Modelling Tourism Demand in Macau: A Panel Analysis

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Abstract: This study aims to examine the determinants affecting tourism demand in Macau. Macau is highly dependent on the tourism and gambling industry, and its economic activities are almost fully controlled by these industries. To ensure the sustainable growth of the tourism industry in Macau, it is crucial to identify the factors influencing its tourism demand. A panel regression covering quarterly data of ten major tourist-generating countries from 2010Q1 to 2019Q4 has been employed in this study. The selected determinants include income level of origin countries, transportation cost, and exchange rate. The empirical results from the fully modified ordinary least square (FMOLS) and dynamic ordinary least square (DOLS) models clearly showed that the income levels in origin countries and exchange rate significantly affect tourism demand in Macau. Income level is positively related to tourism demand while the exchange rate adversely affects tourism demand in Macau. Transportation cost, interestingly, is a statistically insignificant determinant for the Macau tourism demand. This is because majority of the tourists visiting Macau are from neighbouring countries such as China and Hong Kong, and thus the travel cost is not their main consideration when deciding to travel. The empirical findings of this study validated the linkage among income level, exchange rate, and transportation cost on tourism demand in Macau. This study is useful for the government and key industry players to design strategic tourism plans for sustainable growth of the tourism industry in Macau.

1. INTRODUCTION

Macau is the Special Administrative Region (SAR) of China that is governed under the "One Country, Two Systems" policy with restricted autonomy in its own authorities and economic activities. With a population of 679,600 people in 2019, Macau is located across the Pearl River Delta from Hong Kong, at the South Coast of China (Statistics & Census Service (DSEC), 2020a). Approximately 90% of the population is made up of Chinese people despite formerly being a Portuguese colony until 1999. According to the World Population Review (2020), Macau is the most densely populated country in the world with 21,055 people per square kilometres. Currently, Macau is the renowned "Monte Carlo of the East" or "Gambling capital of the world", as it is the only location in China where gambling is legalized.

Since the 1850s, Macau has transformed its economy from an industrial-based economy to a service-based economy. The tourism industry has since been strongly developed by the government and part of it is through the legalization of gambling in Macau. According to World Travel and Tourism Council (WTTC) (2020a), the world tourism industry contributed 10.3% to the global gross domestic product (GDP) in 2019. Macau is a highly tourism dependent country, a total of 91.3% (USD48.9 billion) of Macau's GDP was

generated from the tourism and gambling industry in 2019. For the gambling industry itself, Macau has earned USD36.7 billion from gaming revenue and approximately USD13.0 billion from gaming taxes revenue. In addition, the tourism industry has created 253,700 jobs or 65.5% of total employment in Macau (WTTC, 2020b). It is noticeable that Macau's economy is heavily dependent on the tourism industry as the focal engine for economic growth and development.

Aside from its gambling avenue, Macau is also well-known for its rich historical and cultural heritage. Fig. (**1**) shows the number of tourist arrivals alongside gaming revenue received by Macau from 2010 through 2019. The figure reveals a steady growth in the number of tourists visiting to Macau from 2010 to 2019. The gambling industry has performed well, and its performance peaked in 2013. It began to decline in 2014 (-4.8%) due to casino concession liberalization in China the year before. In 2015, it further declined by 63.9% and then another 4.2% in 2016. The gambling industry clearly gained some recovery in 2017, so as Macau's number of tourists. Tourism has become a key source of foreign exchange earnings for many Asia Pacific countries and one of the most dynamic economic sectors in the world (Soh et al., 2021). Soh et al. (2019a) stated that the tourism sector is not spared from external shocks such as the political crisis and global financial crisis. These critical issues motivated the current study to identify the determinants affecting tourism demand in Macau.

