Modelling and Forecasting International Tourist Arrivals to Mainland China

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Abstract:

The general-to-specific modelling approach is used to forecast tourist flows to mainland China from eight major origin countries/regions over the period 2006-2015. The existing literature shows that the general-to-specific methodology is a useful tool in modelling and forecasting tourism demand at the destination level. With the aid of econometric models, the factors which contribute to the demand for mainland China tourism have been identified. Empirical results reveal that the most important factor that determines the demand for mainland China tourism is the economic condition in the origin countries/regions. The "word of mouth" effect, the costs of tourism in mainland China and the price of tourism in the competing destinations also have noticeable influence on the demand for mainland China tourism. The generated forecasts suggest that mainland China will face increasing tourism demand by residents from all the origin countries/regions concerned while the growth rate of tourist arrivals from Korea is the most significant one. The demand elasticities and the forecasts of tourist arrivals obtained from the demand models form the basis of policy formulation for the tourism industry in mainland China.

Key words: Tourism demand, elasticity, econometric modelling, forecasting

1. Introduction

Due to its vast territory and extensive mystery, its civilization of over 5,000 years and numerous places of attraction, mainland China has experienced a spectacular growth in inbound tourism since the start of its open-door policy in 1978 and has fast become one of the world's top players in tourism. During the last 20-odd years, tourism industry in mainland China has been one of the fastest-growing industries in the national economy and one of the most significant foreign currency earners (China Knowledge Press, 2004).

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In 1978, mainland China only received about 1.81 million international tourists and merely made an income of US$2.63 billion. In 2005, international tourism arrivals in mainland China increased to 102.29 million, which was 56 times more than that in 1978, and mainland China was the fourth most popular tourist destination in the world (World Tourism Organization [UNWTO], 2006). The World Tourism Organization has projected that mainland China will be the top tourism destination in the world by 2020 (UNWTO, 2003). International tourism receipt in 2005 reached US$29.29 billion, which was 11 times more than that in 1978, ranked number six in the world (UNWTO, 2006). The majority of international visitors (about 83.16%) are compatriots from Hong Kong, Macao and Taiwan. Foreign visitors exceeded 20 million for the first time in history in 2005 and showed an impressive increase of 19.62% from 2004 (CNTA, 2006). Japan has been the biggest source market for mainland China's inbound tourism during the period 1978-2005, accounting for about 20% of the total market followed by South Korea, USA, Australia, Canada, and several western countries that have shown increasing interest in travelling to mainland China recently.

Mainland China's tourism industry faced big challenges during the financial crisis in 1997 and the SARS epidemic in 2003. For example, the total number of tourist arrivals dropped by 6.4% (6.25 million) due to SARS resulting in a substantial decline of tourist receipt of 14.7% (US$2.99 billion). This shows that the industry is vulnerable to external shocks. Tourism practitioners including policymakers and recreation facilities providers need to know how the industry is impacted by the influencing factors. In addition, for planning and investment purposes, accurate forecasts of the future trend of the international tourism demand in mainland China are important. Now that the country is currently expecting a growth in inbound demand on account of its deepening reform and success in hosting the Olympics in Beijing in the year 2008, the need for accurate inbound tourism forecasts is even more imperative.

However, against this background, the studies on the demand for mainland China tourism have been limited, especially by quantitative analysis (Kulendran & Shan, 2002). Even fewer attempts have been made to forecast China's inbound tourism (Turner & Witt, 2000). This is particularly true when econometric methods are considered. In this connection, one main contribution of this paper is that it employs the general-to-specific methodology to analyze the demand for mainland China tourism. In achieving this, we have identified the key factors that contribute to the demand for mainland China tourism and established the dynamic econometric models to account for the effect of these factors on tourists' choice of mainland China as a destination. Another main contribution of this paper is the generation of the forecasts of tourist arrivals to mainland China for the period of 2006-2015 with the aid of the estimated econometric models.

The rest of this paper is organized as follows. Section 2 reviews recent publications in the area of tourism modelling and forecasting, which provides the rationale for using the chosen research methodology for this study. Section 3 presents the models employed in this research for the analysis of demand for mainland China tourism and explains the data used for the estimation of these models. Section 4 contains empirical estimates of the inbound demand models. The forecasts of tourist arrivals in mainland China for the period 2006-2015 are generated based on the estimated models in Section 5 and Section 6 concludes the study.

