sites	5.50	7.29	0.00	44.00
CULTURAL	Number of cultural world heritage sites	4.23	6.33	0.00	42.00
NATURAL	Number of natural world heritage sites	1.09	1.89	0.00	12.00
GDP	GDP (billion, constant 2000 USD)	246.21	1029.56	0.25	11670.80
POP	Population (million)	42.68	143.00	0.03	1331.38
EX	Official exchange rate (LCU per US$, period average)	659.77	2078.67	0.00	17065.08
RAIL	Rail lines (total route-km)	11545.25	25988.60	251.00	228999.00
FREEDOM	The index of political rights and civil liberties	5.19	2.18	1.00	7.00
HEALTH	Health expenditure (% of GDP)	6.35	2.22	0.01	16.21
EDU	Education expenditure (% of government expenditure)	15.48	5.50	6.20	71.09
AREA	Dummy variable: Africa, Asia Pacific, Middle East, Europe, N. America, S. America				
YEAR	Dummy variable: 2000 – 2009				

3.3.2. Varying Marginal Effect of World Heritage Sites

The marginal effect of WHSs is the partial derivative of $ARRI_{it}$ with respect to WHS_{it} in Eq. (3.2).

$$\text{Marginal effect of WHS} = \frac{\partial ARRI_{it}}{\partial WHS_{it}} = \delta \tag{3.3}$$

That is, for a destination country, possessing one more WHS would increase its inbound tourists by δ visits. This δ is the average effect across all countries with different numbers of WHSs. However, even though the constant marginal effect of WHSs could be easily concluded by δ, this effect may change by the different number of WHSs. Thus, to reveal more details, we divide our sample into several equal parts according to the number of WHSs. The new model is specified as

$$\begin{aligned} ARRI_{it} &= \alpha + \sum_{s=1}^{S} \delta_s \, WHS_{it} \times g_{sit} \\ &\quad + \beta_1 \, GDP_{it} + \beta_2 \, POP_{it} + \beta_3 \, EX_{it} + \beta_4 \, RAIL_{it} + \beta_5 \, FREEDOM_{it} \\ &\quad + \beta_6 \, HEALTH_{it} + \beta_7 \, EDU_{it} + \sum_{j=1}^{6} \gamma_j AREA_{jit} + \sum_{k=1}^{10} \gamma_k YEAR_{kit} + q_i + \varepsilon_{it} \end{aligned} \tag{3.4}$$

where g_{sit} is the dummy variable for the s^{th} group of the WHS. The data are divided into S equal parts, according to the number of WHSs. The WHS_{it} multiplied by g_{its} make us focus on the marginal effect for a specific range of the number of WHSs.

However, when we decide to divide our sample, the first question is concerned with how many groups we would obtain. On the one hand, if S is too large, which means that the number of groups is large, the small size of the subsample would give rise to highly sensitive estimated results. On the other hand, if S is too small, say, S = 2 (as a result of dividing the sample into two equal parts), the large subsample would reveal little of the varying marginal effect of the WHSs. Moreover, we should note that the WHS is a discrete right-skewed variable, which means that the number of WHSs is an integer and the data are concentrated in small numbers. In this distribution, it is impossible to divide the data into too many equal parts.

As a result, we start with three equal parts and extend this to seven equal parts (S = 3, 4 …7). It turns out that when S is equal to 4, the decrease pattern is the same as the one when S is equal to 3. When S is bigger than 5, the estimated results of the U-curve effect would be similar to the case where S = 5. Therefore, in this paper, we present two representative results, S = 3 and S = 5, because they are the smallest groups to capture the pattern of varying marginal effects and perform well in dividing the data into several equal parts.

3.3.3. Methodology

To understand the preliminary sign of each determinant, pooled ordinary least squares (pooled OLS) regression is employed at first (*e.g.*, Naude and Saayman, 2005, Yang *et al.*, 2010). Thus, the pooled OLS residual (u_{it}) is the summation of the country-specific unobserved variable (q_i) and the error term with a normal distribution (ε_{it}):

$$u_{it} = q_i + \varepsilon_{it} \tag{3.5}$$

However, in pooled OLS estimation, omitting the unobserved variable, which may be correlated with other explanatory variables (x_{it} or z_{it}), will cause severe problems of bias and inconsistency. Fortunately, this problem could be solved in a panel data model under certain assumptions. Using the *fixed effects* (FE) or the *random effects* (RE) technique, we could eliminate the country-specific effect. The fixed effects model assumes that each country has its own q_i and estimates the constant term for each country, while the random effects model assumes that q_i follows a normal distribution, thus estimating one overall constant term. In this paper, both the fixed and random effects models are estimated, and then the *Hausman test* is employed to determine which model is more accurate. Under the null hypothesis (H_0), the RE model performs better, and if the Chi-square statistic is significant (the p-value is small), then H_0 should be rejected and the FE model chosen. We also show the estimated results of the pooled OLS for reference. For more details about the panel data model and the Hausman test, the interested reader should refer to Chamberlain (1984), Hausman (1978) and Wooldridge (2002).

3.3.4. Data

In this study, the data on international tourist arrivals (*ARRI*) come from the World Tourism Organization, while the data on the number of WHSs, including cultural and natural sites, (*WHS, CULTURAL*, and *NATURAL*) come from the World Heritage Centre, UNESCO. In addition, the other explanatory variables (*GDP, POP, EX, RAIL, HEALTH,* and *EDU*) are collected from the World Development Indicators (WDI) of the World Bank Online Resources. The data for the freedom index (*FREEDOM*) come from the annual report of Freedom House.

When combining these four data sets, we try to collect as many informative observations as we possibly can. However, there are missing data, more or less, for each variable, and especially for some developing countries whose statistical surveys are less comprehensive. To focus on countries with relatively more information and avoid too much missing data causing a severe problem of data imbalance in the panel data, countries with too many kinds of data unavailable are deleted without loss. We originally collected the data for the WHSs of 148 countries. After combining data sets, the data actually used consist of 66 countries. The data distributions of WHSs before and after combining the data are shown in Figure 3.5. The countries deleted are mostly those containing few or no WHSs. One thing we should mention is that, among these observations, there is only one, Israel in 2000, that possesses zero WHSs.

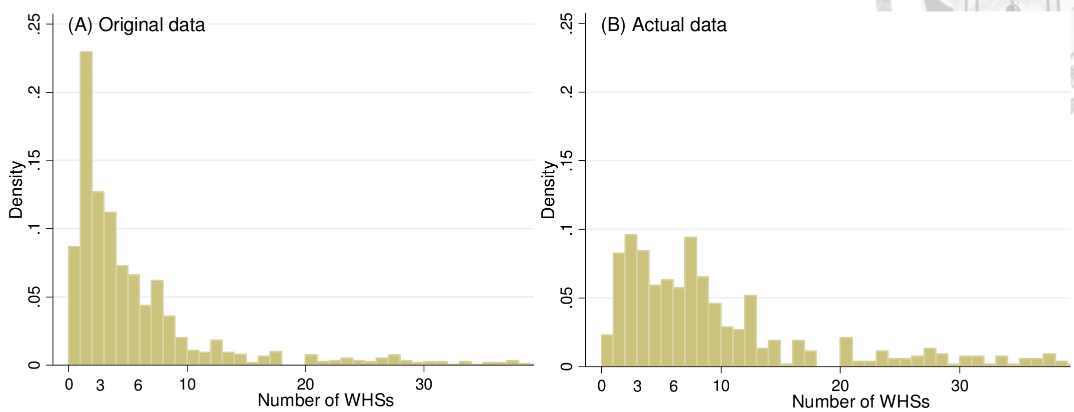

Figure 3.5. Distribution of WHSs

Therefore, sifting the observations can not only simplify the analysis but also will not critically affect the estimated results. In this research, the panel data comprise 66 countries over the period from 2000 to 2009 with 359 observations after deducting the missing data for each variable. The names of these 66 countries are listed in Appendix A.

