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The effect of China's open-door tourism policy on Taiwan: Promoting or suppressing tourism from other countries to Taiwan?

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ABSTRACT

This study employs an extended gravity model to analyse the complementarity or competitiveness relationship of the number of inbound tourists and corresponding tourism revenue between China and 19 other nations under the implementation of China's Open-door Tourism Policy to Taiwan in 2008. A simulation for 2018–2021 demonstrates the sustained impact of this policy. The results show that the number of tourists to Taiwan from China reached its peak in 2015 at 41% and will decrease to 9% by 2021. The corresponding tourism revenue will decrease from 49% to 11% over the same period. The results also show that if the number of tourists from China remains above 836,772, the number of tourists from Japan, Hong Kong, Australasia, North America, and Europe will still increase. However, the number of tourists from South Korea and South and Southeast Asia will increase continuously regardless of tourists from China, even far below 836,772.

1. Introduction

Tourists who travel from different regions or nations generate economic revenues for destination nations. Thus, travel and tourism play important roles in the economic development of some nations, such as Fiji (Aresh, Umar, & Aryan, 2004; Eilat & Einav, 2004). Fiji, one of the nations in the Pacific region, is a typical tourism nation for tourists from Australia, New Zealand, the US, Canada, the UK, and Japan. The national income for Fiji is not as large as that of other nations. Thus, revenue from tourism is relatively more important than it is for other nations. The tourism revenue for Fiji reached 22% of its GDP in 1998 (Eilat & Einav, 2004). Similarly, tourism revenue accounted for approximately 32% of total government revenue in 2017 for the Maldives (Statistics & Research Section, Ministry of Tourism, Maldives, 2018). In 2008, the World Tourism Organization of the United Nations (henceforth UNWTO) predicted that the total number of tourists will reach 1.561 billion by 2020 and that tourism will be one of the major sources of revenue for developing nations (UNWTO (2017)). Data by UNWTO (2018a) also indicate that tourism in Asia and the Pacific region contributes 25% of the total tourism revenues of all nations.

The development of tourism directly benefits revenues and employment opportunities in the tourism sector and indirectly encourages improvement and investment in new infrastructure and the reformation of (World Economic Forum (WEF), 2015, 2016) public transportation networks for destination nations. Tax revenues are thus expected to increase. Tourism not only benefits the revenue of a nation as a whole but also has specific benefits for a city or a region within a nation (Neuts, 2019; Tang & Abosedra, 2014). The strong positive connection between tourism and employment opportunities is even more significant in ecotourism (Laterra et al., 2019).

To determine the relative advantage of each nation's tourism attraction, the Travel & Tourism Competitiveness Index (TTCI) was constructed by the World Economic Forum (WEF, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014). The TTCI is a comprehensive index to calculate each nation's travel and tourism competitiveness. Because the TTCI is a composite index, it is difficult to identify the performance of any specific factor of a sub-index or certain category of the index for a specific nation (Hanafiah & Hemdi, 2016; Joshi, Poudyal, & Larson, 2017; Weaver, Kwek, & Wang, 2017). Thus, if a certain factor is prominent or important, it must be calculated individually. Studies by Song and Li (2008) have determined the influence of the relative commodity price level on travel and tourism. Other studies have indicated that factors such as the security of the travelling spot, gourmet food, and scenic views are crucial for tourism decisions (Cîrstea, 2014; Enright &

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Table 1
Total number of tourists from the major nations to Taiwan, 2001-2017.[a]

Year	CN	A AU	C CA	DE	FR	GB	HK	ID	IT	JP	KR	MY	NZ	NL	SG	US	Total from other nations[b]	Total number of tourists
2001	151,741	31,187	43,187	33,906	21,250	33,769	435,164	89,921	10,656	976,750	85,744	348,808	6752	11,067	98,771	348,808	205,587	2,933,068
2002	183,919	33,752	49,119	33,979	20,813	34,492	456,554	87,728	10,732	998,497	83,624	377,470	7172	10,380	111,024	377,470	203,910	3,080,635
2003	163,873	26,612	34,369	28,577	15,340	28,458	323,178	38,078	7695	657,053	92,893	272,858	5418	8061	78,739	272,858	190,880	2,244,940
2004	190,235	41,981	50,518	37,242	21,354	37,146	417,087	44,161	10,343	887,311	148,095	382,822	7716	11,225	116,885	382,822	206,399	2,993,342
2005	198,897	46,394	54,464	39,821	21,967	35,950	432,718	88,464	10,955	1,124,334	182,517	390,929	8174	12,117	166,179	390,929	203,154	3,407,963
2006	271,657	42,549	53,821	38,764	22,622	36,007	431,884	90,870	10,765	1,161,489	196,260	394,802	8329	11,490	184,160	394,802	193,683	3,543,954
2007	268,654	51,762	57,179	39,529	23,917	39,968	491,437	95,572	11,440	1,166,380	225,814	397,965	8761	12,445	204,494	397,965	195,075	3,688,357
2008	329,204	58,199	60,236	40,309	24,164	48,391	618,667	110,420	12,752	1,086,691	252,266	387,197	9111	12,126	205,449	387,197	192,498	3,834,877
2009	972,123	57,147	60,138	39,533	25,245	44,815	718,806	106,612	12,237	1,000,661	167,641	369,258	8011	11,230	194,523	369,258	174,166	4,331,404
2010	1,630,735	62,254	64,739	42,446	26,455	44,430	794,362	123,834	12,246	1,080,153	216,901	395,729	8644	13,158	241,334	395,729	204,742	5,357,891
2011	1,784,185	60,067	67,545	44,644	29,082	43,419	817,944	156,281	12,407	1,294,758	242,902	412,617	9436	14,401	299,599	412,617	228,368	5,930,272
2012	2,586,428	63,597	70,614	45,054	31,452	42,776	1,016,356	163,598	12,932	1,432,315	259,089	411,416	10,734	15,797	327,253	411,416	315,447	7,216,274
2013	2,874,702	65,777	72,693	46,533	32,384	42,438	1,183,341	171,299	13,663	1,421,550	351,301	414,060	10,694	16,443	364,733	414,060	345,621	7,841,292
2014	3,987,152	78,674	88,601	52,507	36,379	58,201	1,375,770	182,704	14,895	1,634,790	527,684	458,691	12,886	18,498	376,235	458,691	409,135	9,771,493
2015	4,184,102	76,122	90,666	54,954	38,364	58,784	1,513,597	177,743	15,615	1,627,229	658,757	479,452	12,805	19,267	393,037	479,452	442,204	10,322,150
2016	3,511,734	82,361	106,197	59,798	42,380	59,867	1,614,803	188,720	17,102	1,895,702	884,397	523,888	13,676	23,254	407,267	523,888	598,301	10,553,335
2017	2,732,549	90,892	117,687	65,983	46,822	64,858	1,692,063	189,631	18,596	1,898,854	1,054,708	561,365	14,639	25,492	425,577	561,365	1,001,609	10,562,690
Average	1,530,699	57,019	67,163	43,740	28,235	44,339	843,161	123,861	12,649	1,255,560	331,211	410,549	9586	14,497	246,780	410,549	312,399	5,741,996

Note:

[a] The abbreviation for each nation is as follows: CH: China; AU: Australia; CA: Canada; DE: Germany; FR: France; GB: the Great Britain; HK: Hong Kong; ID: Indonesia; IT: Italy; JP: Japan; KR: Republic of Korea; MY: Malaysia; NZ: New Zealand; NL: the Netherlands; SG: Singapore; US: the United States.

[b] The other four inbound nations are India, Thailand, the Philippines, and Vietnam. We were unable to obtain data on the daily expenditures of these four nations. To be consistent with the presentation for the total daily expenditures in the follow-up analyses, the presentation for the total number of tourists combines these four nations into one group.

Source: All data were obtained from the World Tourism Organization UNWTO, 2019. Data on the number of tourists from China in 2001–2007 were obtained from the Mainland Affairs Council, Republic of China, Taiwan (2019) and the Ministry of the Interior National Immigration Agency, Republic of China, Taiwan (2019).

Newton, 2004).

Marti and Puertas (2016) noted that in Europe, the tourism industry is important for reducing poverty and regional differences. Tourism increases revenues for destination nations. Durbarry and Sinclair (2003) studied tourism demand in France and concluded that Italy, Spain, and Great Britain (henceforth GB) accounted for 60% of outbound tourists to France. Their study further indicated that from 1996 to 2000, the number of tourists to GB decreased by 16%, and tourism revenue for the nation decreased by 9%. In contrast, the number of tourists to Italy and Spain increased by 26% and 19%, respectively, and their tourism revenue increased by 14% and 22%, respectively. This evidence not only shows the consistent change between the number of inbound tourists and the amount of tourism revenue but also demonstrates tourism competition among nations. Thus, each nation uses different ways to attract tourists (Harb & Bassil, 2018; Kozak, Kim, & Chon, 2017; Maráková, Dyr, & Tuzimek, 2016; UNWTO, 2017).