2. Literature Review

It has been widely acknowledged that reliable tourism demand forecasts are important for government and business for tourism planning, investment decision and policy formulation (Artus, 1972; Frechtling, 1996; Loeb, 1982; Song & Witt, 2006; Wong & Song, 2002). For example, public and private tourism sectors require meaningful estimates of tourism demand in order to ensure efficient allocation of scarce resources, and demand elasticities provide useful information on the comparative advantages of tourism in product diversification (Quayson & Var, 1982). Since the beginning of the 1960s, extensive studies have been carried out on tourism demand forecasts through either qualitative approaches or quantitative approaches. The focus of this study is, however, on quantitative forecasting methods.

Generally speaking, the existing literature on tourism demand analysis using quantitative approaches falls into two major groups: i) non-causal (mainly time-series) methods, which extrapolate historic trends of tourism demand into the future without considering the underlining causes of the trends, and ii) casual (econometric) methods, which use regression analysis to estimate the quantitative relationship between tourism demand and its determinants. Whilst the non-causal time-series approaches are useful tools for tourism demand forecasting, a major limitation of these methods is that they cannot be used for policy evaluation purpose. As pointed out by Song, Wong, and Chon (2003), econometric models (which are mainly causal models) are superior to the time-series approaches for the reason that econometric models are carefully constructed based on economic theory and therefore can be used for policy evaluation. As a result, a large body of literature has been published on tourism demand forecasting using econometric techniques (e.g. Crouch, Schultz, & Valerio, 1992; Hiemstra & Wong, 2002; Kulendran & King, 1997; Morley, 1994; Smeral & Weber, 2000; Smeral, Witt, & Witt, 1992; Song & Witt, 2000; Song, Witt, & Jensen, 2003; Tan, McCahon, & Miller, 2002; Witt & Witt, 1992). Li, Song, and Witt (2005) provided a comprehensive review of these studies. In this paper, considerable attention is devoted to the econometric methodology.

Tourism demand normally refers to the demand for tourism-oriented products such as accommodation, food service, transportation, etc., and is usually measured by tourist arrivals, tourist expenditures, average length of stay, bed occupancy or activities engaged in the visit, etc. Tourist arrivals are the most frequently used measure for tourism demand modelling and usually analyzed by country of residence (nationality) or by purpose of visit. Lim (1997a) studied 100 empirical tourism research works up to 1994 and found 51of them used tourist arrivals as dependent variable followed by tourist expenditure (49) in real or nominal terms. In a more recent literature survey, Li et al. (2005) pointed out that amongst the 84 selected studies published since 1990, 53 of them used tourist arrivals as the dependent variable and only 16 employed tourist expenditure as the dependent variable.

Although tourism demand could be affected by a wide range of factors such as economic, attitudinal and political factors, the majority of studies focus on economic factors to obtain a satisfactory explanation. In this context, income in the origin country/region is regarded as one of the most influential factors that has a positive effect on tourism demand. In cases where income is not included in a model, there is usually some form of aggregated expenditure variable in its place (Witt & Witt, 1995). Crouch (1994) revealed that the income is the most important explanatory variable, and income elasticity generally exceeds unity but below 2.0, which implies that international travel is a luxury good. A considerable diversity of income variables had been used in tourism demand analysis over the past four decades. Edwards (1988, 1991) argued that increases in real disposable income, defined as the income after tax and after necessities (food, clothing, housing, etc.) have been paid for among those population prone to take long haul holidays aboard, cause the demand for tourism to increase. Lim and McAleer (2002) compared the explanatory power of real Gross Domestic Product (GDP) and real private consumption expenditure in modelling tourist arrivals to Australia from Malaysia. Moreover, Gross National Product (GNP) and Gross National Income (GNI) were also used as alternative income variables in a number of studies on business travel or combination of business travel and leisure travel. As pointed out by Song, Romilly, and Liu (2000), Kulendran and Witt (2001), and Turner and Witt (2005), real personal disposable income (PDI) were the most appropriate proxy to be included in the demand models concerning holidays or visiting friends and relatives (VFR). If attention focuses on business visit, then a more general income variable (such as national income) should be used. Additionally, Gonzalez and Moral (1995) and Song, Witt, et al. (2003) made innovative attempts in tourism modelling to use private consumption expenditure and industrial production index, respectively.