In detail, Table **1** presents the top ten inbound tourist generating countries to Macau in 2019. Top of the list are China

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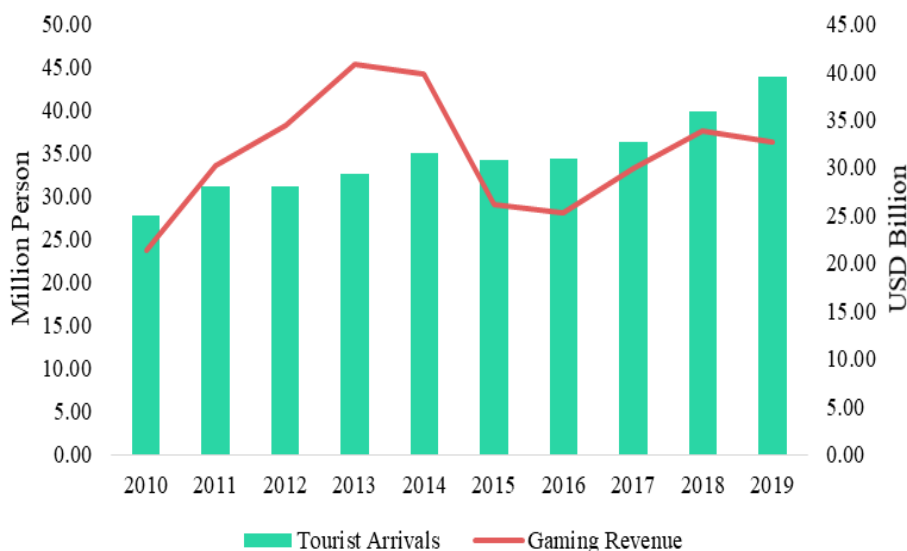
Fig. (1). Total Tourist Arrivals and Gambling Revenue in Macau, 2010-2019.

Source: CEIC & DSEC, 2020b.

and Hong Kong tourists, which accounted for 35.3 million (89.6%) of total tourist arrivals in 2019. This indicates that the Macau tourism industry is too reliant on tourists from China and Hong Kong, which poses a great challenge for long-term sustainable growth. The other main tourist generating countries include Taiwan (2.7%), South Korea (1.9%), Philippines (1.1%), Japan (0.8%), Malaysia (0.5%), United States (0.5%), Indonesia (0.4%) and Thailand (0.4%). These ten major countries contributed 97.9% of total international tourist arrivals received by Macau, indicating their significant role in tourism development.

Table 1. Top Ten Inbound Tourist Generating Countries to Macau, 2019.

Country	Tourist Arrivals (Person)	Percentage Contribution (%)
China	27,923,219	70.9
Hong Kong	7,354,094	18.7
Taiwan	1,063,355	2.7
South Korea	743,026	1.9
Philippines	423,106	1.1
Japan	295,783	0.8
Malaysia	206,277	0.5
United States	199,800	0.5
Indonesia	169,957	0.4
Thailand	151,521	0.4

Source: DSEC, 2020c.

With the significant performance of the tourism industry, Macau, a tiny island with 115.3 km² of land area, received over 38 million international tourists in 2019. This has led to

over tourism and posed one of the greatest challenges for sustainable growth of the tourism industry in Macau. Both over-reliance on tourism and over tourism have been great motivations to this in-depth study. The benefits of this study are two-fold. First, the outcome of this study aids in the designation of tourism policy to efficiently boost the tourism sector in Macau. This allows the Macau government to allocate and utilize the right resources in resolving overcrowding and carrying capacity issues. Besides that, it sheds light on other economic sectors that Macau can invest in to reduce reliance on the tourism industry.

2. LITERATURE REVIEW

In the existing literature, Li et al. (2005), Song and Li (2008), and Jong (2020) reviewed numerous studies in the tourism field. They concluded that tourist arrivals are the leading measurement to proxy the tourism demand and subsequently tourism receipts. Previous studies that utilized tourist arrivals to measure tourism demand include Seetanah et al. (2010), Puah et al. (2014), Thien et al. (2015), Tanjung et al. (2016), Puah et al. (2018), Shahbaz et al. (2018), Soh et al. (2019b), Jong et al. (2020), and Santamaría (2021). Besides that, Divisekera (2003), Andraz and Rodrigues (2016), and Husein and Kara (2020) used tourism receipts to proxy tourism demand.