3.4. Empirical Results

Using the panel data, we investigate the effect of WHSs (both cultural and natural sites) on international tourist arrivals, while other possible explanatory variables are controlled. We also explore how this effect changes for different numbers of WHSs.

3.4.1. Main Results

The estimated results for Eq. (3.2) are shown in Table 3.2. Models (3.1), (3.2) and (3.3) use the number of WHSs (*WHS*) as their explanatory variable, while Models (3.4), (3.5) and (3.6) separate WHSs into cultural and natural sites (*CULTURAL* and *NATURAL*) to better understand the influence of these two kinds of sites. In these models, we estimate coefficients by pooled OLS regression, and the fixed effects and the random effects models. The latter two models are ideal for dealing with the country-specific unobserved variables, and could also be judged by the Hausman test. The pooled OLS regression, which is beset by problems resulting in inconsistency and bias, is for reference only. We could observe that the coefficients are quite different between the pooled OLS regression and the panel data model (both the fixed and random effects models). This result proves that the country-specific effect should be considered. If we were to just grab the data and run the regression directly, the estimated results would be unreliable.

According to the Hausman test, in which the Chi-square statistics are insignificant at the 5% significance level, the random effects model, as in Model (3.3) and Model (3.6), performs better. This result is quite reasonable. Because the data comprise a cross section of countries, in considering the sampling problem, it makes sense to assume that the omitted variable is distributed randomly. Note that Model (3.5), the fixed effects model, unexpectedly performs better at the 10% significance level. This may be caused by the imprecise setting of the WHSs, which are assumed to have constant effects. When the varying effects of WHSs are considered later, all the random effects models are found to perform better.

Table 3.2. Estimated results of international tourist arrivals (with constant effects of WHSs)

	(3.1) Pooled OLS	(3.2) Fixed effects	(3.3) Random effects	(3.4) Pooled OLS	(3.5) Fixed effects	(3.6) Random effects
WHS	**533384.15*****	**89416.14**	**382637.04*****			
	[11.77]	[0.64]	[4.69]			
CULTURAL				**563357.95*****	**15548.61**	**396658.60*****
				[10.79]	[0.09]	[4.16]
NATURAL				**637057.13*****	**292458.01**	**418605.71****
				[4.57]	[1.07]	[2.10]
GDP	603.74***	3920.65***	1020.66**	571.65**	3838.76***	1009.84**
	[2.34]	[2.70]	[2.04]	[2.20]	[2.64]	[1.99]
POP	-18734.67***	-26942.45	-13580.09***	-19810.79***	-24204.26	-14154.76***
	[-6.08]	[-0.79]	[-3.07]	[-6.41]	[-0.70]	[-3.16]
EX	-599.37***	-158.43	-106.47	-611.63***	-158.05	-107.29
	[-4.36]	[-1.01]	[-0.83]	[-4.46]	[-1.01]	[-0.84]
RAIL	169.21***	47.85*	105.58***	166.02***	48.70*	105.60***
	[10.17]	[1.80]	[6.20]	[9.60]	[1.83]	[6.19]
FREEDOM	270388.44*	-490387.43***	-233925.56	232962.58	-526645.08***	-245556.68
	[1.84]	[-2.50]	[-1.38]	[1.59]	[-2.62]	[-1.44]
HEALTH	-268317.73*	455884.54***	244248.75	-254538.64*	452640.93***	248966.53
	[-1.90]	[2.62]	[1.58]	[-1.77]	[2.60]	[1.60]
EDU	355451.28***	-55592.36	-868.38	363171.76***	-57697.20	-1427.52
	[6.72]	[-1.25]	[-0.02]	[6.90]	[-1.30]	[-0.03]
AREA	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6461538.15***	3396688.79	-3148908.15	-6531921.78***	3631736.20	-3099144.91
	[-3.54]	[1.43]	[-1.41]	[-3.60]	[1.53]	[-1.38]
Hausman Test		22.00 (p-value = 0.143)			25.27* (p-value = 0.089)	
R-square	0.815	0.539	0.737	0.818	0.547	0.739
Chi-square			461.239***			460.099***
Observations	359	359	359	359	359	359

1. t statistics are in parentheses. 2. *, ** and *** denote significance at the 10%, 5% and 1% statistical levels.

In Model (3.3), the number of WHSs has a significantly positive effect on international tourist arrivals. That is, adding one WHS would on average increase the number of international tourist arrivals by 382,637 in just one year after controlling other variables. Thus, this positive effect proves that a country possessing more WHSs would promote international tourism, not only for some specific countries but for the whole world. Moreover, possessing more WHSs increases the international tourism demand, which also brings in relatively more tourist expenditures to the tourism-related industries, such as accommodation, transportation or even retail outlets located around the site. These industrial linkages will generate several times the revenue earned from the visits to the WHSs themselves.

In Model (3.6), both the cultural and natural WHSs have significantly positive effects on the number of international tourist arrivals when other variables are controlled. Increasing the number of cultural sites by one would create an additional 396,659 international tourist arrivals, while adding one more natural site would increase international tourist arrivals by 418,606, which is on average 21,947 more tourist arrivals than for an additional cultural one. To sum up, both the cultural and natural world heritage sites could enhance international tourism, and the effect is greater for the natural world heritage sites than for the cultural ones.

Models (3) and (6) assume that the marginal effect of WHSs is constant, which is quite a simplification. However, the marginal effect may vary according to the number of WHSs. That is, the effect of WHSs on international tourist arrivals may differ between countries with an abundant supply of WHSs and countries with few WHSs. Thus, to better understand the marginal effect of WHSs for a specific range of numbers, we have divided our sample into three and five equal parts. The estimated results are listed in Tables 3 and 4, respectively. Still, the pooled OLS, fixed effects and random effects models of Eq. (4) are estimated. The latter two models are judged using the Hausman test, and according to the test results, all of the random effects models, i.e., Models (3.9), (3.12), (3.15) and (3.18), are more accurate.

