The impacts of financial and non-financial crises on tourism: Evidence from Macao and Hong Kong

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ABSTRACT

This study examines the negative impacts of economic crises and disasters caused by weather or diseases on inbound tourists. We use two well-known tourist cities, Macao and Hong Kong, to highlight the importance of economic variables in attracting tourists, and the significant decreases in tourists when economic crises and disaster hit. Our results show that ignoring the impacts of crises will bias the statistical estimates. Using a simple dummy variable method, we illustrate that the test results can change from insignificant to significant statistically. We find that different types of crises will have different degree of negative impacts on tourism industry which are important for policy makers and the tourism industry in crisis management and in overcoming the difficulties in attracting more tourists under very unfavorable conditions.

1. Introduction and objectives

Tourism industry becomes more and more important in many countries. As reported in OECD (2018), tourism industry has contributed directly to 4.2% of GDP and 6.9% to employment for its member countries. Hong Kong is an international city, more than 58 million tourists have visited Hong Kong in 2017. The tourism industry has contributed 4.5% of GDP in Hong Kong (see Census and Statistics Department, 2018). In Macao, after the gaming licenses are liberalized to foreign investors, the gambling industry has experienced dramatic growth. It also attracts more tourists to Macao. The tourism industry has contributed more than 4.3% of GDP in Macao (see DSEC, 2018[3]). City safety is always the first priority of tourists to choose their destination (Faulkner, 2001; Ritchie, 2004; Zopiatis, Savva, Lambertides, & McAleer, 2019). Different types of crises may have different impact on city safety as well as tourist confidence. This paper will investigate how different types of crises affect the tourism industry in Macao and Hong Kong. The results can also provide information to policy makers to improve tourism crisis management that may reduce the negative impact.

Recently, because of global warming, natural disasters such as earthquake, tsunami, typhoons, etc., are more common than before. These disasters created serious property damages and loss of lives, including tourists from other countries. Several years ago, the tsunami in Japan, Thailand, and Indonesia, the earthquake in Taiwan, China, and Peru etc. killed thousands of people and put most travelling on hold. The tourism industry thus suffered huge losses. Previous studies have found that disasters have strong and negative effect on tourism demand (see Charfeddine & Goaied, 2019; Chu, 2008; Enders, Sandler, & Parise, 1992; Tsai & Chen, 2010; Wang, 2009).

Health related crises also affect the tourism industry. Novelli, Burgess, Jones, and Ritchie (2018) studied the impact of Ebola Virus Disease Epidemic (EVDE) on The Gambia. The Gambian tourism developed steadily before the Ebola outbreak in 2013, receiving more than 170 thousand tourists in that year. After the Ebola outbreak, the number of tourist arrivals reduced by 60%. It caused a huge damage on

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[3] Since the Macao Statistics and Census Service does not directly document the GDP from tourism industry, we used the GDP from "hotel and similar activities" as the proxy.

tourism industry in The Gambia. Kuo, Chen, Tseng, Ju, and Huang (2008) studied the effect of SARS crisis on tourism industry in Asia. A strong negative impact was also perceived.

Prideaux and Witt (2000) showed that the Asian financial crisis caused significant downturn in the number of tourist arrivals in Asian countries. Okumus, Altinay, and Arasli (2005) studied the impact of economic crisis in Turkey on the tourism industry in Northern Cyprus. Both positive and negative effects are observed but the negative impact is much stronger. Campos-Soria, Inchausti-Sintes, and Eugenio-Martin (2015) found out that around 50% of tourists (in their interviewees) were willing to cut back tourism expenditure during the global economic crisis in 2009. The effect of economic crisis on the tourism industry thus cannot be ignored.

Although the recent terrorist attacks in New Zealand, Manchester, Madrid, Paris, Bali, etc. had created fear, safety and security issues for tourists, our sample cities have not exposed to such risk and therefore the adverse impacts are not covered by this study.

This paper studies the tourism demand in Macao and Hong Kong. The key factors that affect the tourist demand are identified. Similar to previous studies, we find that prices and income are significant variables that affect the tourism demand in Macao and Hong Kong. Unlike other studies, we examine the impact of crisis events on the number of tourist arrivals. We find that the impacts were significant. The lagged variables of number of tourist arrivals, income and prices are also considered in our tourism demand model.

The economic crises, weather and health related disasters in Hong Kong and Macao and their impacts on tourism are reviewed in Section 2. Section 3 will introduce Macao and Hong Kong. Research methods and data are provided in Section 4. Empirical results and analyses are available in Section 5 and we share our conclusion and suggestions in Section 6.

2. Related studies and income effect puzzle

2.1. Crises and tourism in Macao and Hong Kong

From 2000 to 2018, the tourism industry of Macao and Hong Kong experienced three disasters with different natures: health, economic and weather. We hypothesize that the natures of the disaster might have different mental and psychological impact on human beings and therefore different impacts on their interest to travel aboard.

The first disaster was SARS in 2003Q2. It lasted from March 11 to June 6. The outbreak was the worst epidemic in Hong Kong's history (see Hung, 2003). In Macao, fortunately, there was only one identified case and without causing any death. However, Macao is near Hong Kong whose airport is one of the best and largest around the world. Many long haul tourists visit Macao through the Hong Kong airport. Therefore, during the SARS outbreak, the number of tourist arrivals reached a record low in both Macao and Hong Kong. We find that SARS has the strongest negative effect on the number of tourist arrivals in both Macao and Hong Kong.

The second disaster was subprime mortgage crisis. This disaster started in 2007 and reached to the peak when Lehman Brothers declared for bankruptcy in 2008Q4.[4] The S&P 500 index dropped by more than 30% during this year. The US government bailed out the largest banks in US to stabilize the financial system. Laeven and Valencia (2012) showed that the cost of bailout was more than US$9000 billion. After the first quantitative easing (QE) was announced in 2008Q4 and expanded the size of QE in 2009Q1, the financial system started to recover. The purchasing power in many countries dropped during the

crisis. Cao, Li, and Song (2017) showed that international tourists plummeted by 8% from January to April in 2009. The citizens' wealth substantially dropped during the crisis and the willingness to travel declined. The number of tourist arrivals slumped to a trough in 2009Q2. We find that the subprime mortgage crisis also had negative and statistically significant effect on the number of tourist arrivals in both Macao and Hong Kong.

The third disaster was typhoon Hato. It happened in August 23, 2017. Hato was the strongest typhoon in both Macao and Hong Kong in the past five decades. The No.10 tropical cyclone signal hoisted for around 5 h in both Macao and Hong Kong. During the disaster, there were 12 people died in Macao. It caused around US$1.55 billion and US$511 million losses in Macao and Hong Kong respectively.[5] According to the path of Hato, Macao suffered more economic losses than Hong Kong. Typhoon Hato also created serious flooding in Macao. The outage of water and power lasted for few days. Macao Government Tourism Office halted the tour groups until the end of August. It created strong negative effect on tourism industry in Macao. We find that the typhoon Hato had negative and statistically significant effect on the number of tourist arrivals in Macao but not in Hong Kong (see the Empirical Results and Analyses section).

2.2. Tourism and growth: Causality and negative income effect puzzle

While empirical evidence seems to support that tourism and economic growth are correlated, and most likely the growth-led tourism hypothesis holds, Li, Jin, and Shi (2018) point out that under some circumstances, the tourism's positive economic impacts may not hold. Gwenhure and Odhiambo (2017, p.33) state that "...Our empirical literature review shows that the causal relationship between tourism and economic growth differs from country to country...". Our findings of "negative Hong Kong income effect on the number of tourist arrivals in Hong Kong" and positive income effect for Macau (see the Empirical Results and Analyses Section) seem to be consistent with these recent studies. But why and what caused the differences. Li, Song, Cao, and Wu (2013) showed that Macao and Hong Kong are strong competitors in the tourism industry, especially for the Mainland Chinese market. The separate visa application procedures to some extent require Mainland Chinese visitors to choose one as their destination. Other consideration such as time, cost of transportation may also affect their choice of destination between Macao and Hong Kong.