Economic theory indicates that prices also play an important role in determining tourism demand, as tourism demand can be interpreted as the demand for specific tourism goods and facilities. It is clear that the prices should include the prices of goods and facilities relating to both tourism destination and substitution destinations. However, the price variables are normally difficult to determine because of the enormous diversity of the products purchased by tourists. Edwards (1988) summarized the methods used to establish these proxies of prices variables. Tourism demand analysis in the 1960s and 1970s usually defined the price variable as a ratio of price indexes in the destination to a weighted price index in the origin country and substitute destinations. In recent demand studies, the impact of prices on the tourism demand is usually considered by two separate price variables: the own price of tourism and the substitute prices in alternative destinations.

The own price of tourism is defined as the relative cost of travelling abroad to domestic travel and it includes two components: the cost of living for tourist at the destination and the travel cost to the destination. Due to potential multi-colinearity problems and difficulties in obtaining reliable data, the cost of the travelling to the destination have been omitted in most of the studies with some exceptions, such as Ledesma-Rodríguez, Navarro-Ibáñez, and Pérez-Rodríguez (2001), who included such cost in their models by employing oil or gasoline costs as a proxy of travel costs. The cost of living in destination consists of two components. One is the relative price of tourism in the destination to that of the origin country/region, which evaluates the real expenditure at destination. The other is the relative exchange rate between the origin country/region and the destination. Normally, tourists are more aware of exchange rate than the living cost in destination. As Song and Witt (2006) stated, an exchange rate in favour of the origin country's currency would result in more tourists visiting the destination from the origin country. The specific results of the empirical study (Witt & Martin, 1987b) indicated that the consumer price index (CPI, either alone or together with the exchange rate) is a reasonable proxy for the cost of living while exchange rate on its own, however, is not an acceptable one. The own price could be calculated as an exchange rate adjusted price index by dividing the relative CPI index between the destination and origin countries/regions by relative exchange rate between those two countries. The justification for this method is that the level of price in the destination may work against beneficial exchange rates.

The influence of substitute prices on tourism demand is less apparent than own price of tourism. According to the review article by Lim (1997a), less than 10 of the 100 studies published before 1990 included substitute prices in the demand models. However, over the past 15 years, 37 of 84 studies incorporated the substitute price as an independent variable (Li et al., 2005) in tourism demand research. Martin and Witt (1988) calculated the substitute price based on a weighted average index where the weights were determined by the market shares of the competing destinations, and the weights were allowed to change over the estimation period to cater for changing trends. Their empirical results support the hypothesis that substitute prices play an important role in determining the demand for international tourism, but there is considerable variation in importance according to the origin-destination pairs and travel mode. So far, there are two forms of substitute prices that have been adopted. One allows for the substitution between the destination and a number of competing destinations separately (Kim & Song, 1998). The other one calculates the cost of tourism in the destination under consideration relative to the costs of living in the competing destinations, and this relative price is also adjusted by relevant exchange rates. The cost of living of the competing destinations is calculated as a weighted index with the weight being the market share (arrivals or expenditures) of each competing destination under consideration (Song & Witt, 2000). This substitute price variable has been frequently used in recent empirical studies.

In addition to the variables mentioned above, marketing expenditure, consumer taste, consumer expectations and habit persistence, population and one-off events, are also potentially important factors that could be incorporated in tourism demand models (Song & Witt, 2000). Marketing expenditure can play an important role in inbound tourism demand, as promotions are normally conducted to increase the attractiveness of the tourism destination where tourism is a major industry in the economy. Crouch et al. (1992) estimated the impact of international marketing activities of Australian Tourist Commission on tourist arrivals and the results show that the marketing variable is significant in the empirical models of their study. Only a small number of studies, with the exceptions of Crouch et al., Dritsakis and Athanasiadis (2000), Law (2000), have included the marketing expenditure variable in their empirical analyses because of the unavailability of the marketing expenditure data.

Witt and Martin (1987a) discussed that the time trend represents tourists' taste change as well as population increases. The lagged dependent variable describes tourists' expectations, habit persistence, "word of mouth" effect and tourism product supply constraints. The problem of including the time trend and lagged dependent variables in tourism demand analysis is that we cannot locate exactly which factor the model really captures. Lagged explanatory variables are also included in the demand model to capture the dynamic effect (Lim, 1997).