Table 3.3. Estimated results of international tourist arrivals (with 3 variant effects of WHSs)

	(3.7) Pooled OLS	(3.8) Fixed effects	(3.9) Random effects	(3.10) Pooled OLS	(3.11) Fixed effects	(3.12) Random effects
WHS (0-5)	**649675.36*** **	**471627.62*** **	**691823.08*** **			
	[3.42]	[2.34]	[4.30]			
WHS (6-11)	**524222.32*** **	**261853.32***	**494946.73*** **			
	[6.37]	[1.74]	[5.13]			
WHS (12 up)	**552693.31*** **	**148088.03**	**408442.34*** **			
	[11.03]	[1.07]	[4.91]			
CULTURAL (0-5)				**343297.35**	**328116.38**	**561704.25*** **
				[1.60]	[1.44]	[2.96]
CULTURAL (6-11)				**415442.66*** **	**149397.07**	**489724.36*** **
				[4.64]	[0.78]	[4.35]
CULTURAL (12 up)				**574952.78*** **	**45192.87**	**402313.64*** **
				[10.33]	[0.26]	[4.14]
NATURAL (0-3)				**1245048.05*** **	**431978.19**	**514498.16***
				[4.24]	[1.39]	[1.88]
NATURAL (4 up)				**525079.02*** **	**319811.62**	**419242.31***
				[3.59]	[0.85]	[1.82]
GDP	634.78***	4921.81***	1117.50**	439.52*	4579.66***	1074.26**
	[2.44]	[3.32]	[2.20]	[1.66]	[3.06]	[2.07]
POP	-18785.75***	-29217.91	-13424.19***	-20131.53***	-26937.45	-13911.79***
	[-6.09]	[-0.86]	[-2.99]	[-6.57]	[-0.78]	[-3.02]
EX	-613.43***	-154.64	-118.68	-657.32***	-157.18	-112.50
	[-4.42]	[-1.00]	[-0.93]	[-4.76]	[-1.01]	[-0.88]
RAIL	167.29***	33.26	102.92***	176.62***	38.05	103.57***
	[9.94]	[1.24]	[6.05]	[9.89]	[1.41]	[6.01]
FREEDOM	300558.20**	-442934.67**	-212081.06	262095.24*	-485929.35***	-243021.32
	[2.00]	[-2.27]	[-1.25]	[1.75]	[-2.42]	[-1.41]
HEALTH	-262654.04*	472894.08***	275290.34*	-222294.49	477397.87***	277947.65*
	[-1.85]	[2.75]	[1.79]	[-1.56]	[2.74]	[1.77]
EDU	354913.42***	-43024.16	3765.01	353746.63***	-47052.61	-377.20
	[6.68]	[-0.98]	[0.09]	[6.75]	[-1.05]	[-0.01]
AREA	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6738359.51***	1631441.45	-4313752.97*	-6414358.53***	2276009.67	-3789343.37
	[-3.50]	[0.67]	[-1.87]	[-3.40]	[0.93]	[-1.63]
Hausman Test		22.37 (p-value = 0.216)			23.03 (p-value = 0.288)	
R-square	0.816	0.537	0.733	0.823	0.537	0.734

Chi-square			466.364***			455.597***
Observations	359	359	359	359	359	359

1. t statistics are in parentheses. 2. *, ** and *** denote significance at the 10%, 5% and 1% statistical levels.

In Model (3.9), just like in the previous analysis, the marginal effect of the WHSs is positive. Moreover, this positive effect declines as the number of WHSs rises. For countries possessing 0 – 5, 6 – 11 and more than 12 WHSs, the marginal effects of WHSs are around 692, 495, and 408 thousand, respectively. The positive effect of WHSs on international tourist arrivals is larger in countries with fewer WHSs. This result is quite reasonable. For WHS-poor countries, once unknown sites become famous after being included on the WHS list, this will attract more visits from international tourists. On the contrary, for WHS-abundant countries, which already possess many attractions and are famous in the global tourism market, adding one more WHS will result in a smaller increase in inbound tourists than for WHS-poor countries.

Correspondingly, in Model (3.12), both cultural and natural sites have positive effects on international tourist arrivals. These effects also decrease as the number of cultural and natural WHSs increases. The marginal effects are 562, 490 and 402 thousand for countries with 0 – 5, 6 – 11 and more than 12 cultural WHSs, respectively. Meanwhile, for countries with 0 – 3 and more than 4 natural WHSs, the marginal effects are 514 and 419 thousand, respectively. Note that because the sample size of natural WHSs is relatively small, it is divided into two equal parts only.

To understand the marginal effects of WHSs in more detail, the sample is also divided into five equal parts. In Models (15) and (18) of Table 3.4, the effects of WHSs, cultural WHSs and natural WHSs are still positive. Moreover, the pattern of the decreasing marginal effects as the number of WHSs increases is almost the same. However, after controlling for more WHSs, the marginal effects of WHSs for

WHS-abundant countries (possessing more than 21 WHSs) increase instead. This increase means that when a country possesses sufficient WHSs, the 'gearing effect' of WHSs will emerge. For countries possessing 0 – 3, 4 – 6, 7 – 10, 10 – 20 and more than 21 WHSs, the marginal effects of WHSs decrease from 975, to 580, 498 and 375 thousand, and rise slightly rise to 475 thousand, respectively. Similarly, the marginal effects of cultural WHSs are 776, 361, 373, 285 and 509 thousand, respectively. Meanwhile, the marginal effects of natural WHSs for countries with 0 – 3 and more than 4 natural WHSs are 514 and 419 thousand, respectively. In addition, compared with Models (3.9), (3.12) and (3.18), Model (3.15) with the highest R-square of 0.749, is a relatively accurate model. Based on Models (3.15) and (3.18), Figure 3.6 shows how these marginal effects of WHSs vary based on the number of WHSs, and the U-curve of the effect is quite obvious.

We also considered the quadratic form of the WHSs when a U-curve resulting in S = 5 was observed, but the estimated results of the quadratic form are not good enough. A possible reason for the badly-performing quadratic form is that, in Table 3.4, the coefficients are not very smooth so that the quadratic form can not capture the pattern well. Therefore, dividing the data into 5 groups creates more flexibility to the varying coefficients and fits the model better, even though the number of coefficients needed to be estimated increases.

Table 3.4. Estimated results of international tourist arrivals (with 5 variant effects of WHSs)

	(3.13) Pooled OLS	(3.14) Fixed effects	(3.15) Random effects	(3.16) Pooled OLS	(3.17) Fixed effects	(3.18) Random effects
WHS (0-3)	**717354.26*** **	**759195.41*** **	**975394.75*** **			
	[2.38]	[2.86]	[4.15]			
WHS (4-6)	**585643.22*** **	**346695.08* **	**580418.01*** **			
	[3.95]	[1.91]	[4.06]			
WHS (7-10)	**531494.95*** **	**254907.28* **	**498169.26*** **			