Gu, Li, and Tam (2013) showed that many Mainland Chinese citizens are traditionally risk-seeking gamblers. The liberalization of visa application to Macao in a sense encourages Mainland Chinese to travel to Macao for gambling. However, it is possible that the gambling industry in Macao is not the only reason for the negative income effect in Hong Kong. We claim that the negative income effect in Hong Kong is because of (1) the high-income public and corporate officials in Mainland China are attracted by the gambling industry in Macao so reduce in the number of tourist arrivals in Hong Kong. Gu, Wu, Guo, and Li (2018) showed that many public and corporate officials in Mainland China are VIP customers in casinos. Some of them may involve in corruption in Mainland China. Before 2014, 2/3 of gross gaming revenue in Macao is reaped by VIP gambling services and more than 95% of VIP customers are Mainland Chinese corporate and public officials. The corporate and public officials earn a lot of "easy money" from corruption. Sheng and Tsui (2009, p.72) also mentioned that "However, things have begun to change recently, as corrupt mainland Chinese government officers embezzled public resources and gambled in Macao." Sheng (2017) restated this phenomenon. Pontell, Fang, and Geis (2014) also illustrated that the casino industry in Macao offers a

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[4] Meanwhile, Mainland Chinese government tightened the visa policy. It affected the number of tourist arrivals from Mainland China to Macao and Hong Kong. However, this effect is not worldwide. The number of tourist arrivals from other countries may only be affected by the subprime mortgage crisis.

[5] Macau News Agency: Typhoon Hato losses around MOP12.55 billion. http://www.macaubusiness.com/macau-typhoon-hato-impact-estimated-around-mop12-55-billion

unique opportunity to examine the corruption in Mainland China. Gambling for them seems to be an investment with high returns but zeros loss since their capital may come from the corruption. On the other hand, gambling can be used for money laundering. Therefore, the intensified anticorruption campaign in Mainland China in 2014 exerted a direct and serious effect on VIP gaming services in Macao (see Gu, Li, Chang, & Guo, 2017) as reflected by the drop of gross gambling revenue. This paper finds that the income effect is significantly mitigated in Macao but not in Hong Kong after 2014. (2) The rise in income of Macao people reduced their willingness to travel to Hong Kong and their willingness to travel to other countries has risen. We find that the ratios of the number of tourist arrivals from Macao to Hong Kong over the number of Macao outbound tourists drop after 2013. The results are opposite to the fast GDP growth in Macao (see the Empirical Results and Analyses Section).

The impact of vacation costs on the number of tourist arrivals in Hong Kong was stronger than in Macao. The visitor profile report (2017) prepared by the Hong Kong Tourism Board showed that around 80% tourists in Hong Kong would go shopping.[6] The results reveal that the main purpose of tourist arrivals in Hong Kong was for shopping. The changes in prices would highly affect the willingness of tourists to travel to Hong Kong. The results are supported by Li et al. (2013).

3. Macao and Hong Kong: Integrated resorts, tourism and policy

After Macao became a Special Administrative Region (SAR) of China in 1999, its economic condition turned south. Unemployment and crime rates increased significantly. In order to "jump-start" Macao's economy, the Chinese government in Beijing allowed Macao to become the only city in China to have liberalized commercial gaming. Both Chinese and foreign investors are welcome to apply for the three gaming licenses. Since then, investors from Hong Kong, America and Australia established casinos, hotels and other luxury facilities in Macao. The combination of casinos and MICE (Meetings, Incentives, Conventions, and Exhibitions) creates a super-size entity known as Integrated Resorts (IRs).

The IRs, especially its gambling component, developed rapidly in Macao. It attracts many tourists from different countries and regions (e.g. Taiwan, Japan, Korea). Later on, because of the worldwide economic crises, the Mainland Chinese government announced a critical policy, known as Individual Visit Endorsement/Scheme (IVS), to stimulate the tourism industry in Macao and Hong Kong. This policy allows Mainland Chinese to travel to Macao and Hong Kong with one permit and multi-entry. In the past, Mainland Chinese could only visit Macao and Hong Kong through the business or group tours. Since gambling is prohibited by law in China, the gambling industry in Macau becomes very attractive to Mainland Chinese. The fast growth of Chinese tourists and the completion of many new casinos enable Macao's casinos to become famous and become the most profitable in the world. The gaming gross revenue in Macao increased from MOP28 billion in 2002 to the peak of MOP361 billion in 2013. This amount is seven times as high as Las Vegas's. The gambling industry and tourism industry create very high economic growth for Macao.

Hong Kong is an international city. Hong Kong airport is the 8th busiest airport (by passenger traffic) in the world. It handled more than 70 million passengers in 2017. Unlike Macau, the tourists travel to Hong Kong from many different countries. The main purposes of their travelling are mainly leisure and sight-seeing that may include shopping. The Mainland Chinese enjoy shopping in Hong Kong since there are a lot of consumer goods with famous brands but less expensive than in Mainland China. The total number of tourists grew around triple from 2003 to 2018 in both Macao and Hong Kong (see Figs. 1 and 2).

The tourists from Mainland China, on the other hand, grew much more, around six times (see Figs. 3 and 4).

4. Methodology and data

4.1. Data

We used quarterly data from the period of 2000Q1 to 2018Q3. The data is collected from Emerging Market Economic Data (EMED). It includes the number of visitor/tourist arrivals (TA), consumption price index (CPI), GDP by Expenditure: Current price (GDP) and Exchange rate (EX) of Macao (MO), Hong Kong (HK), Singapore (SG), Malaysia (MY), Mainland China (CN), Taiwan (TW), Japan (JP), Korea (KR), United States (US), United Kingdom (UK), German (DE), France (FR) and Italy (IT). The number of tourist arrivals are used as a proxy of tourism demand (see Charfeddine & Goaied, 2019; Song & Witt, 2006; Wang, 2009). The ratios of GDP over CPI in source country are used as a proxy of tourist income. The ratios of CPI in visited country over the CPI in source country are used as the proxy of tourist prices (see Dritsakis, 2004; Jin, Qu, & Bao, 2019; Song & Li, 2008; Wang, 2009).[7] The exchange rates are the spot rates of the currency in visited country against the currency in source country. Many researchers have found that the number of tourist arrivals has seasonality issue (see Charfeddine & Goaied, 2019; Gil-Alana, Cunado, & Perez de Gracia, 2008; Song & Li, 2008). The seasonality issue may cyclically enlarge the variations of number of tourist arrivals in particular seasons. This issue may also affect the significance of dummy variables when the events happened in these particular seasons. To address the seasonality issue, we apply the X-12-ARIMA technique to deseasonalize the series of TA before importing to the tourism demand model.[8] For simplicity, TA is the adjusted number of tourist arrivals hereafter. For the Macao tourism demand model, the tourist data from CN, HK, TW, JP, KR, US, UK, DE, FR and IT is used. For the Hong Kong tourism demand model, the tourist data from HK will be replaced by MO, other tourist data remains unchanged.

4.2. Tourism demand model and crises

In the tourism demand model, we assume that the log changes in the number of tourist arrivals ($\Delta\ln TA_t$) is determined by the log changes in tourist incomes ($\Delta\ln IC_t$); tourist prices ($\Delta\ln PR_t$); exchange rate ($\Delta\ln EX_t$); the number of tourist arrivals in the past ($\Delta\ln TA_{t-i}$) and dummy variables (DI_t, $D03_t$, $D08_t$, $D17_t$).[9] Before including the dummy variables in the tourism demand model, we used Hansen (1992)'s parameter instability test to verify the stability of the model. Since the test is used for time series data, we apply this test to the model with tourist data individually. The results show that tourist data in most countries has breakpoints in the model. Moreover, we applied the Lee

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[6] The visitor profile report (2017) is available in https://securepartnernet.hktb.com/en/research_statistics/research_publications/index.html

[7] Precisely, the proxy of tourist prices is relative prices. In general, real exchange rate will be used in the tourism demand models. Dritsakis (2004) showed that the relationship between relative price, nominal exchange rate and real exchange rate. The logarithm of real exchange rate is equal to the difference between the logarithm of relative price and the logarithm of nominal exchange rate. Therefore, the references which used relative prices as the proxy of tourist prices will use nominal exchange rate instead of real exchange rate.