The UNWTO has compiled a complete tourist record for each nation since 1995 (World Tourism Organization UNWTO, 2019). The record shows that the total number of tourists visiting Taiwan was approximately 2.3 million in 1995 and 11 million in 2017 (World Tourism Organization UNWTO, 2019). The number of tourists over 23 years increased by approximately 8.7 million, with an average annual increase of 378,000 tourists. Previously, Japan had the largest share of inbound tourists in Taiwan. Tourists from the United States (henceforth the US) were ranked second. However, this situation changed in 2009. The number of inbound tourists from Japan decreased, as did the share of total inbound tourists. A similar situation was observed for inbound tourists from the US. The UNWTO began recording data on tourists from China to Taiwan in 2008. In 2008, there were only 329,000 tourists to Taiwan. Before 2008, only Chinese living overseas, studying abroad, with permanent residency in other nations, or transferring to other nations for business purposes were allowed to travel to Taiwan. There was clearly a change in 2009.

Prior to 2015, the total number of tourists from China was approximately 4.2 million, accounting for 40.54% of the total number of inbound tourists to Taiwan. This number exceeds the number of tourists from many other nations, including Japan and the US, in terms of both the number and the share. This situation reversed in 2016, when the number of tourists from China decreased dramatically from its highest level of 4.2 million in 2015 to 3.5 million in 2016 and further decreased to 2.7 million in 2017. The reason for this significant variation was the implementation of China's Open-door Tourism Policy to Taiwan (hereafter Open-door Policy) in 2008. In 2008, the number of tourists allowed to visit Taiwan was relaxed, but it was tightened in 2016 when the ruling party of the central government in Taiwan changed. Thus, this policy has highly political connotations. It is quite different from regular tourism policies that are designed to limit or attract tourists based on tourists' personal qualifications.

Theoretically and ideally, increasing the number of inbound tourists from any nation should have a positive impact on Taiwan's economy. It is generally believed that an increase in the number of tourists will create more employment opportunities in the travel industry, generate more revenue from the tourism sector, and provide frequent cultural exchanges among nations (Ap & Crompton, 1998; Kwek & Lee; Omkar, Poudyal, & Larson, 2017). However, these positive impacts may not occur if the number of inbound tourists is less than that stipulated by policies implemented by other nations. That is, if there is a tremendous increase in the number of inbound tourists or a large number of tourists pour into Taiwan and tourism revenue increases due to the Open-door Policy, a decline could occur in the number of tourists and tourism revenues. The changes in the number of Chinese tourists to Taiwan stated above from 2008 to 2015 and to 2017 are obvious evidence.

In a broad sense, the Open-door Policy can be categorized as a tourism policy under the TTCI categories. However, when the implementation of such a policy is imposed by other nations, it affects the nature of tourism as an action of free movement. For tourists, the selection of destinations is not a free choice but should be approved by home nations. For destination nations, this causes the potential number of inbound tourists and potential tourism revenue to become highly uncertain. As such, improvement in any facility or other factor might not be useful for engaging inbound tourists. This uncertainty could make tourism either change or remain the same for destination nations. For instance, tourists and the associated tourism revenues from other nations might decline due to an increase in the number of tourists from China. Specifically, if the number of inbound tourists declines, this will reduce travel expenditures, and the overall tourism revenue in Taiwan will decrease. However, this pessimistic situation may not occur. An increase in the number of tourists from China might attract more tourists from other nations.

The purpose of this study is to employ an extended gravity model (EGM) to explore the relationship between the change in the number of inbound tourists and the corresponding tourism revenue from China and from visitors from 19 other major nations to Taiwan in 2001–2017 under China's Open-door Policy to Taiwan. To the best of our knowledge, this study is the first to analyse the change in the number of tourists to Taiwan and tourism revenue under the Open-door Policy. The innovation of this study is that a policy factor imposed by a nation other than Taiwan is included in the EGM. This factor means that the number of tourists to Taiwan is basically controlled by other nations. The analysis in this study not only empirically allows us to identify the impact of a particular factor in the EGM but also scientifically provides deeper insight into tourism management in the EGM. The simulation for 2018–2021 observes the sustained impact in the number of tourists visiting Taiwan and the change in tourism revenue for different nations under this policy.

The remainder of this paper is arranged in four sections. The second section presents the EGM for inbound tourists to Taiwan proposed in this study. The third section indicates the selection of variables and data sources used in the empirical analyses. The fourth section presents the results and discussion. The final section proposes a conclusion.

2. Conceptual framework of an extended gravity model for inbound tourists to Taiwan

2.1. Development of the tourism industry in Taiwan and China's open-door tourism policy

According to the World Tourism Barometer prepared by the UNWTO (2018), world tourism can be classified into five regions: Europe, America, Asia, the Pacific Islands, and the Middle East. In 1995, the total number of tourists in Asia and the Pacific Island regions was only 85.6 million, but this number dramatically increased to 324 million in 2017. These regions had a rapidly increasing tourism market. Approximately 4.61 million tourists from Taiwan to Japan in 2017 accounted for 29.46% of the total outbound tourists from Taiwan. Japan was ranked fourth in the world and first in the Asia Pacific region as a tourist destination. Among the reasons that tourists selected Japan as a destination, the "attitude of the population towards foreign visitors" and "convenience of ground transportation" were ranked highest. In 2017, Japan attracted approximately 28.7 million tourists from around the world (World Tourism Organization UNWTO, 2019).

In terms of inbound tourism in Taiwan, the tourism sector started in 1956. In the early stage, inbound tourists were mainly from the US. A large number of tourists came from Japan in 1964. To attract more tourists to Taiwan, the Ministry of Foreign Affairs in Taiwan made visas free in 1994 for tourists from France, GB, Germany, Spain, Italy, the Netherlands, Austria, Belgium, Portugal, Switzerland, Singapore, Japan, the US, Canada, New Zealand, and Australia. The total number of tourists was approximately 2.3 million in 1995 and increased to more than 10 million in 2017. There has been a significant increase in the number of tourists to Taiwan in the past 20 years. The largest number of tourists comes from Japan, with 0.914 million tourists in 1995 and

approximately 1.1 million in 2008, accounting for 39.21% and 28.34%, respectively, of the total number of inbound tourists. The share of inbound tourists from the US was 12.44% in 1995 and was still higher than 10% (10.07%) in 2008.

Data from the World Tourism Organization UNWTO, 2019 show that tourists who came to Taiwan in 1995–2017 were from 43 nations. However, only a few tourists came from many of these nations, and there was no variation over the years. Tourists mainly come from 20 nations, which are the nations used in our analyses: Australia, Canada, China, France, Germany, GB, Hong Kong, Indonesia, India, Italy, Japan, South Korea, Malaysia, New Zealand, Singapore, Thailand, the Netherlands, the US, the Philippines, and Vietnam.[1] The UNWTO began recording the number of tourists visiting Taiwan from China in 2008. There are no data available from the UNWTO in the number of tourists from China visiting Taiwan before the Open-door Policy (i.e., before 2008). As a result, data on the number of inbound tourists from China during 2001–2007 must be obtained from other sources. The data obtained from the Mainland Affairs Council, Republic of China, Taiwan (2019) and from the Ministry of the Interior National Immigration Agency, Republic of China, Taiwan (2019) are the data used in this study.

Table 1 provides the number of inbound tourists to Taiwan for the abovementioned 16 nations and a group of 4 other nations in 2001–2017. Table 1 shows that the number of tourists from China constituted approximately 5.18% of the total tourists visiting Taiwan in 2001 and slightly increased to 7.27% in 2007. In the same period, tourists from Japan constituted 33.28% of tourists in 2001 and 31.62% in 2007. Before China's Open-door Policy, the highest share of tourists visiting Taiwan were from Japan. The share of tourists from Japan and China was basically stable. However, the implementation of the Open-door Policy in 2008 significantly increased the number of tourists from China, which represented the largest share of inbound tourists in 2010 at 29.29%, the second year after the implementation of the policy. In 2015, the total number of tourists from China reached 4.2 million and constituted 40.54% of tourists. In contrast, the share of tourists from Japan significantly dropped to 17.97%. This policy has completely changed the composition of inbound tourists in Taiwan.