	[5.83]	[1.64]	[4.61]			
WHS (11-20)	**299724.16*** **	**107881.51**	**356668.67*** **			
	[4.54]	[0.76]	[4.01]			
WHS (21 up)	**716652.88*** **	**184221.66**	**474846.97*** **			
	[13.62]	[1.27]	[5.42]			
CULTURAL (0-3)				**214136.49**	**446149.55**	**776329.93*** **
				[0.86]	[1.59]	[3.29]
CULTURAL (4-6)				**389665.43*** **	**33589.64**	**360513.45*** **
				[2.75]	[0.16]	[2.34]
CULTURAL (7-10)				**289594.82*** **	**-45539.87**	**373257.65*** **
				[3.21]	[-0.23]	[3.08]
CULTURAL (11-20)				**354390.56*** **	**-129725.75**	**284574.55*** **
				[5.20]	[-0.73]	[2.75]
CULTURAL (21 up)				**913255.68*** **	**131702.65**	**508761.04*** **
				[12.23]	[0.79]	[5.16]
NATURAL (0-3)				**1259993.21*** **	**599675.81** **	**750817.04*** **
				[4.52]	[2.13]	[2.93]
NATURAL (4 up)				**439219.79*** **	**-158265.28**	**298612.05**
				[3.26]	[-0.44]	[1.34]
GDP	1011.06***	3912.38***	1191.96***	351.46	3096.00**	1026.69**
	[4.09]	[2.73]	[2.36]	[1.29]	[2.17]	[1.99]
POP	-22989.06***	-25653.01	-14762.50***	-18369.94***	-22490.11	-11419.79***
	[-7.83]	[-0.76]	[-3.31]	[-6.30]	[-0.69]	[-2.46]
EX	-392.67***	-158.20	-102.65	-514.67***	-149.48	-115.16
	[-2.96]	[-1.02]	[-0.81]	[-3.85]	[-1.00]	[-0.92]
RAIL	168.28***	47.84*	102.34***	206.62***	61.58***	109.33***
	[10.78]	[1.83]	[6.07]	[11.49]	[2.39]	[6.56]
FREEDOM	167820.66	-460859.81***	-217766.63*	258111.45*	-518235.42***	-273159.23*
	[1.18]	[-2.37]	[-1.69]	[1.80]	[-2.69]	[-1.64]
HEALTH	-200791.39	516818.85***	308048.78**	-157775.79	359633.58**	231209.95
	[-1.48]	[3.00]	[2.01]	[-1.16]	[2.14]	[1.52]
EDU	354455.52***	-51271.76	-1071.33	332053.13***	-48415.31	-7087.38
	[7.00]	[-1.17]	[-0.03]	[6.65]	[-1.14]	[-0.17]
AREA	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6039499.56***	1659178.51	-4300985.68*	-6256850.52***	4221109.45*	-2887056.58
	[-3.12]	[0.68]	[-1.85]	[-3.46]	[1.75]	[-1.23]
Hausman Test		19.79 (p-value = 0.471)			11.37 (p-value = 0.955)	
R-square	0.841	0.558	0.749	0.843	0.486	0.739
Chi-square			486.3***			506.274***

Observations	359	359	359	359	359	359

1. t statistics are in parentheses. 2. *, ** and *** denote significance at the 10%, 5% and 1% statistical levels.

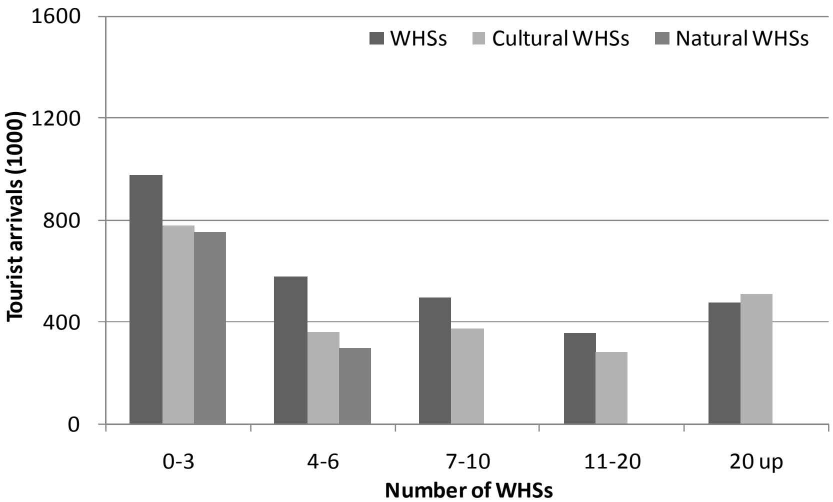

Figure 3.6. Marginal effects of WHSs, cultural WHSs and natural WHSs

In addition, the other explanatory variables merit discussion. Among Models (3.9), (3.12), (3.15) and (3.18), the coefficients of the variables are quite similar, regardless of the number of WHSs or the cultural and natural sites that are included in the model. In Model (3.15), for example, the marginal effect of GDP is positive, which means that tourism demand benefits from economic development. When the GDP of the destination country (*GDP*) increases by 1 billion USD, international tourist arrivals will increase by 1,192. Meanwhile, the effect of population (*POP*) is negative. The tourism demand will decrease by 14,763 as the population increases by 1 million people. This indicates that international tourists would like to travel to destinations with fewer people and less crowded conditions.

In addition, railway lines (*RAIL*) have a positive effect on international tourist arrivals, with the number of international tourist arrivals increasing by 102 for each extra kilometer that the railroad route is extended. It makes sense that the destination will be more attractive to international tourists when the basic transportation is more convenient. The political and civil freedom (*FREEDOM*) variable negatively affects the tourism demand at the 10% significance level. When the index of freedom, measured on a one-to-seven scale, increases by one (becoming less free), the number of international tourist arrivals declines by 217,767. That is, freer countries attract more international tourists. In addition, the health expenditure share of GDP (*HEALTH*) has a positive influence. When a country spends more money on health, say, 1% of GDP, it will improve the sanitary conditions and increase its inbound tourist visits by 308,048.

The effects of other controlled variables, namely, the exchange rate (*EX*) and the expenditure proportion of education (*EDU*), are insignificant in Model (3.15). However, it should be noted that the sign of the exchange rate is negative, which means that increasing the relative price will make the number of international tourist arrivals drop. Thus, the price effect of tourism exists, even though the coefficient is insignificant at the 10% significance level.

3.4.2. Comparison of Regions and Time Periods

The behavior of tourists may vary in different destinations, and some effects may also change over time. Therefore, based on Model (3.15), we separate our observations according to the region and the time period to reveal more details. This further research may also be seen as a robustness check of our model, especially for WHS variables. The estimated results of eight models are classified according to four regions in Table 3.5: Africa, Asia, Europe and America, and four time periods in Table 3.6: 2000 – 2001, 2003 – 2003, 2004 – 2006 and 2007 – 2009.

Three things should be noted. First, to avoid the small sample problem, we combine the Asia Pacific with the Middle East as the 'Asia' group, and combine North America with South America as the 'America' group. Second, because the numbers of WHSs of African countries are all below ten, the coefficients of *WHS (11-20)* and *WHS (21 up)* are eliminated in Model (3.19). Third, in mid-2003, the SARS epidemic occurred, especially in China, Singapore and Canada. Later, in 2009, the H1N1 epidemic also occurred in several countries. These two dummy variables of SARS (for countries whose confirmed cases were over 200 in 2003) and H1N1 (for countries whose confirmed cases were over 5,000 in 2009) enter our models to control for the effect of these diseases in the relatively small sample.