The choice of determinants in gauging tourism demand generally consists of income variables and price variables. This is because tourism demand studies are supported by the consumer demand theory that is associated with income and price level (Botti et al., 2007). The income variable can be presented as GDP, GDP per capita, or real GDP to represent tourist's income level. Kum et al. (2015), Kaplan and Aktas (2016), Puah et al. (2018), Puah et al. (2019), Soh et al. (2019c), Lee et al. (2021), and Sharma and Khanna (2021) utilized income level in their studies to analyse the dynamic relationship between income level and tourism demand. Their empirical outcomes are evident of a positive associa-

tion between tourist's income and tourism demand. Despite that, some previous literature such as Dogru et al. (2017) argued that income is not a significant factor affecting tourism demand.

Transportation cost is another price variable that captures the cost spent by the tourists throughout their trip including airfare, cost of public and private transportation. Several studies such as Munoz (2006), Salleh et al. (2008), and Jong et al. (2020) have utilized crude oil prices to proxy travel expenses. The monitoring of crude oil prices is a crucial aspect that must be considered when making decisions since it is strongly tied to foreign direct investment, the stability of the local market share, and the competitiveness of a market's prices (Soh et al., 2022). Despite that, Leitao (2010), Seetanah et al. (2010), and McKercher and Mak (2019) have used distance to represent transportation costs between South Africa and the origin countries and concluded that travel distance adversely influences tourist arrivals in South Africa. Other studies such as Lim (1997), Khadaroo and Seetanah (2007), Chaiboonsri et al. (2010), Thien et al. (2015), and Puah et al. (2018) also reported a negative relationship between transportation cost and tourism demand. This shows that travel distance does influence travel intention, causing tourists to choose nearer destinations.

According to Puah et al. (2019), exchange rate may be utilized as a component integrated with the computation of tourism prices or can be included as an independent variable in the tourism demand model. Lee et al. (2021) also mentioned that the exchange rate is used to measure the relative price differences between the home country and origin country. Often, exchange rate is used in measuring tourists' intention to travel abroad. Studies by Lim (1997), Chaitip and Chaiboonsri (2009), Dogru et al. (2017), Puah et al. (2018), Lee et al. (2021) and Nguyen and Nguyen (2021) have used exchange rate as one of the independent variables and confirmed that it is a significant factor in estimating tourism demand. Prior to the work of Thien et al. (2015), Puah et al. (2018), and Jong et al. (2020) detected a negative relationship between exchange rate and tourism demand. On the contrary, the study by Chaiboonsri et al. (2010) indicated that the destination's currency has positive impact on tourist arrivals, in which appreciation of tourist country's currency improved the spending power of tourists and motivated them to travel. Therefore, exchange rate has been chosen as another key determinant in modelling tourism demand model in Macau.

3. METHODOLOGY

To identify the determinants affecting tourism demand in Macau, a balanced panel data covering ten major tourist origin countries from the period of 2010Q1 to 2019Q4 was used in this study. These countries accounted 97.9% of total international tourist arrivals in Macau. The dependent variable is the number of international tourist arrivals (TA) to proxy tourism demand in this study. The selected key determinants include income per capita of the tourists (GDPPC), transportation cost (TC), and exchange rate (EXC).

Table 2. Data Description.

Proxy	Variables	Variable's Description	Data Source
TA	International Tourist Arrivals	The top ten international tourist arrivals to Macau SAR in person.	DSEC
GDPPC	Gross Domestic Product per Capita	GDP divided by population	CEIC
TC	Transportation Cost	International Crude Oil Price	World Bank Data
EXC	Exchange Rate	Currency of foreign currency per Macau's currency (MOP)	CEIC

Equation 1 shows the empirical function for tourism demand in Macau.