Various waves of the Open-door Policy have been implemented since 2008. The first wave began for people from 13 provinces with tour groups in and out of Taiwan. The second wave extended to 25 provinces in 2009. The policy was further extended to 31 provinces in 2010. People from Beijing, Shanghai, and Xiamen were allowed to travel to Taiwan individually in 2011, with a total quota of 500 tourists per city per day. The quota was extended to 1000 tourists per day for each city, and people from Tianjin, Chongqing, Nanjing, Guangzhou, Hangchow, and Chengdu were included on the list. The quota for each city was further extended to 4000 tourists per day in 2014 and to 5000 tourists per day in 2015.

2.2. EGM including prominent factors in Taiwan's tourism

The WEF identified three categories of factors regarding tourism competitiveness for each nation in 2007. These categories are international openness and price competitiveness in relation to the sustainability of travel and tourism development, the availability and quality of all types of transportation, and the number of natural spots and areas as well as cultural, and known heritage sites (UNWTO, 2017). One more category, the tourism environment, which includes business security, health and human resource-related factors, was added by the WEF in 2017. From 2007 to 2017, although the overall ranking of Taiwan increased compared to the rest of the Asia Pacific region and Taiwan was ranked among the top 30 of 124 nations, the overall tourism performance for Taiwan as measured by the TTCI was unimpressive. However, from 2007 to 2017, some individual indexes, such as the primary educational enrolment rate, lack of malaria incidence, HIV prevalence, purchasing power parity, and fixed telephone lines, were ranked in the top during this period. Mobile network coverage was ranked number one globally in 2015.

The gravity model is a commonly used model for issues related to immigration activities such as international trade or transportation in travel. Marti and Puertas (2016) used a gravity model with the TTCI to examine the competitiveness of tourists in the Euro-Mediterranean region. The performance of the TTCI is used as a tourism industry development guideline for many developing nations, although some indices have been adjusted to fit nations' unique concerns (Lall, 2001). Cîrstea (2014) used the TTCI to analyse the 15 most competitive nations, including France, Germany, the US, Japan, and Singapore, and concluded that these nations were not a homogenous group. That is, differences exist among the nations, and each nation has its own advantages.

In addition to considering traditional variables (i.e., the GDP, population, and distance between sites), Bikker (1987) extended the traditional gravity model to include variables that have special or particular meaning for sites (i.e., nations) and called it the extended gravity model (EGM). The estimation of the EGM can determine factors that influence international trade, and the model can be applied to tourism. Park and Jang (2014) used the EGM to analyse 30 nations from 1995 to 2009 and found that the major factors were not only the GDP, population, and distance but also natural and cultural resources, infrastructure for tourism, price competitiveness, and political and policy factors (e.g., the process of applying for a visa). Certain types of infrastructure, such as public transportation, have been included in the gravity model (e.g., Khadaroo and Seetanah's study, 2008) to study their effect on tourists. Moreover, both economic and non-economic factors affect tourism. Vietze (2012) noted that a common culture, such as the same or a similar language, was a decisive factor for the selection of visiting nations. Climate factors may also affect tourism demand (Cohen & Cooper, 1986; Lorde, Li, & Airey, 2016; Yingsha, Li, & Wu, 2017).

Past literature shows that the application of the EGM to tourism issues mainly addresses the identification of the major factors that influence travel and tourism decisions. Moreover, the application of the EGM in past studies has been used to explore the competitiveness among various nations. These nations usually have their own advantages and disadvantages in attracting different types of tourists in different tourism industry development periods. Thus, the nations used for comparison are those with similar levels of incomes or in close geographical locations, such as travel among developed nations or among nations in the Euro-Mediterranean region. Under these circumstances, the analysis can reduce the impact of two essential factors in the gravity model, income and distance, to their minimum. The effect of other particular factors that attract tourists can thus be presented clearly from the EGM analysis. Furthermore, past research has used the EGM to analyse the attraction of each tourism destination to different nations.

There is no study in the current literature that utilizes the EGM to analyse a policy factor imposed by other nations with an impact on the destination nation. Thus, a policy factor imposed by China that influences inbound tourists to Taiwan is included in the EGM employed in this study. Moreover, typical factors of the gravity model, the GDP and population of visiting nations and the destination nation and the distance between visiting nations and the destination nation are included. The model is extended to contain factors $S_{ij,t}$ evaluated by the WEF for various years that have been deemed to have relatively prominent performance for Taiwan since 2007. In this study, $Tourist_{ij,t}$ is the total number of tourists from nation or region i to destination nation or region j in year t. The income and population for the visiting nation and the destination nation in certain time periods are $C\_GDP_{i,t}$, $T\_GDP_{j,t}$ and $C\_POP_{i,t}$, $T\_POP_{j,t}$, respectively. $Distance_{ij}$ is the distance between each

[1] The number of tourists visiting Taiwan from these 20 nations constitutes 94% of the total number of tourists visiting Taiwan, according to the UNWTO (2019).

visiting nation or region i and the destination nation or region j. Normally, the distance between the two will not change; thus, the distance will not vary over time t.

When more provinces are approved to travel in groups or individually to Taiwan under the Open-door Policy, there will potentially be more tourists visiting Taiwan. Thus, the actual number of tourists from China in a specific time period is $TouristChina_t$, a policy factor mentioned above, used as a proxy for the degree of openness of this policy. The estimated coefficient of $TouristChina_t$ measures the competitiveness or complementarity of tourists from China with those from all other nations. The general EGM used in this study is presented in Eq. (1):

$$Tourist_{ij,t} = \sum_i \sum_j \frac{(C\_GDP_{i,t})(T\_GDP_{j,t})(C\_POP_{i,t})(T\_POP_{j,t})(S_{ij,t})(TouristChina_t)}{(Distance_{ij})} \quad (1)$$

3. Model and materials

3.1. Variable selection and data sources

$$\ln Tourist_{i,t} = \beta_0 + \beta_1 ln(C\_POP_{i,t}) + \beta_2 ln(T\_POP_{i,t}) + \beta_3 ln(C\_GDP_{i,t}) + \beta_4 ln(T\_GDP_t) + \beta_5 ln(T\_CPI_t) + \beta_6 SARS + \beta_7 \ln(Distance) + \beta_8 Language t + \beta_{10}[\ln(TouristChina)_t]^2 + \mu_i + \varepsilon_{i,t} \quad (2)$$

To observe the impacts of the Open-door Policy on the number of tourists and tourism revenue from other nations, the magnitude of the variable ($TouristChina_t$) indicates the degree of openness. Since the observation focuses on China's policy and its impact on all other nations visiting Taiwan, the population and GDP for Taiwan vary by year. Moreover, under the same conditions, distance is a key factor for the selection of tourist destinations. Normally, a short distance between the visiting nation and the destination nation is considered more advantageous than a long distance between the two nations (Kozak et al., 2017; Nicolau & Mas, 2006).

The other extended variables used in the EGM include English as the official and/or national language in the visiting nation ($Language_i$). The relative advantage indices for Taiwan presented in the TTCI include "malaria incidence," "primary education enrolment rate," and "purchasing power parity." However, the above indices used in the TTCI are for universal comparison purposes. As compulsory education in Taiwan is junior high school (grade 9 or 10 in some nations) and approximately 98% of junior high school pupils continue their education to senior high school, the use of senior high school is difficult to compare over time. Therefore, the "university rate" (*University Rate*) is used for this variable. However, the results of the preliminary test indicate that this variable is highly correlated with Taiwan's GDP. Thus, *University Rate* is dropped from further analysis.

As with purchasing power parity, the consumer price index (*CPI*) is used specifically for this variable (Arsad & Johor, 2010; Craigwell, 2007; Morley, 1994). Malaria has not been a problem in Taiwan for decades. One recent outbreak of infectious disease involved severe acute respiratory syndrome (SARS), which occurred in 2002 and lasted until 2006 in Taiwan. A dummy variable is set as 1 for the period 2002–2006 and 0 for others to detect whether the SARS outbreak influenced the number of inbound tourists. The notations, definitions, and mean values of all variables used in the estimation are listed in Table 2.

3.2. Model specification

Once all the variables are prepared, the specific functional form of double log is set for the EGM in this study as in Eq. (2). We assume that the impact of tourists from China is not in a single direction, and the total effect on the number of tourists from other nations is a combination of the linear and square terms of the number of tourists from China $\ln(TouristChina)$. Thus, the quadratic form allows us to consider the possible existence of nonlinearities in the effect of the number of tourists from China.