Table 3.5. Estimated results of international tourist arrivals (by region)

	(3.19) Africa	(3.20) Asia	(3.21) Europe	(3.22) America
WHS (0-3)	**311945.43**	**569240.22**	**1556751.62*** **	**1491710.19**
	[1.48]	[1.21]	[3.48]	[0.59]
WHS (4-6)	**700653.37*** **	**306748.19**	**895027.86*** **	**368894.77**
	[5.26]	[1.18]	[4.09]	[0.31]
WHS (7-10)	**668600.19*** **	**578652.66*** **	**633983.70*** **	**601731.02**
	[8.44]	[2.35]	[4.54]	[1.50]
WHS (11-20)	**0**	**27387.03**	**428506.56*** **	**1309071.96*** **
		[0.18]	[3.38]	[3.57]
WHS (21 up)	**0**	**52326.23**	**465289.26**	**1133299.43*** **
		[0.31]	[1.41]	[5.19]
GDP	-6097.11	350.46	-4338.24	4629.76***
	[-0.30]	[0.63]	[-0.86]	[2.73]
POP	-21793.65	-15756.36***	455643.96***	-108256.42***
	[-0.57]	[-4.51]	[6.01]	[-2.46]
EX	102.11	-134.88	1130.06	1709.17
	[0.52]	[-1.06]	[1.00]	[0.43]
RAIL	226.39***	245.68***	278.66*	43.47
	[2.61]	[4.93]	[1.72]	[0.58]
FREEDOM	-88542.01	-11224.13	-1270677.58***	-1696149.2
	[-0.80]	[-0.05]	[-3.07]	[-0.54]
HEALTH	119010.42	-271410.15	450324.73**	-689745.98

	[0.60]	[-1.10]	[2.04]	[-0.95]
EDU	71233.96	78745.46	107376.01	-522070.2
	[1.53]	[1.02]	[0.79]	[-1.34]
AREA	No	No	No	No
YEAR	Yes	Yes	Yes	Yes
Constant	-2510878.64	92106.25	-2528566.8	19603323.34
	[-1.56]	[0.03]	[-1.11]	[1.14]
R-square	0.956	0.542	0.891	0.997
Chi-square	719.79***	109.96***	1003.18***	5060.39***
Observations	53	126	145	35

1. t statistics are in parentheses. 2. *, ** and *** denote significance at the 10%, 5% and 1% statistical levels.

Table 3.6. Estimated results of international tourist arrivals (by time period)

	(3.23) 2000 - 2001	(3.24) 2002 - 2003	(3.25) 2004 - 2006	(3.26) 2007 - 2009
WHS (0-3)	**479370.55**	**403720.74**	**613022.27***	**1227144.45*****
	[0.08]	[1.05]	[1.65]	[4.47]
WHS (4-6)	**411201.49***	**394058.86**	**442751.21***	**309651.41**
	[1.82]	[1.32]	[1.92]	[1.50]
WHS (7-10)	**343859.20****	**307086.84****	**510984.50*****	**284435.48***
	[2.09]	[2.08]	[2.64]	[1.70]
WHS (10-20)	**360265.29*****	**245966.27***	**271689.13***	**224635.71**
	[2.54]	[1.88]	[1.70]	[1.48]
WHS (21 up)	**376666.37*****	**542954.80*****	**834250.42*****	**909319.29*****
	[2.77]	[4.32]	[5.95]	[4.93]
GDP	685.57	828.67	853.48	-711.92
	[1.04]	[1.47]	[0.91]	[-0.64]
POP	-18545.22***	-21720.38***	-4842.39	-175.16
	[-3.36]	[-4.94]	[-0.27]	[-0.01]
EX	-1047.28	-475.25	-344.05	-193.14
	[-0.90]	[-1.38]	[-0.81]	[-0.75]
RAIL	179.00***	162.64***	52.80***	318.41***
	[3.73]	[3.94]	[3.69]	[4.22]
FREEDOM	-256215.71	-527021.99	-13912.68	-123137.59
	[-0.63]	[-1.43]	[-0.04]	[-0.65]
HEALTH	-311163.79	-340883.73	2511.2	-82209.48
	[-0.78]	[-1.36]	[0.01]	[-0.62]
EDU	24163.51	-106243.45*	64066.16	-50353.33
	[0.32]	[-1.91]	[1.11]	[-1.04]

SARS		-2306389.69***		
		[-3.72]		
H1N1				-359981.67
				[-0.57]
AREA	Yes	Yes	Yes	Yes
YEAR	No	No	No	No
Constant	3827725.47	2939585.09	-2011503.17	-2696260.86
	[0.58]	[0.81]	[-0.57]	[-0.86]
R-square	0.825	0.889	0.839	0.782
Chi-square	170.96	262.29	207.1	188.65
Observations	72	70	120	97

1. t statistics are in parentheses. 2. *, ** and *** denote significance at the 10%, 5% and 1% statistical levels.

Even though the coefficients of the WHSs are not quite constant between Models (3.19) and (3.26), their marginal effects are all positive. After controlling other explanatory variables, the estimated results show that the positive effect of WHSs is quite robust so that the sign would not change for the different subgroups. In Section 4.1, we know that as the number of WHSs increases, the marginal effect declines, and then rises after a country possesses sufficient WHSs. However, in Models (3.19) to (3.22), this U-curve is not obvious in each region. For each region, the marginal effects of the WHSs exhibit different patterns. In Africa, where the numbers of WHSs are all below 10, the marginal effect is less for WHS-poor countries than for WHS-rich countries. In Asia, international tourists are mainly attracted by countries possessing fewer than 10 WHSs. On the contrary, in Europe and America, the marginal effects of WHSs are found to be U-shaped, but the turning points are different. In Europe, the turning point occurs when the number of WHSs ranges between 11 and 20, while in America, the turning point is located in the 4 – 6 WHSs group.

Even though the individual pattern in each region is different, the overall U-shaped pattern can be observed in Figure 3.7 (A). Moreover, in Models (3.23) to

(3.26), which are classified by four time periods, the U-shaped features of the marginal effects of the WHSs are obvious. The marginal effects are particularly large in WHS-poor and WHS-abundant countries, and they are small between these two groups. This pattern is also displayed in Figure 3.7 (B). Based on the time periods, these sub-samples reveal that our model is quite robust.

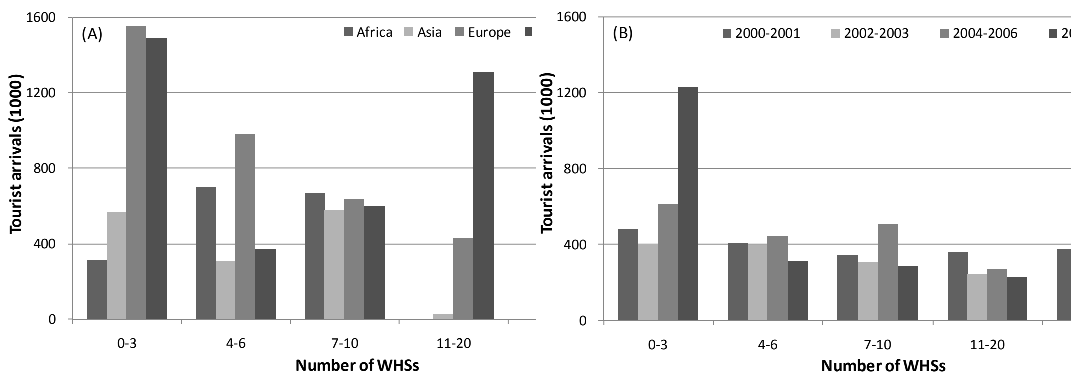

Figure 3.7. Marginal effects of WHSs (by region and time period)

In addition, the two global epidemics, SARS and H1N1, have indeed had negative impacts on international tourism worldwide in the last ten years. The SARS epidemic resulted in a significant reduction of around 2.3 million international tourists in 2003, while the H1N1 outbreak was insignificant, with the number of international tourists being reduced by about 359,982 in 2009.