[8] This method is a commonly used method to address the seasonality issue, see Findley, Monsell, Bell, Otto, and Chen (1998). The algorithms of X-12-ARIMA is provided by Time Series Research, Staff Statistical Research Division, U.S. Census Bureau Washington, DC 20233, http://www.census.gov/srd/www/x12a/

[9] In Wang (2009)'s tourism demand model, the log changes in crude oil prices are included. Since the CPI has already included the effect of transportation cost in the visited countries, the global oil prices will have similar effect on the transportation cost of Macao and Hong Kong, therefore we exclude the log changes in oil prices to increase the degree of freedom in our model.
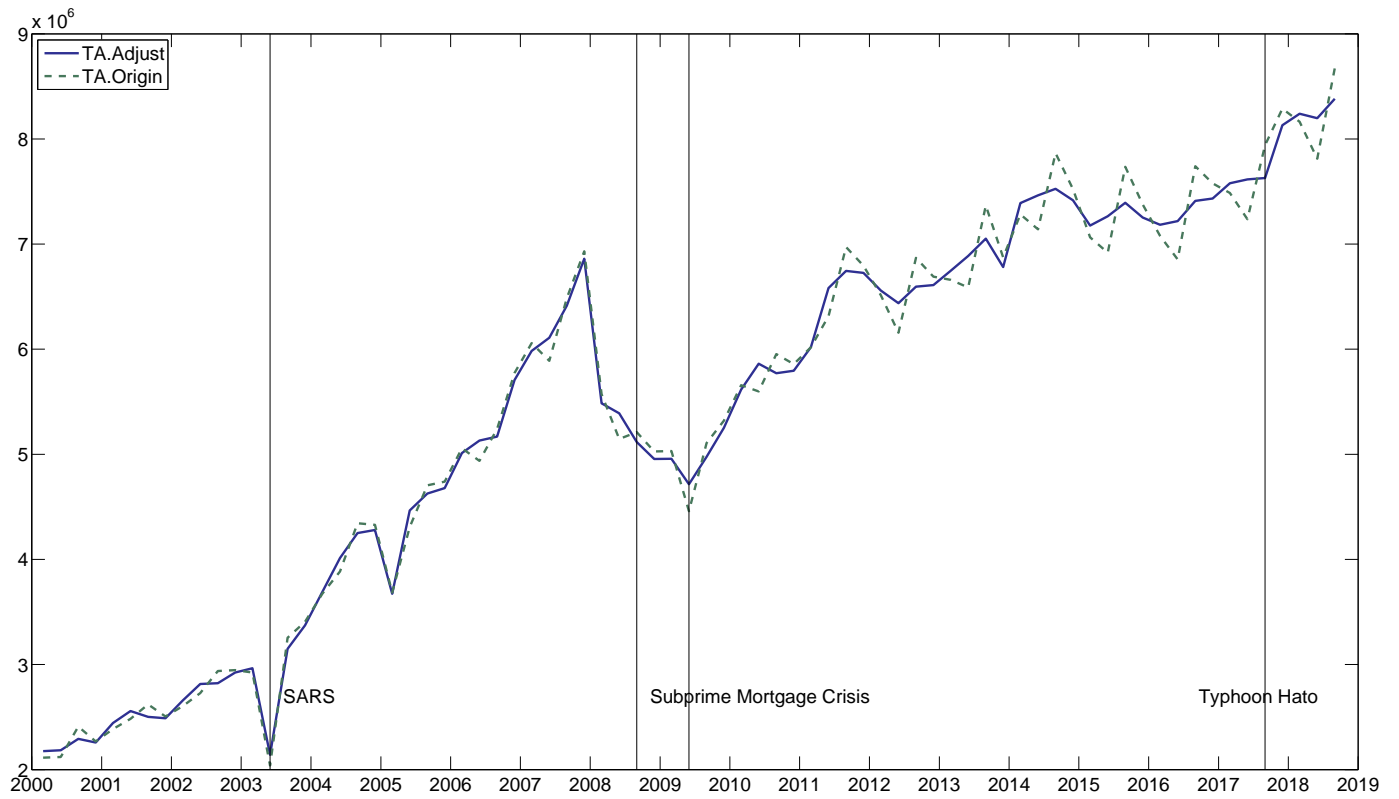
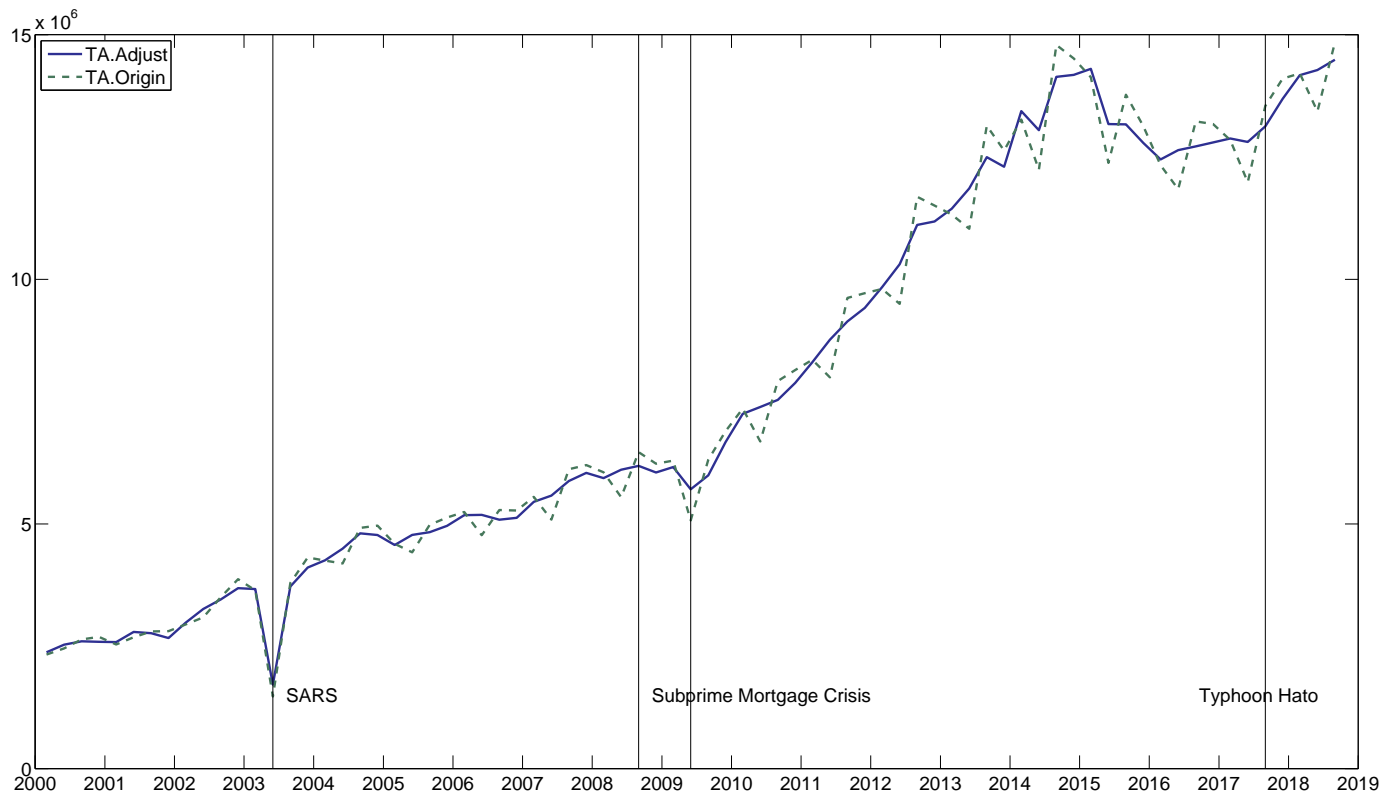**Fig. 1.** Total number of tourist arrivals in Macau.