Zhang, Wei, and Liu (2004) studied the demand for tourism in mainland China by taking account of the influence of the political system, macroeconomic policies, the forthcoming Olympic Games and other influential factors using the qualitative approach. However, very little attention has been paid to the quantitative analysis of demand for mainland China tourism over the past decades. Wang and Zeng (2001) and Wu, Ge, and Yang (2002) introduced the possibility of using artificial neural network (ANN) in inbound tourism analysis without any support of empirical evidence. Yin, Hu, and Qiu (2004) applied the support vector machine (SVM) model in Yunnan tourism demand data. The only noteworthy studies on mainland China tourism demand are Kulendran and Shan (2002) and Turner and Witt (2000). The former examined mainland China's monthly inbound travel demand using the conventional seasonal autoregressive moving average (ARMA) model. The latter used a technique known as structural integrated time-series econometric analysis (SITEA) by combining both time-series and econometric methodologies to forecast inbound tourism to mainland China. The SITEA approach is a specific-to-general modelling approach, which starts with a relatively simple model. The simple model is then expanded to include causal variables if the simple model does not perform well. As a result, the final model used for forecasting could be very complex.

An alternative modelling approach is known as general-to-specific approach[1]. This methodology was originally proposed by Davidson, Hendry, Saba, and Yeo (1978) and subsequently modified by Hendry and von Ungern-Sternberg (1981) and Mizon and Richard (1986). Full development of the general-to-specific modelling approach has only taken place recently, coupled with the development of co-integration and error correction methodologies (ECM) (Hendry, 1995). The general dynamic autoregressive distributed lag model (ADLM) encompasses a number of specific models (simple autoregressive, static, growth rate, leading indicator, partial adjustment, finite distributed lag, dead start, and error correction) and the general model can be reduced to one of the specific models by imposing certain restrictions on the parameters in the model. On the basis of various restriction tests and diagnostic statistics, the final models could be selected and used for forecasting and policy evaluation purpose.

[1] Detail is discussed in Song & Witt, "Tourism Demand Modelling and Forecasting", 2000, pp. 28-51.

3. The Model

This section deals with the issues related to the model specification. In this study the general-to-specific model is used to forecast the demand for mainland China tourism by tourists from eight major origin countries/regions. The majority of international visitors in mainland China are compatriots. Statistics published by CNTA show that tourists from Hong Kong and Taiwan accounted for about 61.77% of the total tourist arrivals in mainland China in 2005. In terms of the foreign visitors, statistics in the same year show that the followings are the major tourism origin countries: Japan (16.74%), Korea (17.5%), UK (2.47%), USA (7.68%), Australia (2.38%) and Canada (2.12%). One reason why this approach is selected is that it has a clear strategy in model specification, estimation and selection, and therefore does not suffer from the extensive data-mining problem that is associated with many other modelling methodologies. Another advantage of this approach is that the general-to-specific method starts with a dynamic ADLM within which the ECM is embedded, the dynamic characteristics of demand behaviour are allowed for, and the spurious regression problem also can be overcome.

3.1 Determinants of tourism demand

As mentioned earlier, tourism demand in this study is measured by tourist arrivals from the major origin countries/regions. The economic conditions that are relevant for the demand for tourism include tourism prices in mainland China, the availability of and tourism prices for substitute destinations, and incomes of tourists in their home countries/regions. In this paper the following demand function is proposed to model the demand for mainland China tourism by residents from a particular origin country/region *i*:

$$TA_{it} = AY_{it}^{b_2} P_{it}^{b_3} P_{sit}^{b_4} e_{it} \quad (1)$$

where TA_{it} is the number of tourist arrivals in mainland China from origin country/region *i* at time *t*; Y_{it} is the income level of origin country/region *i* at time *t*; P_{it}, is the own price of tourism in mainland China for tourists in the origin country/region *i* at time *t*; P_{ist} is the substitute price at time *t*, and e_{it} is the random error and is used to capture the influence of all other factors that are not included in the demand model. The measurement issue and the sources of the variables included in the demand Eq. (1) are explained below.

The dependent variable TA_{it} is measured by the number of arrivals from a particular original country/region *i* in mainland China and the data were obtained from the *Tourism Statistical Yearbook* published by World Tourism Organization.

The income variable, Y_{it}, is income in origin country/region i measured by the index of real GDP, and was collected from *International Financial Statistics Yearbook* published by International Monetary Fund (IMF) for all countries/regions. The personal disposable income may be the best proxy to measure the income, but due to data unavailability and a large proportion of business travellers in tourist arrival data this proxy is not used in this study.

The definition of the own price variable in this study is

$$P_{it} = \frac{CPI_{cn} / EX_{cn}}{CPI_i / EX_i} \qquad (2)$$

where CPI_{cn} and CPI_i are the consumer price indexes for mainland China and origin country/region i, respectively; EX_{cn} and EX_i are the exchange rate indexes for mainland China and origin country/region i respectively. The exchange rate is the annual average market rate of the local currency against the US dollar.