3.4.3. Evaluation of the Economic Contribution of World Heritage Sites

In this section, we employ our model to calculate the contribution of newly-inscribed WHSs to destination countries. According to the World Heritage Center, the latest list of newly-inscribed WHSs reflects the 2011 vision. Table 3.7 lists these newly-inscribed WHSs and their related economic contributions. In Table 3.7, the marginal effect comes from our model, while the average receipt is calculated by dividing the total tourism receipts in 2009 by the international tourist arrivals in 2009, based on data provided by the World Development Indicators. Note that according to the number of WHSs in each country, our model proves that the marginal effect of WHS on international tourist arrivals differs from country to country. In addition, these 25 countries are divided into two groups. The first is the in-sample country, which is included in the 66 countries of our panel data, while the other is the out-of-sample country.

Table 3.7. Contribution of newly-inscribed WHSs in 2011

Newly-inscribed WHSs in 2011	Type	Country	# of WHSs	Marginal effect of WHSs (1000) (A)	Average receipt (USD) (B)	Contribution of WHSs (million USD) (A) x (B)
In-sample countries						
● Petroglyphic Complexes of the Mongolian Altai	C	Mongolia	3	975	616	600
● Coffee Cultural Landscape of Colombia	C	Colombia	7	498	1,244	620
● Selimiye Mosque and its Social Complex	C	Turkey	10	498	965	480
● The Persian Garden	C	Iran	13	357	1,136	405
● Hiraizumi (Temples, Gardens and Archaeological Sites Representing the Buddhist Pure Land)	C	Japan	16	357	1,846	659
● Ogasawara Islands	N	Japan	16	357	1,846	659
● Ningaloo Coast	N	Australia	19	357	4,990	1,781
● Fagus Factory in Alfeld	C	Germany	36	475	1,959	931
● The Causses and the Cévennes, Mediterranean agro-pastoral Cultural Landscape	C	France	37	475	763	362
● West Lake Cultural Landscape of Hangzhou	C	China	41	475	838	398
● Cultural Landscape of the Serra de Tramuntana	C	Spain	43	475	1,141	542
● Longobards in Italy. Places of the Power (568-774 A.D.)	C	Italy	47	475	970	461
Out-of-sample countries						
● Cultural Sites of Al Ain (Hafit, Hili, Bidaa Bint Saud and Oases Areas)	C	United Arab Emirates	1	975	1,032	1,006
● Historic Bridgetown and its Garrison	C	Barbados	1	975	2,162	2,108
● Archaeological Sites of the Island of Meroe	C	Sudan	2	975	712	694
● León Cathedral	C	Nicaragua	2	975	358	349
● Wadi Rum Protected Area	M	Jordan	4	580	916	531
● Residence of Bukovinian and Dalmatian Metropolitans	C	Ukraine	5	580	209	121

● Ancient Villages of Northern Syria	C	Syrian Arab Republic	6	580	621	360
● Fort Jesus, Mombasa	C	Kenya	6	580	807	468
● Kenya Lake System in the Great Rift Valley	N	Kenya	6	580	807	468
● Saloum Delta	C	Senegal	6	580	542	314
● Citadel of the Ho Dynasty	C	Vietnam	7	498	814	405
● Konso Cultural Landscape	C	Ethiopia	9	498	3,391	1,689

1. C: cultural site, N: natural site, M: mixed site. 2. Missing data of tourist arrivals in 2009: Iran, Ethiopia (replaced by 2008 data), Senegal (replaced by 2007 data), United Arab Emirates (replaced by 2005 data).

The contribution of WHSs is obtained by multiplying the marginal effect of WHSs by the average receipts (expenditure) of inbound tourists in destination countries. Because the buying power and travel costs are different, the average receipts vary across countries, and so do the contributions of WHSs. Australia, for example, possesses 19 WHSs, and the marginal effect of WHSs on international tourist arrivals is around 375,000. However, the average receipt from international tourists is quite high, amounting to 4,990 USD per person, The forecasted contribution of this newly-inscribed WHS is about 1,781 million USD. Comparatively speaking, even though the marginal effect of WHSs is higher in China than in Australia, the contribution of WHSs is lower, or around 398 million USD, because the average receipt is much lower than for other countries. In addition, the economic contribution of WHSs can be seen as the lower bound of the increase in tourism income while other control variables are unchanged. That is, after considering the changes in other variables, such as economic growth, the improvement of transportation or increased political liability, the number of inbound tourists will increase further, and bring in more income from tourism. Thus, the authorities of the destination countries could refer not only to the result, but also to the method in order to evaluate the economic contribution of WHSs and to budget for their conservation.

3.5. Conclusion and Discussion

In this paper, we investigate the positive relationship between the WHSs and international tourist arrivals at the worldwide level using the panel data of 66 countries between 2000 and 2009. We also study the effect of new inscriptions on the world heritage list, and observe how this influence changes over time.

According to the estimated results, a country possessing one more WHS would increase its annual international tourist arrivals by 382,637. Among these WHSs, both cultural and natural WHSs could enhance the inbound tourism, but the effect of natural WHSs is slightly bigger than the effect of cultural ones. The marginal effects of WHSs on international tourist arrivals are 396,659 million and 418,606 million for cultural and natural WHSs, respectively. Moreover, in considering that the marginal effect may vary with the number of WHSs, we divided our sample into three and five equal parts to better understand the marginal effect of WHSs for a specific range of numbers. After dividing our data into five equal parts, the positive effect of WHSs was found to decline while the number of WHSs actually rose. However, when a country possesses sufficient WHSs, this effect increases slightly. The effect of WHSs exhibits a U-shaped pattern as the number of WHSs increases. In addition, for each region, the marginal effects of WHSs demonstrate different patterns, but our results are quite robust in different time periods.

For WHS-poor countries, once unknown sites become famous after being inscribed on the WHS list, which will attract more visits from international tourists. On the contrary, for WHS-rich countries, which already possess many attractions and are famous in the global tourism market, adding one more WHS would lead to smaller increases in inbound tourists than in the case of WHS-poor countries. However, for the WHS-abundant countries (possessing more than 21 WHSs), the marginal effects of WHSs increase instead. This increase means that when a country possesses sufficient WHSs, the 'gearing effect' of WHSs will emerge.

To sum up, increasing the number of WHSs will have a significantly and robustly positive effect on international tourist arrivals. Therefore, a country possessing a WHS is in a win-win situation not only for the sustainable conservation of cultural achievements and natural resources, but also for the development of the tourism economy. Moreover, we could say that these two purposes are not contradictory, but rather complementary. It is because conservation is the only way to maintain sustainable tourism income from WHSs, and this tourism income is indispensable for the further preservation of WHSs.

More information will be gained after extending the time span or the cross section of available data associated with WHSs. Furthermore, extending the data will make the regional analysis more meaningful and reliable. Even though the positive impact of WHSs on international tourist arrivals does not change across regions or time periods in our paper, the coefficient itself is different and deserves further study. In addition, we use international tourist arrivals as the dependent variable, which captures the international tourism demand. However, a gap between tourist arrivals and tourist incomes may exist, because the consumption behavior of tourists may differ across countries. Thus, the exchanges between tourist arrivals and incomes, compared with the costs of maintaining WHSs, should be explored using cost-benefit analysis. These topics are thus both important and interesting for further research.