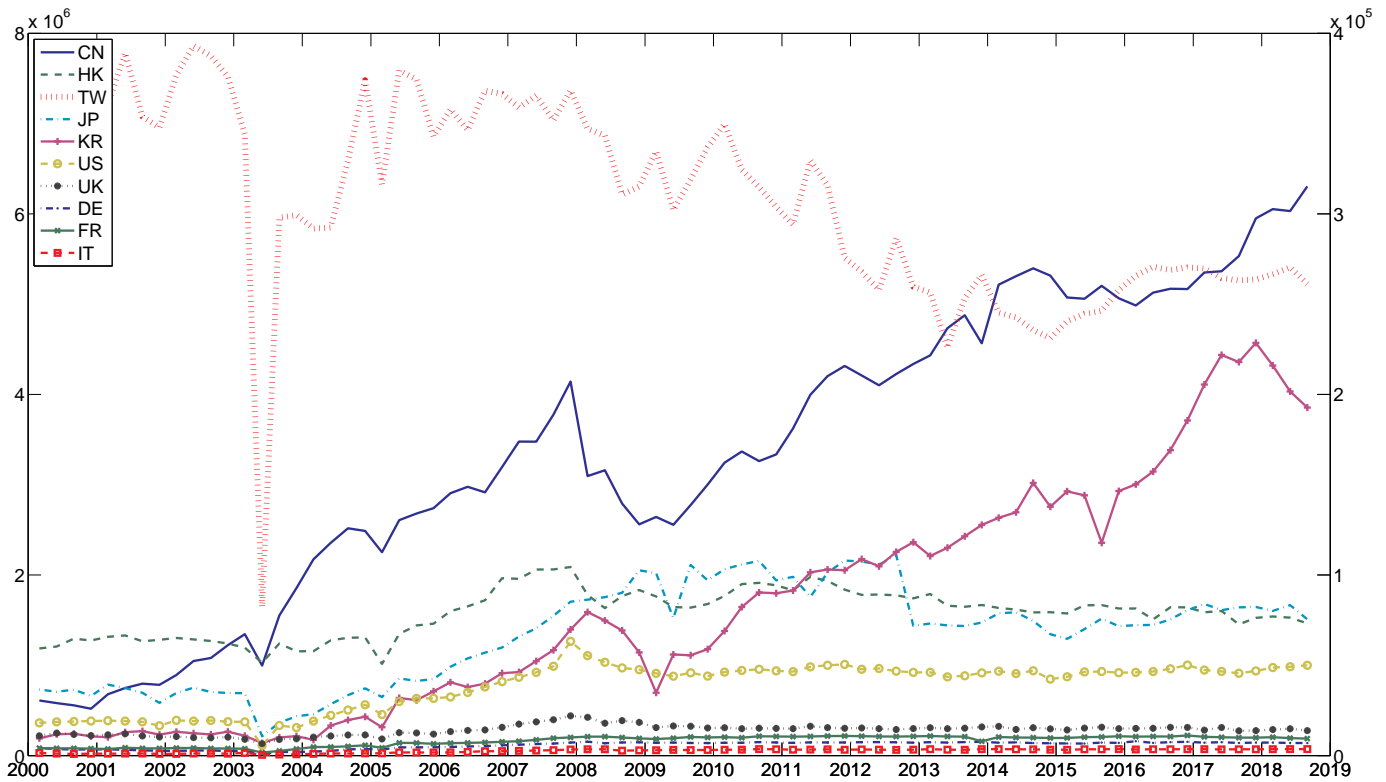**Fig. 2.** Total number of tourist arrivals in Hong Kong.

Fig. 3. The number of tourist arrivals from ten major regions to Macao. The left y-axis represents the number of tourist arrivals from China and Hong Kong. The right y-axis represents the number of tourist arrivals from other regions.
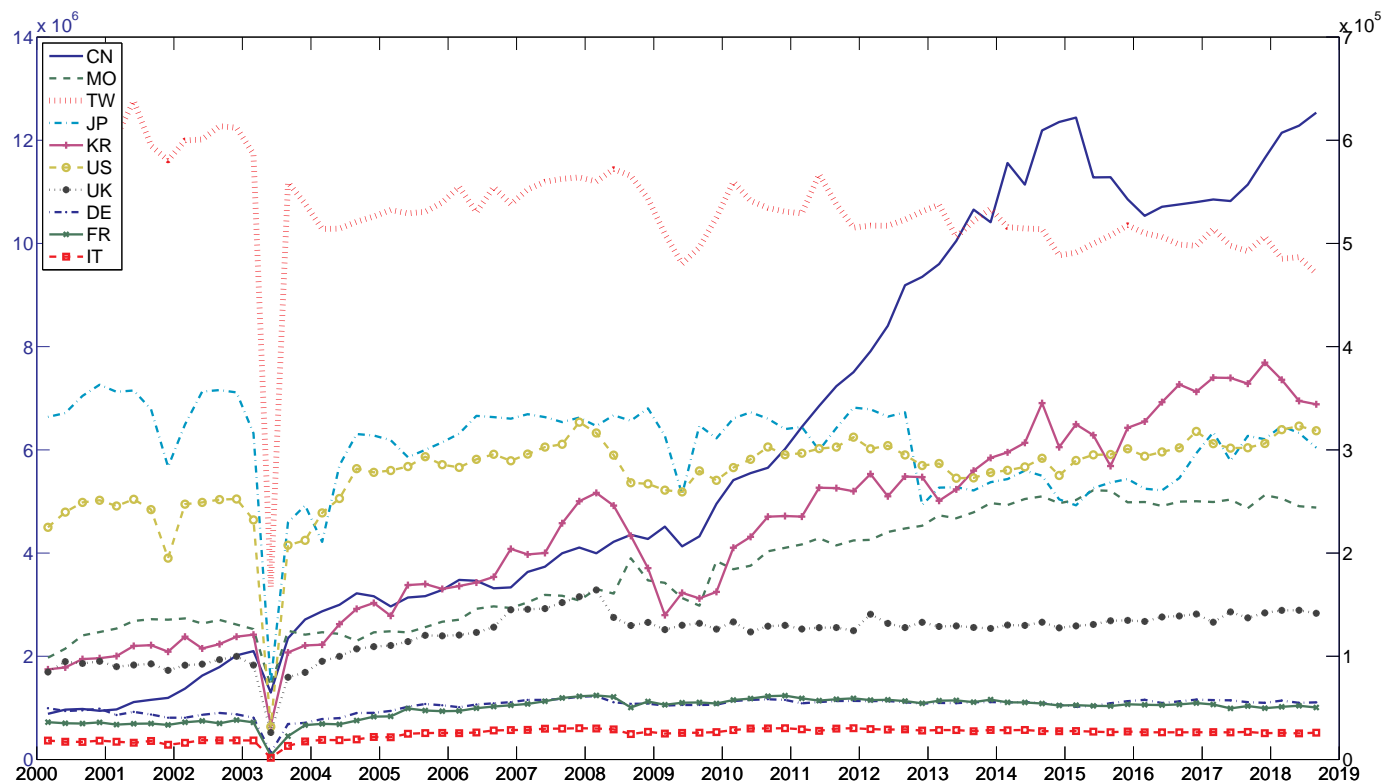

Fig. 4. The number of tourist arrivals from ten major regions to Hong Kong. The left y-axis represents the number of tourist arrivals from China. The right y-axis represents the number of tourist arrivals from other regions.

Table 1
The break dates of tourist arrivals in Macao and Hong Kong.