$$TA = f(GDPPC, TC, EXC) \tag{1}$$

For the estimation purpose, the empirical function in Equation 1 has been transformed into logarithm form as expressed as follows:

$$logTA_{ijt} = \beta_0 + \beta_1 logGDPPC_{ijt} + \beta_2 logTC_{ijt}$$
$$+ \beta_3 logEXC_{ijt} + \varepsilon_{ijt} \tag{2}$$

Under panel cointegration tests, panel unit root test is required prior to cointegration tests to identify the order of integration. This is to ensure all the variables are stationary at $I(1)$ and there are no $I(2)$ variables in this model. The panel unit root tests employed under study are Fisher-Augmented Dickey and Fuller (ADF) (Maddala & Wu, 1999), and Im, Pesaran and Shin (IPS) (Im et al., 2003). After the confirmation of the stationarity level of the variables, the empirical model has been analysed using the panel cointegration approach introduced by Pedroni (1999) to detect the existence of long-run cointegration among the variables. There are seven panel cointegration tests which divided into two groups, namely the within-dimension (four cointegration tests that sum up the numerator and denominator terms) and between-dimension statistic (three tests that pool the data along the dimension of the panel).

Once it is confirmed that the variables are stationary at $I(1)$, then this study proceeded to the FMOLS estimator proposed by Saikkonen (1991) and further developed by Pedroni (2000). A simultaneous adoption is the DOLS estimator introduced by Stock and Watson (1993). The major advancement of both estimators is to solve the possibility of endogeneity arising from the parameters as well as the serial correlation problem from the stochastic term. By employing both estimators, the connection between tourism demand and the selected determinants can be identified for the tourism industry in Macau.

4. EMPIRICAL RESULTS AND DISCUSSION

Prior to performing panel cointegration tests, two panel unit root tests – ADF and IPS tests have been carried out to examine the stationarity level of the variables. Table **3** shows that all variables are stationary at $I(1)$. Subsequently, we proceed to carrying out the cointegration tests introduced by Pedroni (1999). The findings are evident of a long-run cointegration in the model for Macau since four out of seven panel cointegration tests are statistically significant at 1 percent level (see Table **4**).

Table 3. Panel Unit Root Test Results

Test Statistic		
Variable	**ADF**	**IPS**
Level		
LTA	17.62 (0.61)	0.75 (0.77)
LGDPPC	21.37 (0.38)	0.66 (0.26)
LTC	11.97 (0.92)	0.43 (0.67)
LEXC	16.83 (0.53)	0.01 (0.49)
First Difference		
LTA	426.94 (0.00) ***	18.61 (0.00) ***
LGDPPC	35.96 (0.02) **	1.56 (0.06) *
LTC	206.44 (0.00) ***	16.01 (0.00) ***
LEXC	203.11 (0.00) ***	15.75 (0.00) ***

Notes: Asterisks (***), (**), and (*) indicate the significant level at 1 percent, 5 percent, and 10 percent, respectively.

Table 4. Panel Cointegration Test Results.

Within group	*t*-Statistic	Probability
Panel v-Statistic	-1.56	0.94
Panel rho-Statistic	-6.92	0.00***
Panel PP-Statistic	-15.87	0.00***
Panel ADF-Statistic	-7.78	0.22
Between group		
Group rho-Statistic	-4.45	0.00***
Group PP-Statistic	-16.55	0.00***
Group ADF-Statistic	-0.35	0.64

Notes: Asterisks (***) indicates the significant level at 1 percent.

The confirmation of a long-run equilibrium through the cointegration tests enabled us to further determine the dynamic relationship between the variables through FMOLS and DOLS estimators. Table 5 presents the empirical outcome of FMOLS and DOLS tests. Both estimation results consistently suggested that the LGDPPC and LEXC are statistically significant affecting tourism demand in Macau. However, LTC is not a significant factor in this study. As expected, a positive association was detected for LGDPPC and an ad-

verse relationship for LEXC for tourism demand in Macau. Both FMOLS and DOLS have almost similar findings whereby 1% increase in tourists' income has increased the tourism demand in Macau by 0.63% and 0.65%, respectively. This shows that tourists tend to travel to Macau when their income level is higher. Consistently, Thien et al. (2015), Puah et al. (2018), and Puah et al. (2019) have also reported this same phenomenon for other countries.