Appendix

Appendix A. 66 countries whose data were used (in alphabetical order)

Argentina	Armenia	Australia	Austria	Azerbaijan	Bangladesh
Belgium	Benin	Brazil	Bulgaria	Cameroon	Canada
Chile	China	Colombia	Croatia	Czech Republic	Denmark
Egypt	Estonia	Finland	France	Georgia	Germany
Greece	Hungary	Indonesia	Iran	Ireland	Israel
Italy	Japan	Korea	Kyrgyzstan	Latvia	Lithuania
Madagascar	Malaysia	Mali	Mexico	Moldova	Mongolia
Morocco	Netherlands	Norway	Pakistan	Peru	Philippines
Poland	Portugal	Romania	Russia	Saudi Arabia	Slovakia
Slovenia	South Africa	Spain	Sweden	Switzerland	Thailand
Tunisia	Turkey	Ukraine	U.K.	U.S.	Uruguay

Reference

Adams, P.D. & Parmenter, B.R. (1995). An applied general equilibrium analysis of the economic effects of tourism in a quite small, quite open economy. *Applied Economics*, 27. 985-994.

Airey, D. & Chong, K. (2011). *Tourism in China: policy and development since 1949*. New York: Routledge.

Andrews, D.W.K. & Ploberger, W. (1994). Optimal tests when a nuisance parameter is present only under the alternative. *Econometrica*, 62, 1383-1414.

Andrews, D.W.K. (1993). Tests for parameter instability and structural change with unknown change point. *Econometrica*, 61, 821-856.

Artus, J.R. (1970). The effect of revaluation on foreign travel balance of Germany. *IMF Staff Paper*, 27, 601-617.

Artus, J.R. (1972). An econometric analysis of international travel. *IMF Staff Paper*, 19, 579-614.

Bell, W.R. & Hillmer, S.C. (1983). Modeling time series with calendar variation. *Journal of the American Statistical Association*, 78, 526-534.

Bille, T. & Schulze, G.G. (2008). Culture in urban and regional development. In V. A. Ginsburgh & D. Throsby (Eds.), *Handbook of the economics of art and culture. Amsterdam*: North Holland-Elsevier.

Bonet, L. (2003). Cultural tourism. In R. Towse (Ed.), *A handbook of cultural economics. Cheltenham*: Edward Elgar.

Box, G.E.P. & Jenkins, G.M. (1976). *Time Series Analysis: Forecasting and Control*. 2nd ed. Holden Day: San Francisco, CA.

Box, G.E.P. & Tiao, G.C. (1975). Intervention analysis with applications to economic and environmental problems. *Journal of the American Statistical Association*, 70, 70-79.

Cellini, R. (2011). Is UNESCO recognition effective in fostering tourism? A comment on Yang, Lin and Han. *Tourism Management*, 32, 452-454.

Chamberlain, G. (1984). Panel data. In *Handbook of econometrics, Volume 2*. Amsterdam: North Holland, 1247-1318.

Chan, F., Lim, C. & McAleer, M. (2005). Modelling multivariate international tourism demand and volatility. *Tourism Management*, 26, 459-471.

Chang, I., Tiao, G.C. & Chen, C. (1988). Estimation of time series parameters in the presence of outliers. *Technometrics*, 30, 193-204.

Chen, C. & Liu, L.M. (1993). Joint estimation of model parameters and outlier effects in time series. *Journal of the American Statistical Association*, 88, 284-297.

Chu, C.S., Hornik, K. & Kuan C.M. (1995). MOSUM tests for parameter constancy. Biometrika, 82, 603-617.

Chu, F.L. (2008). A fractionally integrated autoregressive moving average approach to forecasting tourism demand. *Tourism Managemen*t, 29, 79-88.

Cooke, P. & Lazzaretti, L. (2008). *Creative cities, cultural clusters and local economic development*. Cheltenham: Edward Elgar.

Coshall, J.T. (2005). A selection strategy for modeling UK tourism flows by air to European destinations. *Tourism Economics*, 11, 1-158.

Crouch, G.L., Schultz, L. & Valerio, P. (1992). Marketing international tourism to Australia. *Tourism Management*, 13, 196-208.

Deng, J., King, B. & Bauer, T. (2002). Evaluating natural attractions for tourism. *Annals of Tourism Research*, 29(2), 422-438.

Dhariwala, R. (2005). Tourist arrivals in India: how important are domestic disorders? *Tourism Economics*, 11(2), 185-205.

Divisekera, S. (1995). An econometric model of international visitor floes to Australia. *Australian Economic Papers*, 34, 291-308.

Dougan, J.W. (2007). Analysis of Japanese tourist demand in Guam. Asia Pacific *Journal of Tourism Research*, 12(2), 79-88.

Dritsakis, N. (2004). Cointegration analysis of German and British tourism demand for Greece. *Tourism Management*, 25(1), 111-119.

Engle, R.F. (1982), Autoregressive conditional heteroskedasticity with estimates of the variances of United Kingdom inflation, *Econometrica*, 50, 987-1007.

Garin-Munoz, T. & Amaral, T.P. (2000). An econometric model for international tourism flow in Spain. *Applied Economics Letters*, 7, 525-529.

Gil-Alana, L.A. (2005). Modeling international monthly arrivals using seasonal univariate long-memory processes. *Tourism Management*, 26, 867-878.

Goh, C. & Law, R. (2002). Modeling and forecasting tourism demand for arrivals with stochastic nonstationary seasonality and intervention. *Tourism Management*, 23, 499-510.

Gray, P. (1966). The demand for international travel by the United States and Canada. *International Economic Review*, 7, 83-92.

Gunadhi, H. & Boey, C.K. (1986). Demand elasticities of tourism in Singapore. *Tourism Management*, 7, 239-253.

Hansen, B. (1997). Approximate asymptotic p values for structural-change tests. *Journal of Business and Economic Statistics*, 15, 60-67.

Hausman, J.A. (1978). Specification test in econometrics. *Econometrica*, 46, 1251-1271.

Herbert, D. (2001). Literary places, tourism and the heritage experience. *Annals of Tourism Research*, 28(2), 312-333.

Hillmer, S.C. (1982). Forecasting time series with trading day variation. *Journal of Forecasting*, 1, 385-395.

Huang, J.H. & Min, J.C.H. (2002). Earthquake devastation and recovery in tourism: The Taiwan case. *Tourism Management*, 23, 145-154.

Kalman, R.E. (1960). A new approach to linear filtering and prediction problems. *Journal of Basic Engineering (ASME)*, D85, 35-45.

Kim, J.H. & Moosa, I.A. (2001). Seasonal behavior of monthly international tourist flows: Specification and implications for forecasting models. *Tourism Economics*, 7, 381-396.

Kiran, B. (2010). The structure of tourism revenues in Turkey. Evidence from fractional integration under multiple structural breaks, *Economic Studies Journal*, 4, 85-96.

Kuan, C.M. & Hornik, K. (1995). The generalized fluctuation test: A unifying view. *Econometric Reviews*, 14, 135-161.

Kulendran, N. & Shan, J. (2002). Forecasting China's monthly inbound travel demand. *Journal of Travel & Tourism Marketing*, 13, 5-19.

Ledesma-Rodriguez, F.J., Navarro-Ibanez, M. & Perez-Rodriguez, J.V. (2001). Panel data and tourism: a case study of Tenerife. *Tourism Economics*, 7, 75-88.

Lee, K., Var, T. & Blaine, T.W. (1996). Determinants of inbound tourist expenditures. *Annals of Tourism Research*, 23, 527-542.

Li, G., Song, H. & Witt, S.F. (2006). Time varying parameter and fixed parameter linear AIDS: An application to tourism demand forecasting. *International Journal of Forecasting*, 22, 57-71.