Panel A: The break dates of Macao Tourist arrivals									
Breaks	CN	HK	TW	JP	KR	US	UK	DE	FR	IT
1	03Q1	02Q4	03Q1	02Q4	03Q1	03Q1	03Q2	02Q4	02Q4	02Q4
2	07Q3	07Q3	07Q1	08Q3	08Q3	07Q2	07Q2	08Q2	07Q2	08Q1
3	10Q4	09Q4	12Q2	12Q3	10Q1	09Q2	09Q1	10Q1	13Q3	11Q1

Panel B: The break dates of Hong Kong Tourist arrivals									
Breaks	CN	MO	TW	JP	KR	US	UK	DE	FR	IT
1	02Q4	02Q4	02Q4	03Q1	02Q4	02Q4	02Q4	03Q1	03Q1	03Q1
2	09Q3	08Q2	08Q3	09Q1	08Q3	07Q4	09Q3	07Q4	08Q1	08Q1
3	14Q4	11Q2	11Q3	12Q4	10Q4	11Q1	13Q3	11Q2	10Q1	11Q1

and Tieslau (2019)'s panel LM unit root tests with level and trend shifts to estimate the unknown breaks in our sample period.[10] Table 1 shows that the first 2 break dates of Macao and Hong Kong tourist arrivals are very close to the SARS and subprime mortgage crisis but the third break date varies over regions.[11] In addition, we employed the Chow test to further examine the structural breaks in 2003Q2, 2008Q3, and 2017Q3. For the number of Hong Kong tourist arrivals, the F-statistics are 62.4, 3.06 and 0.06 respectively and the critical value is 2.03. For the Macao tourism demand model, the F-statistics are 35.7, 4.59 and 0.12 respectively and the critical value is 2.03. Overall, the results showed that the structural breaks in SARS and subprime mortgage crisis are obvious but the typhoon Hato is not. The sample size of the data after the typhoon Hato is small, it may affect the significance in the tests. Moreover, the typhoon Hato actually made a huge damage to Macao's society. Therefore, the dummy variables of SARS, subprime mortgage crisis and typhoon Hato are necessary in the models.

$$\Delta \ln TA_{i,t} = \alpha + \sum_{j=0}^{n_1} \beta_{1,j} \Delta \ln IC_{i,t-j} + \sum_{j=0}^{n_2} \beta_{2,j} \Delta \ln PR_{i,t-j}$$
$$+ \sum_{j=0}^{n_3} \beta_{3,j} \Delta \ln EX_{i,t-j} + \sum_{j=1}^{n_4} \beta_{4,j} \Delta \ln TA_{i,t-j}$$
$$+ \beta_5 DI_t \Delta \ln IC_{i,t} + \beta_6 D03_t + \beta_7 D08_t + \beta_8 D17_t + \varepsilon_{i,t}. \quad (1)$$

As mentioned in the previous section, the panel data is used in our model with $i = 1, ..., N$ (number of regions), $t = 1, ..., T$ (number of quarters), Δ is the first difference operator, n_1 to n_3 are the optimal number of lags based on AIC criteria. Since the optimal number of lags of the variables in different countries are different, we choose the mode across countries as the optimal number of lags of variables. For Macao, the optimal numbers of lags of $\Delta \ln IC$, $\Delta \ln PR$ and $\Delta \ln EX$ are 4, 1 and 0 respectively. For Hong Kong, they are 4, 3 and 0 respectively. DI_t is the dummy variable that measures the impact of intensified anticorruption campaign on tourist income effect. The value is 1 after 2014Q1 (includable) and is 0 otherwise. $D03_t$ is the dummy variable for the SARS crisis, the value is 1 in 2003Q2 and is 0 otherwise. $D08_t$ is the dummy variable for the subprime mortgage crisis, the value is 1 in 2008Q3–2009Q2 and is 0 otherwise. $D17_t$ is the dummy variable for the typhoon Hato. The value is 1 in 2017Q3 and is 0 otherwise.

Since the lagged numbers of tourist arrivals ($\Delta \ln TA_{i,t-j}$) are included in our model, we applied the Hayakawa (2009)'s simple efficient instrumental variable estimators to address the endogenous issue. This method is consistent under fixed N and large T which is suitable in our models (see p.874 in Hayakawa, 2009). The idea is to use instrument deviated from the past mean as the instrumental variables. This method can improve the efficiency of instrumental variable estimator. Let

$y_{i,t} = \Delta \ln TA_{i,t}$, the variable $y_{i,t}$ will be replaced by its forward orthogonal deviation $y_{i,t}^* = c_t[y_{i,t} - (y_{i,t+1} + \cdots + y_{i,T})/(T - t)]$, where $c_t = \sqrt{(T-t)/(T-t+1)}$. Similarly, the independent variables $\ln TA_{i,t-j}$ will be replaced by $y_{i,t-j}^*$. The instrumental estimators $z_{i,t}^j$ of $y_{i,t-j}^*$ are the instruments deviated from the past mean. It is given as follows

$$z_{i,t}^j = c_t \left[y_{i,t-j} - \frac{y_{i,t-j-1} + \cdots + y_{i,-n_4+1}}{t + n_4 - 1 - j} \right]. \quad (2)$$

Therefore, Eq. (1) can be rewritten as:

$$y_{i,j}^* = \alpha + \sum_{j=0}^{n_1} \beta_{1,j} \Delta \ln IC_{i,t-j} + \sum_{j=0}^{n_2} \beta_{2,j} \Delta \ln PR_{i,t-j}$$
$$+ \sum_{j=0}^{n_3} \beta_{3,j} \Delta \ln EX_{i,t-j} + \sum_{j=1}^{n_4} \beta_{4,j} y_{i,t-j}^*$$
$$+ \beta_5 DI_t \Delta \ln IC_{i,t} + \beta_6 D03_t + \beta_7 D08_t + \beta_8 D17_t + \varepsilon_{i,t}, \quad (3)$$

with the instrumental variables $z_{i,t}^j$, $j = 1, ... n_4$. Since we used the forward orthogonal deviation and backward deviation from past mean, the number of observations T will be reduced by 2. To obtain the optimal number of lags in $\Delta \ln TA$, we compare the partial autocorrelation function (PACF) between Hong Kong and Macao, the effect of autocorrelation will be mitigated after 6 lags and 8 lags in Hong Kong and Macao respectively. Although we used the forward orthogonal deviation to transform the $\Delta \ln TA$, for simplicity and briefly, we will keep using the notation $\Delta \ln TA$ hereafter.

Wang (2009) used the ARDL model to test the long-term relationships of the explanatory variables. We do not take account the error correlation term into our model since the long-term relationships are not the focus in this paper. Instead, we use PACF to find the optimal number of lags of $\Delta \ln TA$ and use instrumental variable estimator to capture the autoregressive effect in our model. This operation is more tractable than including error correlation terms in the panel data. Charfeddine and Goaied (2019) used the Markov-switching model to reveal the structural changes in different breakpoints. However, this model is suitable for time series data but not to the panel data. Finally, the fixed effect model with instrumental variable estimator is applied to estimate the parameter in our tourism demand model.

To demonstrate our findings, we modify our research design by using similar country partner: Singapore and Malaysia as "instrumental variable" to study the underlying sources. We repeat our tourism demand model with tourist arrivals in Singapore and Malaysia. Singapore is another Asian country that permitted to operate legalized casino gambling. The first casino opened in 2010. In contrast with Macao, Singapore is an up-and-coming market of gambling industry (see Wu & Chen, 2015). The gambling tax revenue accounts for more than 90% of total tax revenue in Macao, but it is around 4% in Singapore (see DSEC2018 and DOS, 2018). Malaysia is a large country. It is 400 times bigger than Singapore. Malaysia has a lot of natural resources and tourist attractions. Similarly, Singapore and Malaysia are neighbors.

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[10] Lee and Tieslau (2019)'s algorithm actually used for the panel unit root test. In addition, it also provided the estimate of break dates on each time series.
[11] The unit root test statistics of the data are statistically significant. The data is stationary.

Singapore has casinos but Malaysia does not. Our results show that tourist income has positive and statistically significant effect on the number of tourism arrivals in both Singapore and Malaysia. These results show that the gambling industry in one country is not a sufficient condition to create the negative income effect to the neighbor country. To further study the reasons of the negative income effect in Hong Kong, we remove the Mainland Chinese and Macao tourists from Hong Kong tourism demand model. The results show that the negative income effect eliminated (see Empirical Results and Analyses section).

5. Empirical results and analyses

5.1. Seasonality issue and the importance of dummy variables

Figs. 1 and 2 show the number of tourist arrivals before and after the deseasonalization. From the unadjusted number of tourist arrivals, we observe that there are cyclical fluctuations in the number of tourist arrivals in the second quarter every year. During the second quarter, the number of tourist arrivals drops to its trough, the results are expected since there are less public holidays in this quarter. Therefore, using seasonally adjusted number of tourist arrivals is more reliable to measure the effect of different crises on tourism activity especially for SARS crisis that happens in 2003Q2.