The exchange rate has a negative impact on tourist arrival in Macau. The appreciation (depreciation) of the exchange rate indicates that the currency of the tourists' home country has depreciated (appreciated) against MOP and this discourages (encourages) them to travel to Macau because it has become relatively expensive. The findings of FMOLS and DOLS showed that 1% of appreciation in exchange rate discourages 0.57% and 0.55% of tourists to travel to Macau, respectively (see Table **5**).

An interesting finding from this study is that the transportation cost is not an influential factor affecting tourist's travel decisions to Macau. This finding contradicts to most existing studies. Studies done by Dritsakis (2004), Puah et al. (2018), and Jong et al. (2020) suggested that transportation cost is a significant determinant and adversely affects tourism demand. In this study, transportation cost is not a significant variable because most of the tourist arrivals received by Macau are from neighbouring countries or short-haul tourists. In 2019, 92.3% of tourist arrivals in Macau were from Mainland China, Hong Kong, and Taiwan. These countries are near to Macau and thus, rendered transportation cost as an unimportant determinant.

Table 5. Estimated Results for FMOLS and DOLS Models.

FMOLS				
Independent Variables	**Coefficient**	**Standard Error**	***t*-Statistic**	**Probability**
LGDPPC	0.63	0.12	4.98	(0.00)***
LTC	-0.04	0.06	-0.69	(0.49)
LEXC	-0.57	0.18	-3.17	(0.00)***
DOLS				
LGDPPC	0.65	0.16	3.97	(0.00)***
LTC	-0.05	0.07	-0.69	(0.49)
LEXC	-0.55	0.23	-2.44	(0.02)**

Notes: Asterisks (***) and (**) indicate the significant level at 1 percent and 5 percent, respectively.

5. CONCLUSION

This study empirically investigated the determinants affecting tourism demand in Macau. A quarterly data spanning from 2010Q1 to 2019Q4 have been utilized in this study. In this study, the dependent variable is the number of top ten international tourist arrivals to Macau. Meanwhile, the selected independent variables are income per capita of the tourists, transportation cost, and exchange rate. Prior to the panel cointegration tests, the panel unit tests have been con-

ducted to check for the stationarity properties of the data. The empirical results of the panel unit root tests (ADF and IPS) showed that all the variables are stationary at first difference. Then, we proceed to the panel cointegration tests, and the findings indicated the existence of a long-run relationship in the model. This allowed the adoption of the FMOLS and DOLS models to investigate the dynamic relationship between the variables.

The empirical findings showed that income level and exchange rate are statistically significant in influencing tourism demand in Macau. The income level is positively associated with the tourism demand since it increases the purchasing power and willingness to travel abroad. On the contrary, exchange rate is negatively affecting tourism demand in Macau. An appreciation in exchange rate means that Macau has become relatively more expensive than their home country and this suppresses their willingness to travel to Macau. This is explained as an increase in the tourism price in a country that will ultimately reduce the number of international inbound tourists to the country (Santamaría, 2021).

Interestingly, transportation cost is not a significant determinant in affecting the tourism demand in Macau. This is because most tourists travel to Macau are from neighbouring countries such as China, Hong Kong, and Taiwan. Therefore, the transportation cost is not their main concern to travel to Macau. Moreover, this finding might reflect the fact that majority of the visitors to Macau are not overnight visitors (Law et al., 2019). The strong outbound of China and Hong Kong tourists poses the greatest challenge for Macau to receive such huge volume of tourists with small land size. The recent COVID-19 pandemic has caused all countries to implement movement restrictions to break the chain of infection for approximately two years. This movement restriction has undoubtedly affected the local economic structure but also lessened the problem of over tourism in Macau. Thus, further research on pre-crisis, mid-crisis, and post-crisis economics is equally crucial on the road to recovery and restart for future tourism growth and development plans.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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