$i = 1, 2 \ldots 19; \quad t = 2001, 2002 \ldots 2017,$

3.3. Results of model estimation

Although the combination of 19 nations and 17 time periods is typical for panel data, this analysis can theoretically be achieved using a fixed-effect or random-effect model. However, some variables, such as distance $ln(Distance)$ and language (*Language*), will not change for any nation over time. Thus, the fixed-effect model is not appropriate when these variables are included (Liu, Lai, & Chen, 2012; Prehn, Brümmer, & Glauben, 2016).[2] As such, the random effect model is favoured under such circumstances. The estimated coefficients from the random effect model for Eq. (2) are listed in Table 3.

The results of the estimation show that except for the population in Taiwan ($ln(T\_POP)$), $ln(T\_CPI)$, and *SARS*, all other variables are significant at different significance levels. Moreover, the effects of these significant variables on the number of tourists from the 19 nations to Taiwan are consistent with our expectations. There are fewer tourists to Taiwan from the farthest nations. Nations with high GDPs have more outbound tourists visiting Taiwan, and tourists from countries where English is the official and/or national language visit Taiwan more often than those from other countries. The effect for the dummy variable of language (*Language*) and the outbreak of SARS (*SARS*) is the magnitude of the corresponding estimated coefficient. Because all other variables are taken as the natural logarithm, the effect of each variable on the

[2] This situation occurs frequently in the gravity model. It normally involves variables that are constant throughout the years. Thus, the distance proxy variable between two nations, a typical variable used in the gravity model, has no variation throughout the years. Due to this drawback, the fixed-effect model is not appropriate for this application.

Table 2
Empirical variables and their descriptive statistics.

Variable	Definition	Mean	Standard Deviation
Tourist	2001–2017 number of inbound visitors excluding China (person)	212,957.87	351,658.65
C_POP	2001–2017 population (in millions) of visiting nations	134.76	265.83
T_POP	2001–2017 Taiwan population (in millions)	23.06	0.36
C_GDP	2001–2017 GDP, PPP (2010 constant, in $US billion)	2034.14	3484.32
T_GDP	2001–2017 Taiwan GDP, PPP (2010 constant, in $US billion)	841.69	147.89
T_CPI	2001–2007 CPI in Taiwan (2010 = 100)	98.98	5.70
SARS	Dummy variable for the SARS epidemic period, 2002–2006, denoted as 1; 0 otherwise	0.29	0.46
Distance	The distance between the capital of Taiwan and that of inbound nations (in kilometres)	5914.70	3980.84
Language	Dummy variable for the coverage of official and/or national language, 1 if the official and/or national language includes English; 0 otherwise	0.58	0.49
TouristChina N = 323	2001–2017 number of inbound visitors from China (person)	1,530,699.41	1,447,85418

Where the dependent variable ($Tourist_{i,t}$) is the number of tourists from 19 nations or any combination of these nations (other than the tourists from China) visiting Taiwan each year. If the coefficient of variable (*lnTouristChina*), β_9, is positive for its linear term, then China's policy is more open, and there is an increase in the number of tourists from other nations to Taiwan. Because we assume that the impact of tourists from China is not in a single direction, the total effect on the number of tourists from other nations is a combination of the linear and square terms of the number of tourists from China (ln(*TouristChina*)). Taiwan's GDP and the GDP of the other 19 nations for the 2001–2017 period are based on purchasing power parity. Furthermore, because all GDPs are for the 2001–2017 period, 2010 is used as a constant to deflate the GDP in different years. Furthermore, ε_{it} is a random error term across visiting nations and time, and μ_i is the error term in the random effect model and is distinct for each nation.

number of tourists from the 19 nations means that a 1% change in a certain variable will result in a certain percentage change for the number of total tourists from the nations other than China (ln *Tourist*).

4. Simulation results and discussion

4.1. The impact of tourists from China on the number of tourists from other nations or regions

Although the double log form can be used to compute the elasticity for the variable of ln(*TouristChina*), it is not the purpose here. The main purpose of this study is to observe the effect for every unit (person) change of tourists from China on the unit change of tourists from 19 other nations. Thus, the marginal effect is computed by taking the derivate of total tourists from 19 other nations (*Tourist*) to tourists from China (*TouristChina*). To observe the impact of a one-unit change of tourists from China on the change of tourists from other nations or regions, the marginal effect (ME_t) plays a role. This effect is shown in the estimation of Eq. (2), which accounts for all related factors that influence the number of tourists from all 19 nations except those from China and the interaction between tourists from China and those from the other 19 nations. As a result, the marginal effect is computed as Eq. (3):

$$ME_t = \frac{\partial(Tourist)_{i,t}}{\partial(TouristChina)_{i,t}} = \frac{\overline{\text{Tourist}_{i,t}}}{TouristChina_t}[-9.7234 + (2*0.3565)*\ln(TouristChina)_t]. \quad (3)$$

Thus, $\overline{\text{Tourist}_{i,t}}$ represents the average number of tourists from any specific nation or region of interest.

The sign of the marginal effect is determined by the negative part and the positive part of Eq. (3). The turning point is the number of tourists from China, which reaches a threshold that switches the impact from positive to negative or vice versa. That is, when the number of tourists from China is above 836,772, the increase of tourists from China will concurrently increase the number of tourists from other nations or regions. In contrast, when the number of tourists from China is below 836,772, tourists from China increase under this ceiling, and tourists from other nations or regions will competitively increase.

The following analyses are employed to determine the impact of a change in the number of tourists from China on the number of tourists from the seven nations, areas, or regions. The selection of the nations or areas represents the highest share of tourists among all nations, such as Japan, until 2010 or countries that had a significant increase in the number of tourists in recent years, such as South Korea and Hong Kong. The other 16 nations are classified according to their geographical location. The regions are Australasia, including Australia and New Zealand; North America, including Canada and the US; Europe, including France, GB, Germany, Italy, and the Netherlands; and South and Southeast Asia, including India, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. The marginal effect of every change in the number of tourists from China on the number of tourists from each nation, area, or region can be computed by (3) based on the mean number of tourists from each nation, area or region, $\overline{\text{Tourist}_{i,t}}$, in the last three years (2015–2017).

The results are presented in part B of Table 4. The marginal effects for Japan, South Korea, Hong Kong, Australasia, North America, Europe, South and Southeast Asia are 0.5692, 0.2916, 0.4964, 0.0303, 0.1966, 0.0637, and 0.5741, respectively. The results indicate that the number of tourists from Japan will increase 0.5692 for each additional tourist from China. The explanation for the other marginal effects is the same. The positive marginal effect implies that there is no competitiveness between tourists from China and those from any other nation, area, or region stated above. This is because the variable representing the number of tourists from China (*ln*(*TouristChina*)) has negative linear and positive square terms. The turning point for this curve is 836,772 tourists from China. When the number of tourists from China falls below this number, the number of tourists from the above seven nations or regions will also decrease.

Without considering the effect of China, the actual rate of the increase (decrease) of the number of tourists from each nation or region *i* for the last three years can be computed by taking the average rate between 2017 and 2015 (denoted as $\gamma_{i,2015-2017}$). The results are presented in part A of Table 4. Table 1 shows the significant decrease in the number of tourists from China in 2016 and 2017. Thus, it is crucial to determine the potential impact on the number of tourists from other nations or regions due to this noticeable decline in the number of tourists

from China over the next few years. This can be accomplished by simulating the number of tourists from the above seven nations and regions.

4.2. Simulated number of tourists for 2018–2021

The increase in the rate of tourism between two different years has higher variation than the average rates for the change in the number of tourists for 3 successive years, 2015–2017. The use of the average rate provides a relatively reliable tourist change rate. Thus, it is assumed that the rate of increase (decrease) in the number of tourists for each nation or region has the same rate as in 2015–2017, $\gamma_{i,2015-2017}$. Eq. (4) then takes the average tourist change rate for 2015–2017 as the base to simulate the number of tourists for a specific nation or a region for 2018–2021, beginning from the most recent year and continuing for 4 years. The simulated number of tourists for each nation or region is computed as in Eq. (4):

$$Tourist_{i,2017+k} = Tourist_{i,2017} * k * \gamma_{i,2015-2017}, \qquad k = 1, 2, 3, 4, \tag{4}$$

where k can be treated as a multiple for the average increase in the rate of tourism beginning in the first simulated year 2018 as 1, 2019 as 2, 2020 as 3, and 2021 as 4. This indicates that the number of tourists consistently increases (decreases) at the average rate of 2015–2017 until the future simulated year 2021. The simulated results are presented in Part A of Table 4.