Figs. 3 and 4 show that the vast majority of tourists to Macao and Hong Kong are Mainland Chinese visitors. The large proportion of Mainland Chinese visitors reflect that geographic proximity is a key factor that affects the tourists to choose Macao or Hong Kong as their destination. This factor is related to time consumption and transportation cost from source countries to Macao and Hong Kong. Meanwhile, Mainland Chinese government launches the IVS in July 2003 that allows Mainland Chinese to travel to Macao and Hong Kong with one permit but multiple-entry. After April 2015, Mainland Chinese government adjusted the "multiple-entry" IVS by replacing it with the "one trip per week" IVS.[12] Although the policy has changed, it still enhanced the willingness of Mainland Chinese tourists to travel to Macao and Hong Kong. The percentage of tourist arrivals in Macao from Mainland Chinese visitors increased from 30% to 75%. Similarly, this percentage increased from 40% to 85% in Hong Kong. In other words, the tourism industry of Macao and Hong Kong became highly reliable on Mainland Chinese tourists.

Table 2 shows the parameter estimates of tourism demand model. Tourist income, tourist prices and the number of tourist arrivals in the past are the significant factors that affect the number of tourist arrivals in Macao and Hong Kong. To compare the Macao tourism demand models with and without dummy variables, we find that the adj-R^2 increases from 0.16 to 0.56. *The variable* PR_{t-1} *becomes statistical significance after adding the dummy variables.* For the Hong Kong tourism demand model, the adj-R^2 increases from 0.29 to 0.81. The variable PR_t becomes statistical significance after adding the dummy variables. The significance of dummy variables also show that they are necessary for capturing the structural changes in the model.

5.2. Crises effect

To study the impact of crisis events on the number of tourist arrivals, we find that the coefficients of D03 and D08 are negative and statistically significant in both Macao and Hong Kong. D03 is the greatest coefficient among three disasters. SARS is a highly contagious disease which can be transmitted by respiratory droplets. The fatality ratio of SARS was around 15%.[13] Safety is the first priority for tourists,

they avoided travelling to Hong Kong and Macao to prevent inflection from SARS. Therefore, SARS had the largest impact on the tourism industry. Subprime mortgage crisis had a strong impact on the level of income, unemployment rate rose in many countries during the crisis. Therefore, people were less willing to travel. The tourism industry thus suffered big losses. The coefficient D17 is only statistically significant in Macao. Typhoon Hato created bigger damage to Macao than Hong Kong. The electricity supply and drinking water supply halted for more than 3 days. The streets were filled with piles of rubbish, furniture, dead fish, uprooted trees and broken windows. The Macao's government canceled many events including the 29th Macao International Fireworks Display Contest to prioritise the recovery work.[14] Moreover, Macao Government Tourism Office required travel agencies to halt tour groups until August 30. These actions had strong negative effect on tourism industry in Macao.

5.3. The income effect

After determining the appropriate tourism demand model for Macao and Hong Kong, we found that tourist income has negative and statistically significant effect on the number of tourist arrivals in Hong Kong and we denoted this as a negative income effect. The tourist income reveals the ability of citizens to travel. Increase in income means that tourists can spend more money on travelling. Typically, the rise in income will have positive effect on the number of tourist arrivals (Wang, 2009). The results in Hong Kong are unusual in tourism demand model. We find that the gambling industry in Macao is one reason, but not the only one, for the negative income effect in Hong Kong.

The gambling industry can attract some tourists who are addicted on gambling and some high-income tourists to Macao. Gu et al. (2018) show that the gross gambling revenues in Macao depend heavily on the Mainland Chinese tourists. 2/3 of gross gambling revenues were provided by the VIP gambling services. After the IVS is announced by the Mainland Chinese government, many public and corporate officials came to Macao for gambling. In 2014, the anticorruption campaign was enforced in Mainland China, such tourists reduced sharply.

We observe that the unique geographic location between Macao, Hong Kong and Mainland China and the characteristics of Mainland Chinese tourists are critical on this negative income effect. The corporate and public officials got the benefit through the rapidly economic growth in Mainland China. Their wealth highly increased. The opaque VIP gambling services in Macao is a suitable channel for the money laundering (see Sheng, 2017; Sheng & Tsui, 2009). Therefore, as the GDP grows fast in Mainland China, more corporate and public officials become rich. The more money they had, the more times they came to Macao. Furthermore, the number of tourists from Mainland China to Hong Kong would be diverged since the gambling is the only purpose of such tourists.[15] Second, Macao people benefit from the economic growth. Many Macao people become rich. They can travel far from Macao. Hong Kong was no longer their first priority. More Macao people chose to travel to Japan, Korea, Thailand, or some European countries. Therefore, the more money they earned, the less increased in the number of tourists from Macao to Hong Kong.

To demonstrate these findings, we first find the gambling gross revenue per number of tourist arrivals (GRpT) in Macao (see Fig. 5).[16] A rise in GRpT means that tourists were willing to spend more money on

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Table 2
The parameter estimate of tourism demand models.

	MO		HK		SG	MY
IC	1.74 (**0.00**)	0.66 (**0.04**)	0.78 (**0.01**)	−0.35 (**0.04**)	0.65 (**0.03**)	0.29 (**0.02**)
PR	0.76 (0.32)	−0.41 (0.46)	0.87 (0.22)	−1.03 (**0.01**)	0.30 (0.58)	−1.03 (0.16)
EX	0.33 (**0.06**)	0.25 (**0.06**)	0.10 (0.70)	−0.04 (0.80)	0.24 (0.16)	−0.21 (**0.09**)
DI		−0.51 (**0.01**)		−0.12 (0.54)		
D03		−0.90 (**0.00**)		−1.63 (**0.00**)	−1.09 (**0.00**)	−0.65 (**0.00**)
D08		−0.06 (**0.00**)		−0.12 (**0.00**)	−0.07 (**0.00**)	0.03 (0.27)
D17		−0.09 (**0.02**)		−0.04 (0.29)		
TA_{-1}	−0.35 (**0.00**)	−0.36 (**0.00**)	−0.61 (**0.00**)	−0.63 (**0.00**)	−0.33 (**0.00**)	−0.28 (**0.00**)
TA_{-2}	−0.04 (0.35)	−0.06 (**0.06**)	−0.42 (**0.00**)	−0.43 (**0.00**)		−0.30 (**0.00**)
TA_{-3}	0.04 (0.42)	0.01 (0.76)	−0.27 (**0.00**)	−0.28 (**0.00**)		−0.17 (**0.00**)
TA_{-4}	0.00 (0.99)	0.02 (0.65)	−0.20 (**0.00**)	−0.17 (**0.00**)		−0.09 (**0.01**)
TA_{-5}	−0.02 (0.63)	0.03 (0.40)	−0.14 (**0.00**)	−0.11 (**0.00**)		
TA_{-6}	0.07 (0.18)	0.05 (0.15)	−0.03 (0.44)	−0.05 (**0.02**)		
TA_{-7}	0.18 (**0.00**)	0.16 (**0.00**)				
TA_{-8}	−0.04 (0.37)	−0.03 (0.35)				
IC_{-1}	0.72 (**0.00**)	0.22 (0.28)	0.72 (**0.00**)	−0.06 (0.62)	0.05 (0.80)	
IC_{-2}	0.30 (0.23)	0.21 (0.29)	0.02 (0.92)	0.09 (0.46)	−0.30 (0.11)	
IC_{-3}	0.39 (0.12)	0.39 (**0.05**)	0.25 (0.28)	0.22 (**0.07**)	−0.07 (0.70)	
IC_{-4}	−0.98 (**0.02**)	0.09 (0.76)	−0.41 (0.18)	0.47 (**0.00**)	−0.47 (**0.08**)	
PR_{-1}	−0.37 (0.63)	−2.56 (**0.00**)	0.09 (0.90)	−1.45 (**0.00**)		
PR_{-2}			0.40 (0.57)	−1.76 (**0.00**)		
PR_{-3}			−0.70 (0.33)	−1.15 (**0.00**)		
N	10	10	10	10	11	10
T	65	65	67	67	69	69
Adj. R^2	0.16	0.56	0.29	0.81	0.57	0.28
Loglike	−455.63	−453.04	−475.98	−467.16	−529.92	−483.60
AIC	943.26	946.09	983.96	974.31	1079.84	985.21
BIC	1014.89	1035.63	1056.08	1064.46	1126.16	1026.04