Li, G., Wong, K.F., Song, H. & Witt, S.F. (2006). Tourism demand forecasting: A time varying parameter error correction model. *Journal of Travel Research*, 45, 175-185.

Li, M., Wu, B. & Cai, L. (2008). Tourism development of world heritage sites in China: a geographic perspective. *Tourism Management*, 29, 308-319.

Light, D. (2000). Gazing on communism: heritage tourism and post-communist identities in Germany, Hungary and Romania. *Tourism Geographies*, 2(2), 157-176.

Lim, C. (1997). Review of International Tourism Demand Models. *Annals of Tourism Research*, 24, 835-849.

Lim, C. (2006). A survey of tourism demand modeling practice: issues and implications. *International Handbook on the Economics of Tourism*, Cheltenham: Edward Elgar, 45-72.

Lim, C. & McAleer, M. (2000). A seasonal analysis of Asian tourist arrivals to Australia. *Applied Economics*, 32, 499-509.

Lim, C. & Wang, Y., (2008). China's post-1978 experience in outbound tourism. *Mathematics and Computers in Simulation*, 78, 450-458.

Lin, H.L., Liu, L.M., Tseng, Y.H. & Su, Y.W. (2011). Taiwan's international tourism: A time series analysis with calendar effects and joint outlier adjustments. *International Journal of Tourism Research*, 13, 1-16.

Little, J.S. (1980). International travel in the UK balance of payments. *New England Economic Review*, May, 42-55.

Liu, L.M. & Hanssens, D.M. (1982). Identification of multiple-input transfer function models. *Communications in Statistics*, A11, 297-314.

Liu, L.M. (1980). Analysis of time series with calendar effects. *Management Science*, 26, 106-112.

Liu, L.M. (2006). *Time Series Analysis and Forecasting*. 2nd ed. Scientific Computing Associates Corp.: Chicago, IL.

Liu, L.M. & Chen, C. (1991). Recent developments of time series analysis in intervention in environmental impact studies. *Journal of Environmental Science and Health*, A26, 1217-1252.

Liu, L.M. & Hudak, G.B. (1992). *Forecasting and Time Series Analysis Using the SCA Statistical System, Vol 1*. Scientific Computing Associates Corporation: Chicago, IL.

Loeb, P.D. (1982). International travel to the United States: An econometric evaluation. *Annals of Tourism Research*, 9, 7-20.

Maloney, W.F. & Montes-Rojas, G.V. (2005). How elastic are sea, sand and sun? Dynamic panel estimates of the demand for tourism. *Applied Economics Letters*, 12, 277-280.

Martin, C.A. & Witt, S.F. (1988). Substitute prices in models of tourism demand. *Annals of Tourism Research*, 15, 255-268.

McCool, S.F. & Martin, S.R. (1994). Community attachment and attitudes toward tourism development. *Journal of Travel Research*, 32(3), 29-34.

McIntosh, A. & Prentice, R. (1999). Affirming authenticity: consuming cultural heritage. *Annals of Tourism Research*, 26, 589-612.

Min, J.C.H. (2005). The effect of the SARS illness on tourism in Taiwan: An empirical study. *International Journal of Management*, 22, 497-506.

Naude, W.A. & Saayman, A. (2005). Determinants of tourist arrivals in Africa: A panel data regression analysis. *Tourism Economics*, 11, 365-391.

Pan, G.W. (2003). A theoretical framework of business network relationships associated with the Chinese outbound tourism market to Australia. *Journal of Travel Tourism Market*, 14(2), 87-104.

Papatheodorou, A. & Song, H. (2005). International tourism forecasts: Time-series analysis of world regional data. *Tourism Economics*, 11, 11-23.

Patsouratis, V., Frangouli, Z. & Anastasopoulos, G. (2005). Competition in tourism among the Mediterranean countries. *Applied Economics*, 37, 1865-1870.

Payne, J.E. & Mervar, A. (2002). A note on modeling tourism revenues in Croatia. *Tourism Economics*, 8, 103-109.

Ploberger, W. & Kramer, W. (1992). The CUSUM test with OLS residuals. *Econometrica*, 60, 271-285.

Quayson, J. & Var, J. (1982). A tourism demand function for the Okanagan, BC. *Tourism Management*, 3, 108-115.

Rosensweig, J.A., (1986). Exchange rate and competition for tourists. *New England Economic Review*, 7/8, 57-67.

Song, H. & Li, G. (2008). Tourism demand modeling and forecasting: a review of recent research. *Tourism Management*, 29, 203-230.

Song, H. & Witt, S.F. (2000). Tourism demand modeli*ng and forecasting: modern econometric approaches*. Oxford: Pergamon.

Song, H. & Wong, K.K.F. (2003). Tourism demand modeling: A time-varying parameter approach. *Journal of Travel Research*,42, 57-64.

Song, H., Li, G., Witt, S.F. & Athanasopoulos, G. (2011). Forecasting tourist arrivals using time-varying parameter structural time series models. *International Journal of Forecasting*, 27, 855-869.

Song, H., Witt, S.F. & Jensen, T.C. (2003). Tourism forecasting: Accuracy of alternative econometric models. *International Journal of Forecasting*, 19, 123-141.

Sriboonchitta, S., Chaitip, P., Balogh, P., Kovacs, S. & Chaiboonsri, C. (2011). On tests for long memory process behavior of international tourism market:Thailand and India, *Applied Studies in Agrobusiness and Commerce*, 5, 95-100.

Su, Y.W., Lin, H.L. & Liu, L.M. (2012). Chinese tourists in Taiwan: Crowding out effects, opening policy and its implications. *Tourism Management Perspectives*, 4, 45-55.

Tan, A.Y.F., McCahon, C. & Miller, J. (2002). Modeling tourist flows to Indonesia and Malaysia. *Journal of Travel and Tourism Marketing*, 13, 61-82.

Tremblay, P. (1989). Polling international tourism in Western Europe. *Annals of Tourism Research*, 16, 477-491.

Tsay, R. (1988). Outliers, level shifts, and variance changes in time series. *Journal of Forecasting*, 7, 1-20.

Wang, Y.S. (2009). The impact of crisis events and macroeconomic activity on Taiwan's international inbound tourism demand. *Tourism Management*, 30, 75-82.

Webber, A.G. (2001). Exchange rate volatility and co-integration in tourism demand. *Journal of Travel Research*, 39, 398-405.

Witt, S.F. & Witt, C.A. (1995). Forecasting tourism demand: A review of empirical research. *International Journal of Forecasting*, 11, 447-475.

Witt, S.F., Song, H. & Louvieris, P. (2003). Statistical testing in forecasting model selection. *Journal of Travel Research*, 42, 151-158.

Wooldridge, J.M. (2002). Basic linear unobserved effects panel data models. In *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press, 247-291.

Yang, C.-H. & Lin, H.-L. (2011). Is UNESCO recognition effective in fostering tourism? A comment on Yang, Lin and Han: Reply. *Tourism Management*, 32, 455-456.

Yang, C.-H., Lin, H.-L. & Han, C.-C. (2010). Analysis of international tourist arrivals in China: the role of world heritage sites. *Tourism Management*, 31, 827-837.

Zhang, H.Q. & Heuang, V.C.S. (2001). The emergence of the mainland Chinese outbound travel market and its implications for tourism marketing. *Journal of Vacation Marketing*, 8(1), 7-12.