The simulated tourists in Part A of Table 4 are listed for four individual nations, China, Japan, South Korea, and Hong Kong, and four regions, Australasia, North America, Europe, and South and Southeast Asia. The results indicate that in addition to China, the average rate of all

Table 3
Results for the estimated coefficients.[a]

Variable	Estimated Coefficient
ln(C_POP)	−0.5804**
	(0.2956)
ln(T_POP)	25.1641
	(23.3747)
ln(C_GDP)	1.6969***
	(0.2345)
ln(T_GDP)	−4.9063**
	(2.4349)
ln(T_CPI)	13.7706
	(8.6528)
SARS	0.1034
	(0.2895)
ln(Distance)	−2.7369***
	(0.5487)
Language	1.5024*
	(0.8064)
ln(TouristChina)	−9.7234***
	(3.2617)
$[ln(TouristChina)]^2$	0.3565***
	(0.1182)
Constant	−336.5566
	(355.3591)
R^2	0.4399

Numbers with *, **, and *** indicate that the estimated coefficients are significantly different from zero at the 10%, 5%, and 1% significance levels, respectively.
Note:
[a] The numbers in parentheses are the standard deviations of the corresponding estimated coefficients.

Table 4
Results for the simulation of the total number of tourists considering the average increase in the rate of tourism and the average marginal effect of each nation/region based on the change in the number of tourists from China.

Year	Nation or region								Total tourists from 7 nations and regions	Total tourists from 7 nations and regions and from China
	China	Japan	South Korea	Hong Kong	Australasia[b]	North America[b]	Europe[b]	South and Southeast Asia[b]		
A	Increase in the average rate of tourism from 2015 to 2017 (%)[c]									
	−17.35	8.35	30.05	5.90	9.34	9.55	9.30	24.24	–	–
	Results from a simulation of the total number of tourists considering the corresponding average increase in the rate of tourism, 2015–2017 (person)									
2018	2,358,560	2,057,337	1,371,678	1,791,817	115,383	743,926	242,367	2,664,814	8,987,323	11,847,441
2019	1,784,570	2,215,820	1,688,648	1,891,572	125,235	808,800	262,982	3,184,793	10,177,851	12,508,238
2020	1,310,581	2,374,303	2,005,619	1,991,326	135,087	873,674	283,598	3,704,771	11,368,378	13,269,035
2021	836,592	2,532,786	2,322,589	2,091,080	144,939	938,549	304,214	4,224,749	12,558,906	14,029,833
Average of 2018–2021	1,572,576 (12.74%)	2,295,062	1,847,134	1,941,449	130,161	841,237	273,290	3,444,782	10,773,115 (87.26%)	12,913,637
B	The marginal effect of the average increase in tourism, 2015–2017 (person)[c]									
	–	0.5692	0.2916	0.4964	0.0303	0.1966	0.0637	0.5741	–	–
	Results from a simulation of the total number of tourists based on the corresponding average marginal effect, 2015–2017 (person)									
2018	2,358,560	1,787,541	1,233,455	1,556,541	101,032	650,746	212,170	2,392,683	7,934,168	10,292,728
2019	1,784,570	1,676,227	1,412,201	1,421,019	96,533	622,439	202,588	2,640,529	8,071,536	9,856,106
2020	1,310,581	1,564,914	1,590,948	1,285,497	92,034	594,133	193,007	2,888,376	8,208,909	9,519,490
2021	836,592	1,453,600	1,769,695	1,149,975	87,535	565,826	183,425	3,136,222	8,346,278	9,182,870
Average of 2018–2021	1,572,576 (16.19%)	1,620,571	1,501,575	1,353,285	94,284	608,268	197,798	2,764,453	8,140,223 (83.81%)	9,712,810
Average of 2015–2017[a]	3,476,128 (33.17%)	1,807,262	865,954	1,606,821	96,832	626,418	203,712	1,796,265	7,003,264 (50.93%)	10,479,392
2015[d]	4,184,102 (40.54%)	1,627,229	658,757	1,513,597	88,927	570,118	186,984	1,492,436	6,138,048 (59.46%)	10,322,150

Note:
[a] The average rate of increase in tourism in 2015–2017 was computed based on the data provided in Table 1.
[b] Australasia includes Australia and New Zealand; North America includes Canada and the US; Europe includes France, Germany, Italy, The Netherlands, and GB; and South and Southeast Asia includes Indonesia, Malaysia, Singapore, and four other nations: India, Thailand, the Philippines, and Vietnam.
[c] The percentages indicate the total number of tourists from China or those from the other 7 nations or regions to the total tourists on average.
[d] Tourists from China reached the highest number in 2015 since the implementation of the Open-door Policy, and this number is used as a reference.
Source: Data on the average rate of increase in tourism in 2015–2017 were computed based on data obtained from the UNWTO (2019).

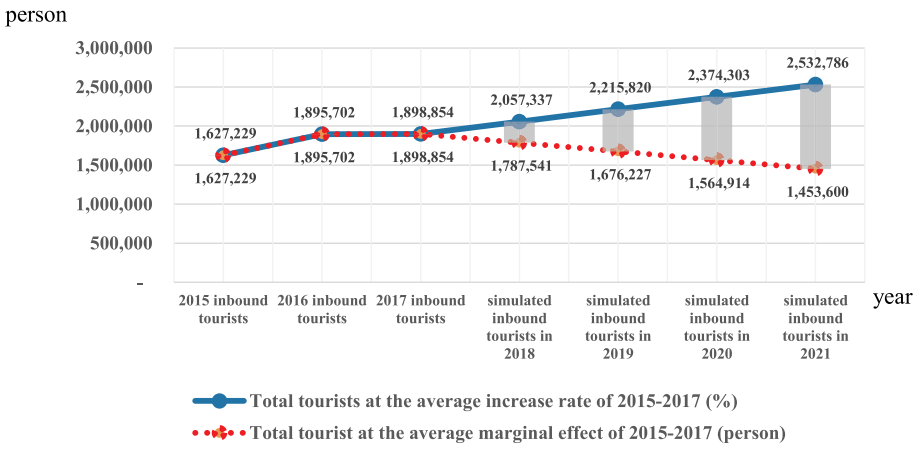

Fig. 1. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for Japan).

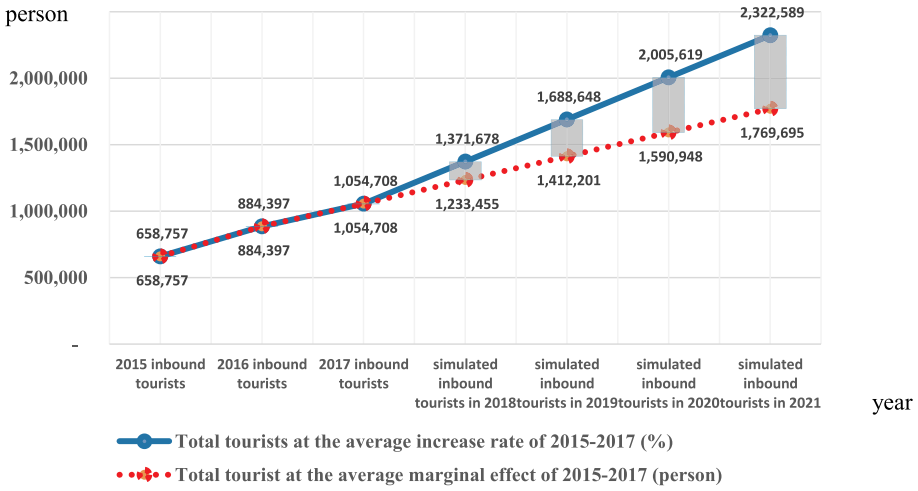

Fig. 2. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for South Korea).