Note: The fixed effect model with Hayakawa (2009)'s efficient instrumental variable estimators is used to estimate the parameters in Eq. (1). The values inside the parentheses are the p-value and bolded when it is less than 0.1. For the limitation of table space, we simplified some notation, i.e., $\Delta \ln TA_t$ is shortened as TA in the table. The number of tourists from Macao to Singapore and Malaysia, from Hong Kong to Malaysia are not available in the dataset. Therefore, we added Malaysia tourists and removed Macao tourists in the Singapore tourism demand model. For the Malaysia tourism demand model, we removed the Macao and Hong Kong tourists, and added Singapore tourists to the model. The optimal number of lag in variables are obtained by using the same method as in Macao and Hong Kong tourism demand models.
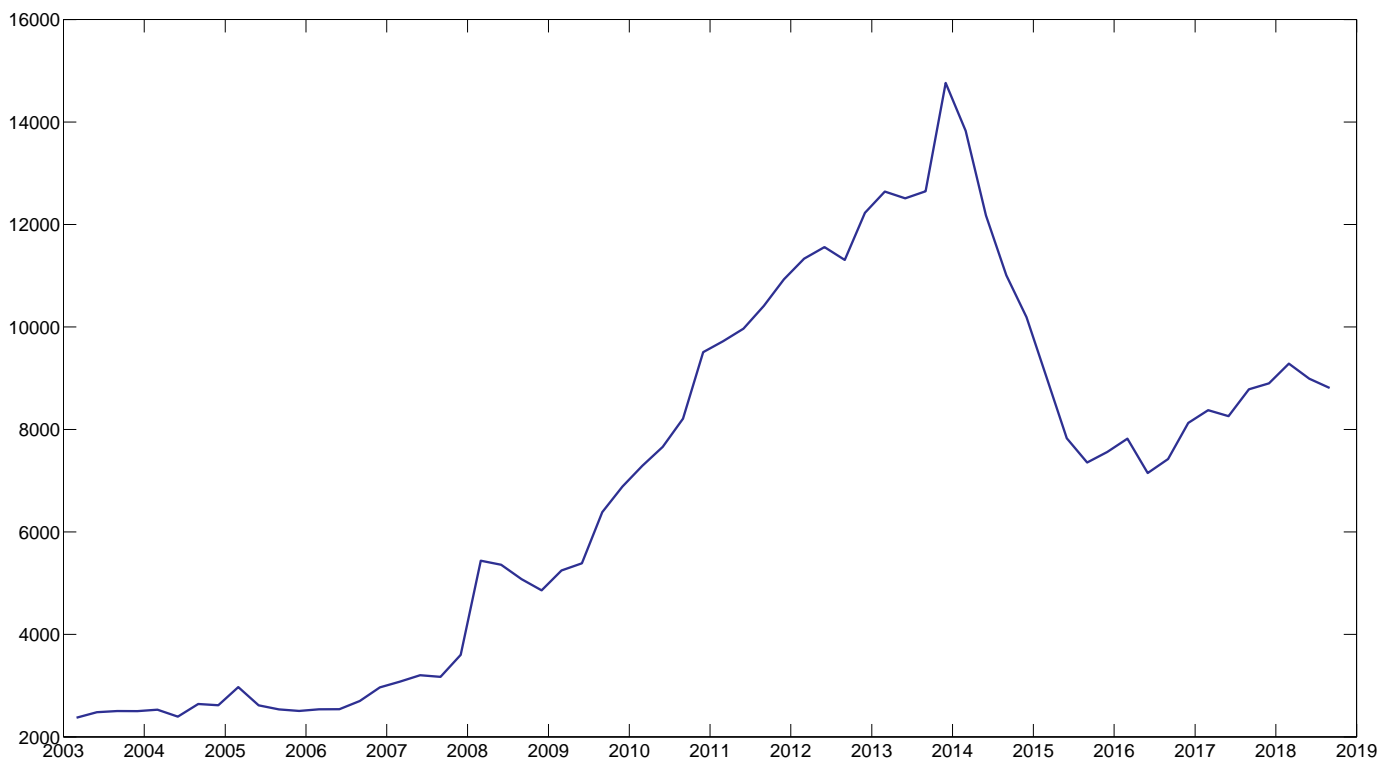

Fig. 5. The gambling gross revenue of game of chance per tourist (GRpT) in Macau.

gambling. From 2002 to 2013, the GRpT increased sharply. The gambling industry in Macao became the most profitable gambling industry over the world. However, it started to drop from 2014 after the Mainland Chinese government strengthened the anticorruption campaign. Therefore, we add the dummy variable (DI_t) to measure the impact of intensified anticorruption campaign on income effect.

Gambling is an activity that people can spend money to acquire heartbreaking experience. The facilities around the casinos are luxurious. Rich people may enjoy gambling and utilizing those facilities. Therefore, the gambling industry can attract high-income tourists. However, if this is the only reason for the negative income effect in Hong Kong, we will observe the same results in Malaysia. Singapore and Malaysia are near with each other. Singapore also has legal gambling casinos. Therefore, we replicate the model with the number of tourist arrivals in Singapore and Malaysia. The results show that the income effect is positive and significant in both Singapore and Malaysia (see Table 2). It exactly reveals that the gambling industry is not the only reason to create the negative income effect to the neighbor country.

To further study the negative income effect in Hong Kong, we remove the Macao tourists and Mainland Chinese tourists in Hong Kong tourism demand model. The coefficient of income changes from −0.348 to 0.151.[17] Although the coefficient is not statistically significant, the results still show that the Mainland Chinese and Macao tourists are critical for the negative income effect in Hong Kong.

The unique geographic location between Macao, Hong Kong and Mainland China and the characteristics of Mainland Chinese tourists are critical. Gu et al. (2013) show that the gambling is prohibited by law in Mainland China, many of its citizens are risk-seeking gamblers. Many Mainland Chinese corporate and public officials were the VIP in casinos. Some of them involved in corruption in Mainland China. The opaque VIP service was very convenient for the money laundering. It encouraged such tourists to gamble in Macao. To support our argument, we add the dummy variable (DI_t) to measure the impact on the income effect before and after the intensified anticorruption campaign in 2014Q1.

We find that the coefficient of DI_t is negative and statistically significant in Macao. The coefficient of income decreases from 0.662 to 0.156 after 2014. The intensified anticorruption campaign only affects the public and corporate officials who involved in corruption. The results to some extent show that the intensified anticorruption campaign highly reduced the willingness of public and corporate officials in Mainland China to travel to Macao. In consequence, the income effect reduced. However, DI_t is not significant in Hong Kong. The intensified anticorruption campaign did not have significant impact on the income effect in Hong Kong. In other words, these public and corporate officials were mainly attracted by the gambling industry in Macao. Second, Fig. 6 shows the ratio of the number of tourist arrivals from Macao to Hong Kong over the number of Macao outbound tourists. The ratio seems to decrease after 2013. The results are opposite to the fast GDP growth in Macao. These results show that Macao people will choose to travel to other countries after their wealth increased.

The relative price index reflects the purchasing power between two regions. For example, the rise in prices, such as the cost of accommodations, food, and beverages, in visited country would reduce the purchasing power of tourists. The effect on the number of tourist arrivals was negative with 1% significance level during the first lagging period in Macao. This effect is much stronger in Hong Kong. It is negatively related to the number of tourist arrivals with 1% significance level from current up to the third lagging period. Hong Kong is a famous shopping paradise. The main purpose of tourists who travelled to Hong

Kong was for shopping. Therefore, prices had stronger effect on the number of tourist arrivals than Macao. The exchange rate between Macao and Hong Kong was almost fixed. The depreciation of Macao and Hong Kong dollars might increase the willingness of tourists to travel to Macao and Hong Kong since the cost of expenditure on travel decreased. However, the coefficient of exchange rate was not so significant in Macao and Hong Kong. The effect of number of tourist arrivals was negative on itself in both Macao and Hong Kong. The sizes of Hong Kong and Macao are small. The attraction of sight-seeing in Macao and Hong Kong is weaker than other Asian countries, i.e. Mainland China, Japan, and Taiwan. Therefore, tourists once travel to Macao and Hong Kong might not come again in a short-term. Therefore, the lagged number of tourist arrivals had negative impact on itself.