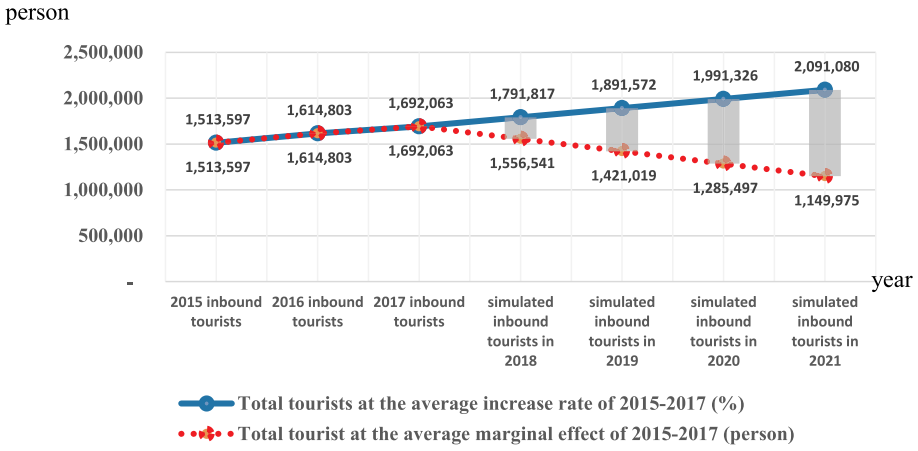

Fig. 3. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for Hong Kong).

other individual nations or regions is positive and has high variation. The highest increase rate is for South Korea, and South and Southeast Asia is ranked second. The lowest increase rate for tourists visiting Taiwan is for Hong Kong. Due to the extreme decrease of tourists from China, the total number of tourists from China has a share of 12.74% of the simulated rate for each nation or region. This share is far below the 25.87% in 2017 shown in Table 1. This means that tourists visiting Taiwan mainly come from nations or regions other than China, with an increase in the rate of tourism for each nation or region.

The simulation can also be accomplished by accounting for the marginal effect at the 2015–2017 level based on a change in the number of tourists from China. Thus, the simulated number of tourists for each nation or region is computed as in Eq. (5)–(1) and Eq. (5)–(2):

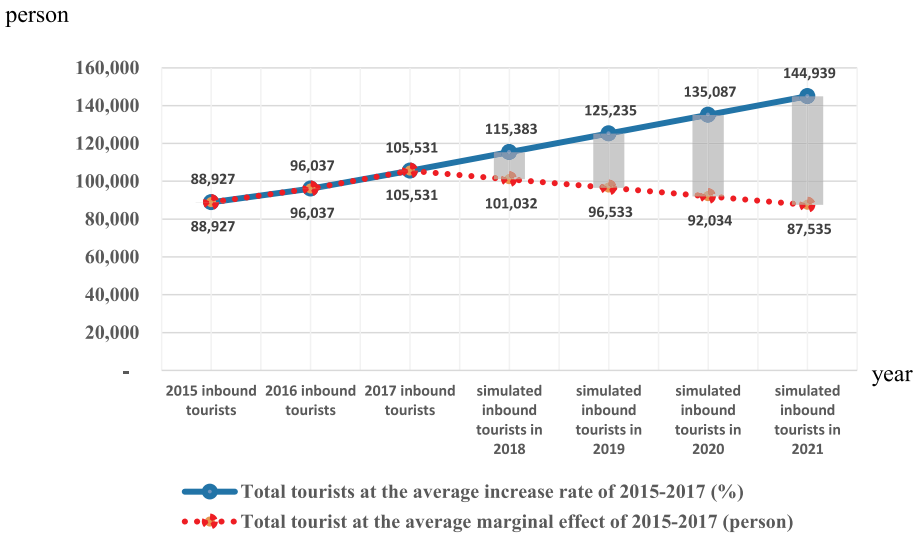

Fig. 4. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for Australasia).

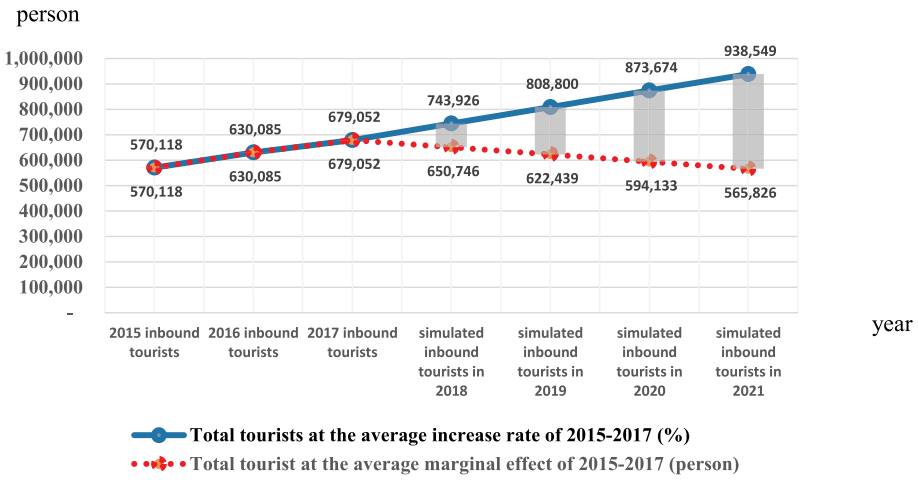

Fig. 5. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for North America).

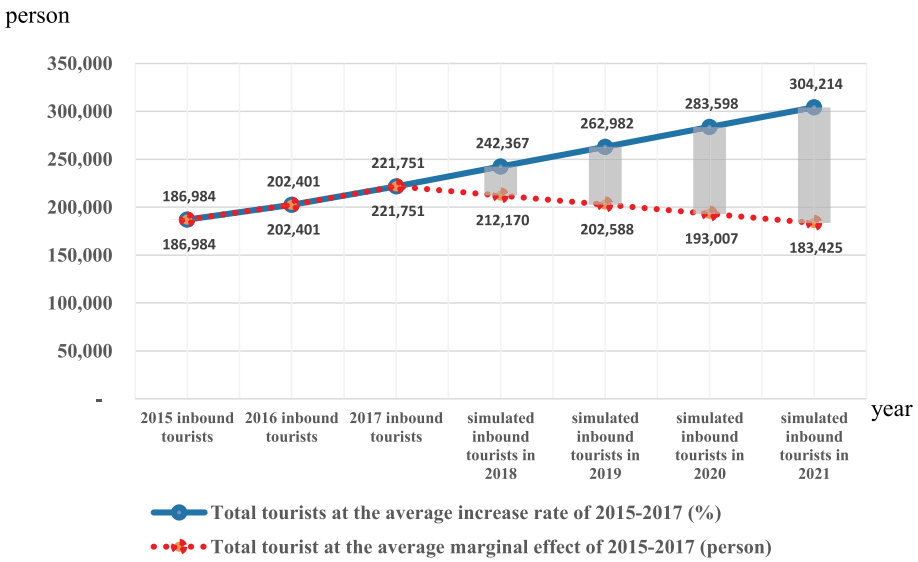

Fig. 6. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for Europe).

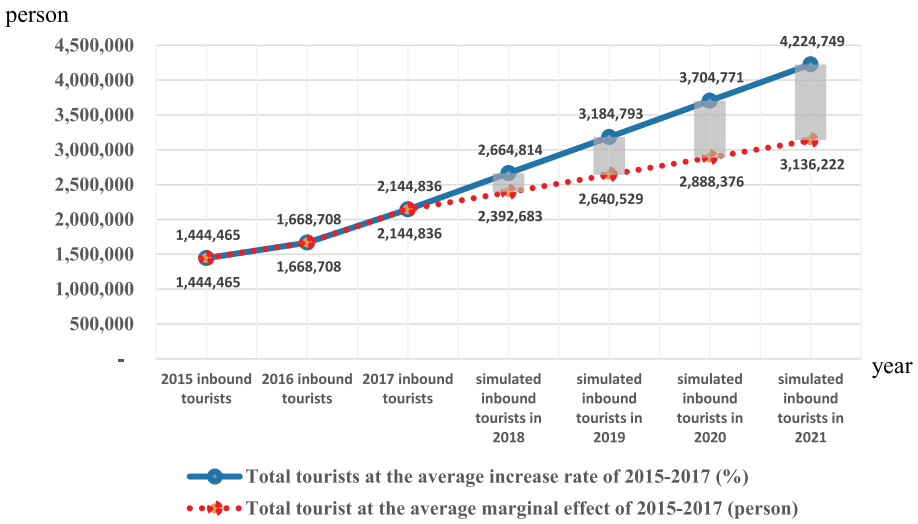

Fig. 7. The impact on the total number of tourists at the average rate of increase and marginal effect under the Open-door Policy, 2018–2021 (for South and Southeast Asian nations).