In summary, in recent decades, there are three major crises affect Macao and Hong Kong. Including weather crisis, economic crisis and health related crisis, they all had negative impact on the tourism industry in Macao and Hong Kong. Overall, the health related crisis had the largest negative impact, since the safety was the first priority to tourists. Weather crisis might also relate to the safety of the city. Fortunately, Macao and Hong Kong did not experience any extreme weather crisis, i.e. 2008 Sichuan earthquake, 3.11 earthquake and tsunami in Japan. However, the typhoon Hato also had negative effect on the tourism industry in Macao. The severity of weather crisis should be aware. As mentioned in Novelli et al. (2018) and Charfeddine and Goaied (2019), the tourism crisis management was very important for the tourism industry. Government should develop a complete system including the crisis prevention and planning, strategic implementation, resolution, evaluation and feedback (see Novelli et al., 2018 for more details). The anti-crisis communication policy was critical to quickly recover the tourist confidence during and after the crisis. The negative income effect in Hong Kong to some extent reflected the uniqueness and the advantages of gambling industry in Macao. The tourism industry between Macao and Hong Kong should be competing but also complementary.

6. Conclusion and suggestions

This paper studies the tourist demand in Macao and Hong Kong, as well as the effect of crisis events on tourism industry. In addition, we investigate the impact of the gambling industry on the number of tourist arrivals in Macao and Hong Kong. We find that tourist income, tourist prices, lagged number of tourist arrivals affect the tourist demand in Macao and Hong Kong. SARS, subprime mortgage crises have negative and statistically significant effect on the number of tourist arrivals in Macao and Hong Kong, but the typhoon Hato is only statistical significance in Macao.

Safety is the first priority when tourists planned their tours. SARS is a highly contagious disease. In Hong Kong, 286 people died. Tourists avoided travelling to Macao and Hong Kong to prevent infection from SARS. Therefore, SARS had the largest impact on the number of tourist arrivals in both Macao and Hong Kong among three crisis events. This paper also finds that the coefficient of the dummy variable of SARS is the most negative.

The subprime mortgage crisis in 2008 was a global financial crisis. It caused large economic losses in many countries. The size of this crisis was much bigger than the Asian financial crisis in 1997. People lost their life time savings and/or wealth. Some people even lost their jobs. The high uncertainty of economic environment discouraged people to travel. Therefore, we find that the subprime mortgage crisis had negative and statistically significant effect on the number of tourist arrivals in both Macao and Hong Kong.

Hato is a strongest typhoon in Macao and Hong Kong in five decades. It caused 12 deaths in Macao. Many public facilities were damaged. Electricity and water supply were halted. It strongly affected the tourism industry in Macao but the damage to Hong Kong was relatively small. Therefore, we find that typhoon Hato had negative and

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[17] The results find that only the income became positive and insignificant, other coefficients remain the same signs. The results are available upon request to authors.
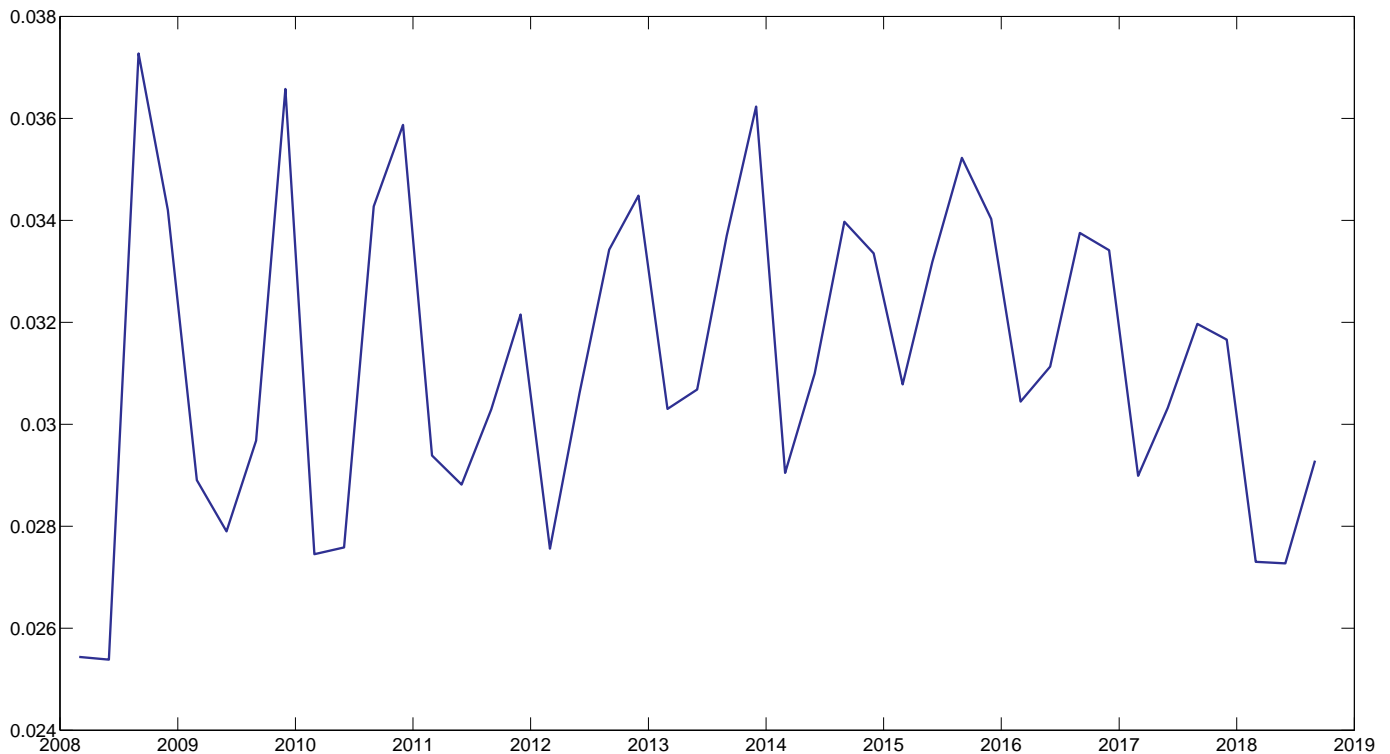
Fig. 6. The ratio of the number of tourist arrivals from Macao to Hong Kong over the number of outbound tourists in Macao.

statistically significant effect on the number of tourist arrivals in Macao but not in Hong Kong.

Macao and Hong Kong are very close in geographic locations but they have different characteristics. The gambling industry in Macao is the most attractive element for tourists. Casinos and other grand facilities attract tourists to come to Macao, especially for high-income tourists. Hong Kong is a famous shopping paradise. Tourists can easily buy consumer goods with many famous brands. Because of their different characteristics, this paper finds that tourist income had different effect on the number of tourist arrivals in Macao and Hong Kong.

The tourist income had positive and statistically significant effect on the number of tourist arrivals in Macao but negative to Hong Kong. The gross gambling revenue per tourist increased sharply from 2006 in Macao. Each tourist on average will generate around MOP15,000 gross gambling revenue at the peak of 2013. It revealed that tourists spent more money on gambling in Macao. In other words, more high-income tourists chose Macao as their destination because of gambling. Tourists with more income seemed to increase their willingness to travel to Macao rather than Hong Kong. However, the gambling industry was not the only reason for the negative income effect in Hong Kong. We find that the unique geographic location between Macao, Hong Kong and Mainland China and the relationship between opaque VIP services and the corruption of corporate and public officials from Mainland China were critical to this negative income effect in Hong Kong. Moreover, many Macao people became rich after the fast expansion of the gambling industry, so they became more likely to travel to other countries. Therefore, the number of tourists from Macao to Hong Kong would be diverged. It will be fruitful for future study to examine the impacts of terrorism on tourism, especially using samples from the emerging countries that have started to use tourism to jump start their economies and to increase employment and decrease poverty. Policies and strategies are badly needed to help these countries recover.

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