Table 5
Daily expenditures and length of stay of each inbound tourist for each trip from the 7 major nations or regions, 2015-2021.[a]

Year	China	Japan	South Korea	Hong Kong	Australasia[b]	North America[c]	Europe[d]	South and Southeast Asia[e]
A	Daily expenditures of each tourist per trip from 2015 to 2017 (US$/day)							
2015	209.39	209.40	191.18	170.00	148.67	145.86	134.81	172.35
2016	180.27	219.33	170.85	166.24	129.32	129.46	121.38	156.76
2017	164.55	191.03	173.65	164.14	123.59	138.52	122.43	135.97
Average 2015–2017	184.74	206.59	178.56	166.79	133.86	137.95	126.21	155.03
B	Predicted daily expenditures of each tourist per trip from 2018-2021[f] (US$/day)							
2018	188.10	210.34	181.81	169.82	136.29	140.45	128.50	157.85
2019	191.52	214.17	185.11	172.91	138.77	143.01	130.84	160.72
2020	195.00	218.06	188.48	176.05	141.29	145.61	133.22	163.64
2021	198.55	222.03	191.90	179.26	143.86	148.26	135.64	166.61
Length of stay for each tourist per trip from 2015 to 2017 (in days)								
2015	7.14	4.63	4.35	4.13	10.74	10.79	10.65	7.93
2016	7.30	4.42	4.18	4.18	10.56	10.30	10.77	9.42
2017	7.33	4.40	4.11	4.19	10.44	10.12	10.55	8.80
Average 2015–2017	7.26	4.48	4.21	4.17	10.58	10.40	10.56	8.72
C	Assumed length of stay of each tourist per trip from 2018 to 2021 (in days)							
2018–2021	7.26	4.48	4.21	4.17	10.58	10.40	10.66	8.72

Note:
[a] The values for daily expenditures are in US$, and the magnitudes for length of stay are in days.
[b] The data on daily travel expenditures per person for tourists from New Zealand and Australia have been combined as a group since 2001. Thus, the data on daily expenditures are grouped as regions of Australasia.
[c] There were no data for Canada in 2017. We use the daily travel expenditures for all other nations in the survey instead.
[d] Daily travel expenditures per person for 2017 are surveyed for tourists from European nations as a whole. Thus, the data on daily travel expenditures are the same for tourists from France, GB, Germany, Italy and the Netherlands.
[e] There are 7 nations included in the South and Southeast Asian nations. Among these, India, the Philippines, Thailand, and Vietnam do not have data on daily expenditures. Thus, the length of stay per tourist for each trip is presented for the four nations as a group.
[f] We assume that the price is consistently inflated at the same rate as that from 2016 to 2017 in US$ for 2018–2021.
Source: Data on daily expenditures were obtained from the TaiwanTourism Bureau, Republic of China (Taiwan) (2002–2018), and data on the length of stay were obtained from the Taiwan Statistics Database of the Taiwan Tourism Bureau (2019).

Table 6
The results of the simulation for total tourism revenue considering the average rate of increase in tourists and the average marginal effect of each nation or region in 2015–2017 from the change of China's tourists.[a]

Year	Nation or region								Total tourism revenue from 7 nations or regions	Total tourism revenue from 7 nations or regions and from China
	China	Japan	South Korea	Hong Kong	Australasia	North America	Europe	South and Southeast Asia		
Year	The average rate of the increase in tourism from 2015 to 2017 (%)									
	−17.35	8.35	30.05	5.90	9.34	9.55	9.30	24.24	–	–
	The results for the simulation of total tourism revenue under the regional average rate of the increase in tourists, 2015–2017 (million US$)									
2018	3221	1939	1050	1269	166	1087	332	3668	9512	12,731
2019	2481	2126	1316	1364	184	1203	367	4463	11,023	13,504
2020	1855	2319	1591	1462	202	1323	403	5286	12,586	14,442
2021	1206	2519	1876	1563	221	1447	440	6138	14,204	15,410
Average of 2018–2021	2268 (16.09%)	2226	1458	1415	193	1265	386	4889	11,832 (83.91%)	14,100
Year	The average marginal effect of the increase in tourism, 2015–2017 (person)									
	–	0.5692	0.2916	0.4964	0.0303	0.1966	0.0637	0.5741	–	–
	The results for the simulation of total tourism revenue considering the regional average marginal effect, 2015–2017 (million US$)									
2018	3221	1684	944	1102	146	951	291	3293	8411	11,632
2019	2481	1608	1.101	1025	142	926	283	3701	8786	11,267
2020	1855	1529	1.262	944	138	900	274	4122	9169	11,024
2021	1206	1446	1430	860	133	872	265	4557	9563	10,769
Average of 2018–2021	2191 (19.61%)	1567	1184	983	140	912	278	3918	8982 (80.39%)	11,173
Average of 2015–2017	5193 (39.76%)	1842	711	1231	150	989	301	2643	7867 (60.24%)	13,060
2015[b]	6799 (48.91%)	1715	595	1155	154	975	292	2217	7103 (51.09%)	13,902

Note:
[a] The percentage in the table is the tourism revenue share from China to the share from the other seven nations and regions.
[b] 2015 is a reference year. In 2015, China had the highest number of tourists coming to Taiwan since its implementation of the Open-door Policy.
Source: Data on the average increase in the rate of tourists for 2015–2017 were obtained from World Tourism Organization UNWTO, 2019.

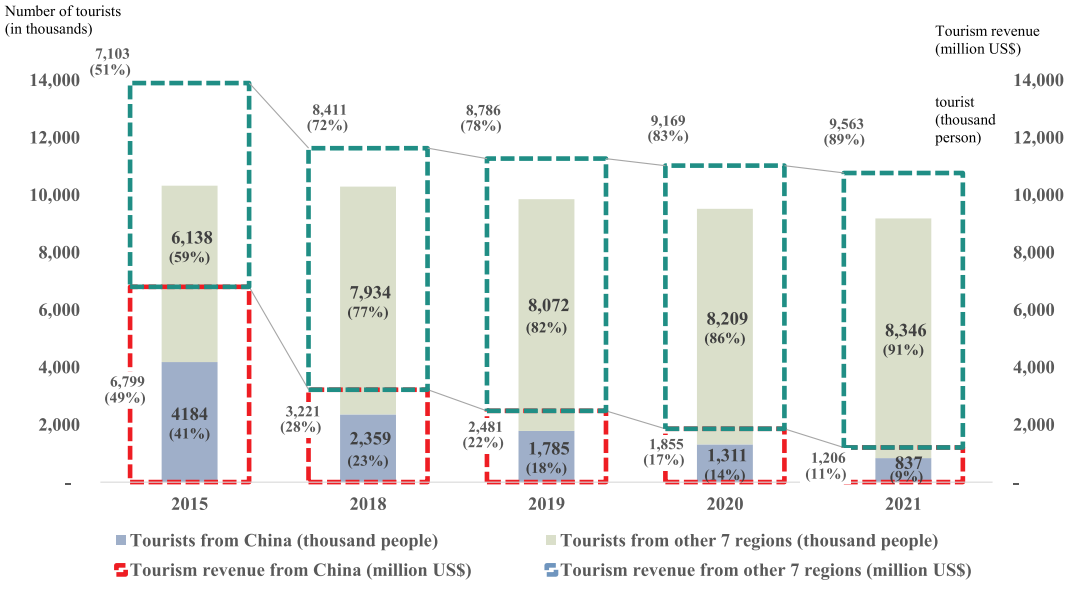

Fig. 8. Comparison of the total number of tourists and tourism revenue from China and seven other nations and regions in 2015 and in 2018–2021.

$$\widehat{Tourist}_{i,2017+k} = Tourist_{i,2017} * k * \gamma_{i,2015-2017} + ME_{i,2015-2017} * (\widehat{TouristChina}_{2017+k} - TouristChina_{2017}), \text{ when } k = 1 \quad (5\text{–}1)$$

$$Tourist_{i,2017+k} = Tourist_{i,2017} * k * \gamma_{i,2015-2017} + ME_{i,2015-2017} * (\widehat{TouristChina}_{2017+k} - \widehat{TouristChina}_{2017+k-1}), \text{ when } k = 2,3,4. \quad (5\text{–}2)$$

The simulated value for the number of tourists from China, $\widehat{TouristChina}_{2017+k}$, $k = 1,2,3,4$, is calculated by using Eq. (4) because the marginal effect will have no impact on the number of tourists from China. As a result, the simulated number of tourists from China in 2018–2021 is the same as that based on its increase (decrease) rate. The simulated values for all other nations or regions depend upon how significantly the marginal effect $ME_{i,2015-2017}$, of a nation or region is affected by the change in the number of tourists from China. Moreover, the marginal effect of other nations or regions causes a decrease in the number of inbound tourists from other nations or regions due to the enormous decline in the actual number of inbound tourists from China in 2016 and 2017. All the simulated results are shown in part B of Table 4 under the corresponding marginal effect of each nation or region.

The actual number of tourists from China in 2015 is the highest on record. The average simulated numbers of tourists from all nations and regions for 2018–2021 are shown in Table 4 for reference. The share of inbound tourists from China in 2015 was approximately 40%, and that of the remaining seven nations was 60%. The situation reverses in 2018–2021, when the number of tourists from China continues to decrease and accounts for only 16%, whereas the share of the other seven nations or regions increases to more than 80%. The discrepancy between the actual number of tourists from the other seven nations and regions is shown in Figs. 1–7. All the figures show that most of the simulated total numbers of tourists from each nation and region have similar patterns, with two exceptions. That is, the simulation of the total number of tourists based upon the average increase (decrease) rate of 2015–2017 is higher than the number simulated by the marginal effect of each nation or region from the change in the number of tourists from China for the coming four years, 2018–2021.

Furthermore, all figures demonstrate that the influence of tourists from China through marginal effects on the other 7 nations or regions can be divided into two groups. One group includes the total number of tourists visiting Taiwan from Japan, Hong Kong, Australasia, some nations in Europe, and nations in North America, and the other group includes South Korea and various nations in the South and Southeast Asia regions. The dotted line in each figure shows that the number of tourists from the first group of nations or regions is affected to different degrees by a decline in the number of tourists from China depending upon the curvature of the line. The number of tourists from South Korea and the South and Southeast Asia regions will continue to increase and will not be affected by a decline in the number of tourists from China.

4.3. The impact of the change in the number of tourists from China on tourism revenue

Regardless of whether there is an increase or decrease in the number of tourists from any nation or region, we are concerned with determining whether tourism revenue might change. To compute the tourism revenue for the next 4 years simulated by either method, data for daily expenditures and length of stay are required. These data were obtained from the TaiwanTourism Bureau, Republic of China (Taiwan) (2002–2018), and the Taiwan Statistics Database of the Taiwan Tourism Bureau (2019). Data on daily expenditures were obtained from a routine survey, and data on the length of stay were included in a long-term record compiled by the Taiwan Tourism Bureau. Table 5 lists the last three years of data on daily expenditures and length of stay. The weighted daily expenditure is computed for each region composed of more than 2 nations. The daily expenditure deflated by the CPI is computed for China and the other seven nations and regions for the last 3 years (2015–2017). We then compute the average of three years of daily expenditures, as shown in Table 5.

The annual tourism revenue for a specific nation can be obtained by multiplying the daily expenditures, length of stay, and total number of tourists in a year. Each component must be calculated before the corresponding tourism revenue is computed for the simulated years, 2018–2021. We assume that the daily expenditures are inflated at the same rate as 2016–2017. The inflated daily expenditures are shown in part B of Table 5. Similar to the length of stay, it is assumed that tourists from China and from the seven other nations and regions stay as long as the average days for the 2015–2017 period, which is shown in Table 5. Total tourism revenues for China and the other seven nations and regions are then calculated by multiplying part B for 2018 and part C in Table 5 and the simulated number of tourists and by considering the average rate of increase for the period 2015–2017, which is shown in part A of Table 4. A similar procedure is used to calculate tourism revenue for the simulated number of tourists, accounting for the average marginal effect of 2015–2017, which is shown in part B of Table 4.

The simulated tourism revenue results for China and all other nations and regions are shown in Table 6. The results show that the tourism revenue from China in the coming four years represents only 20% of the total tourism revenue of Taiwan. The amount is 4608 million US$ less than that in 2015 and 3002 million US$ less than the average for the period 2015–2017. These results indicate that tourism revenue from China is consistently declining due to the noticeable decrease in the number of tourists. However, the simulated tourism revenue from the other seven nations and regions for 2018–2021 is 1879 million US$ higher than that in 2015 and 1115 million US$ higher than the average for the 2015–2017 period. Although the number of tourists for most of the nations and regions is concurrently declining because of the interaction through marginal effects in the decrease in the number of tourists from China, the number of tourists from South Korea and South and Southeast Asia will continuously increase in the next four years. This increase in the number of tourists will lead to an increase in the corresponding tourism revenue from South Korea and South and Southeast Asia.

The results shown in Table 6 are used in Fig. 8 to compare the number of tourists from China and the share in its high peak year, 2015, and all four simulated years, 2018–2021, with those from all other sovereign nations and regions. A similar comparison can be conducted for tourism revenue and its corresponding share to total tourism revenue in the same year for the nations and regions. We find that the actual total number of tourists from China decreases rapidly from its highest point in 2015–2017 (the year for which the most recent data are available) by approximately 35%. If the number of tourists from China continues to decline (as the simulated results indicate it will), the share of tourists from China will decrease to 9% by 2021. The corresponding tourism revenue will then drop from 49% of total tourism revenue in Taiwan in 2015 to 11% in 2021. However, this decline will decrease the number of tourists travelling to Taiwan from some nations and regions but will increase the number of tourists from South Korea and many nations from South and Southeast Asia. That is, the negative effect of suppressing both the number of tourists and tourism revenue from some nations and regions is offset by the positive effect of promoting tourists and tourism revenue from other nations.

5. Conclusions

The Open-door Policy implemented by China in 2008 significantly increased the number of tourists from China who visit Taiwan. In 2015, the number of tourists from China reached its highest level and its largest share, 41%, of all tourists to Taiwan. However, this policy factor, which has highly political connotations, switched its direction when the ruling party in Taiwan changed in 2016. This policy promoted a large

number of tourists to Taiwan. It is important to identify the impact of this policy when operated in opposite directions by China. The impact will reveal not only the number of inbound tourists through competitiveness or complementarity between China and the other 19 major nations visiting Taiwan but also the amount of tourism revenue.

Simulation is employed to observe the impact of manipulating the Open-door Policy for 2018–2021. The results show that if the number of tourists from China is above 836,772, then the number of tourists from the other 19 individual nations or groups of nations will increase. It seems optimistic to have a larger number of tourists from the other nations when there are more tourists from China under its Open-door Policy to Taiwan. However, Taiwan will inevitably be faced with fewer tourists from all other nations (i.e., Japan, Hong Kong, Australasia (New Zealand and Australia), North America (Canada and the US), and Europe (France, Germany, GB, Italy, and the Netherlands)) as China reduces its number of tourists. Among the 19 major nations visiting Taiwan, only tourists from South Korea and from South and Southeast Asia will consistently increase regardless of whether the number of tourists from China is more or less than 836,772. Similar results are found for the change pattern of tourism revenue.

It is difficult for Taiwan to expect good intentions from China that will allow more tourists to visit Taiwan and will complementarily bring more tourists from other nations. The results clearly indicate that Taiwan must identify the reason for the increase in tourists from all other nations. To minimize the impact of China's Open-door Policy on the number of tourists from all other nations (regions), the best strategy for Taiwan is to promote different factors to attract tourists from nations other than China. If the current preparation and arrangement of travel and tourism facilities is specifically designed or developed for China due to its large number of inbound tourists, then other nations have the opportunity to use them only incidentally. This makes other nations a spillover beneficiary of travel to Taiwan. This is not an effective way of developing the tourism industry for Taiwan in the long term. Because inbound tourists from different nations have different preferences and tastes for tourism facilities and installations, such as hotels, motels, and public transportation, the preparation of different types of hardware and software facilities suitable for tourists from different nations around the world is essential. Relying on a policy imposed by other nations to bring Taiwan an abundant number of tourists is an unwise and passive decision. The development and improvement of travel and tourism facilities for tourists from different nations is a constructive way to produce a competitive relationship for the number of tourists and tourism revenue between China and other nations.

There are some limitations of the methodological perspective in this study. First, the distance between the capital of Taiwan and that of a specific country is a proxy variable of travel cost and is constant over time; thus, the model used here, like most other gravity model applications, cannot take into account the effect of travel cost variation for travel and tourism to different destinations. If data for flight routes to different destinations are available, the travel costs from the gasoline use of aircrafts travelling at different times to different nations might replace the current constant distance variable between the capitals of nations. If this is possible, the creation of this variable requires high demands for data. Second, the estimated coefficients of variables in the conventional gravity model only present the mean effects for tourist numbers and fail to capture out-of-average differentiations. An advanced method, such as quantile regression, is a possible solution to this problem and could be used in future research.

Author's contribution

Je-Liang Liou, Pei-Chun Hsu, and Pei-Ing Wu have brainstorm to come out with this topic. Je-Liang Liou contributes all the software management regarding the estimations. Pei-Chun Hsu then develops her specialty in all the computation of number of tourists and the associated tourism revenue of each nation and/or region for all the scenarios simulated in this study. Pei-Ing Wu frames each section of this manuscript and writes the draft for the full manuscript. The meaningful analyzed contents, such as design of the simulation scenarios and the utilization of the estimation outcomes, are certainly from the frequent back and forth discussion among three authors.

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