The substitute price variable, P_{ist}, is defined as a weighted index of selected countries/regions. Both geographic and cultural characteristics are taken into account. Finally, Taiwan, Singapore, Thailand, South Korea and Hong Kong were considered in this study to be substitute destinations for mainland China.

$$P_{it} = \sum_{j=1}^{n} \frac{CPI_j}{EX_j} w_{ij} \qquad (3)$$

where j = 1, 2, 3, 4 and 5 representing Taiwan, Singapore, Thailand, South Korea and Hong Kong, respectively; w_{ij} is the share of international tourism arrivals for country/region j, which is calculated from $w_{ij} = TA_{ij} \Big/ \sum_{j=1}^{5} TA_{ij}$, and TA_{ij} is the inbound tourist arrivals of substitute destination j from origin country/region i.

3.2 Model specification

According to Song and Witt (2000), one major feature of the power function (Eq. (1)) is that it can be transformed into a log linear specification, which can be estimated easily using ordinary least squares (OLS). After taking logarithm of Eq. (1), we have

$$1nTA_{it} = b_1 + b_2 1nY_{it} + b_3 1nP_{it} + b_4 1nP_{ist} + \varepsilon_{ist} \qquad (4)$$

where $b_1 = 1nA$, $\varepsilon_{it} = 1ne_{it}$, and b_2, b_3 and b_4 are income, own price and cross price elasticities, respectively. We expect that $b_3 < 0$ (the price of tourism would have a negative influence on tourism demand) while b_2 and $b_4 > 0$ (the income level of the origin country/region and substitute price of tourism would have positive impacts on tourism demand). The above equation is a static model and does not take into account the dynamic issue of tourists' decision process. In order to capture the dynamic feature of tourism demand, a model specification known as ADLM is used in this study. With a lag length of 1, the simplest ADLM for Eq. (4) is given by Eq. (5).

$$1nTA_{it} = a_1+a_2 1nY_{it-1}+a_3 1nY_{it}+a_4 1nY_{it-1}+a_5 1nP_{it}+a_6 1nP_{it-1} +a_7 1nP_{ist}+a_8 1nP_{ist-1}+«_{is} \quad (5)$$

Extra attention should be placed on the coefficients in Eq. (5) which are definitely not demand elasticities while the coefficients b_2, b_3 and b_4 in Eq. (4) are. Some algebraic manipulations are needed to get the demand elasticities, as indicated by Song and Witt (2000). The long run demand function for Eq. (5) can be written as

$$1nQ_{it} = \frac{a_1}{(1-a_2)} + \frac{(a_3+a_4)}{(1-a_2)} 1nP_{it} + \frac{(a_5+a_6)}{(1-a_2)} 1nY_{it} + \frac{(a_7+a_8)}{(1-a_2)} 1nP_{it}^{s} \quad (6)$$

where $b_2 = \frac{(a_3+a_4)}{(1-a_2)}$, $b_3 = \frac{(a_5+a_6)}{(1-a_2)}$ and $b_4 = \frac{(a_7+a_8)}{(1-a_2)}$.

4. Estimates of the Demand Models

This section presents the empirical results from the estimation of the models discussed in Section 3. All models are estimated using annual data from 1985 to 2005. In estimating Eq. (5), a number of dummy variables were also included to capture the influence of one-off events on the demand for mainland China tourism. These dummy variables include: the Asian financial crisis in 1997, D_{97}, which takes a value of 1in 1997 and 0 otherwise; the 911 terrorism attack in 2001 in USA, D_{911}, which takes a value of 1 in 2001 and 0 otherwise; and the SARS in China in 2003, D_{SARS}, which takes a value of 1 in 2003 and 0 otherwise. Therefore, the initial ADLM now becomes

$$1nTA_{it} = a_1+a_2 1nTA_{it-1}+a_3 1nY_{it}+a_4 1nY_{it-1}+a_5 1nP_{it}+a_6 1nP_{it-1} +a_7 1nP_{is}^{s}+a_8 1nP_{ist-1}^{s}+a_9 D_{97}+a_{10} D_{911}+a_{11} D_{SARS}+e_{it} \quad (7)$$

OLS is employed to estimate model parameters.

Before the model estimation, the data were tested for unit roots and co-integration. Augmented Dickey Fuller (ADF) test and Johansen maximum likelihood procedure were used for this purpose. All the variables are found to be integrated of order 1 and at least one co-integration relationships are identified among the variables included the demand models. A model reduction procedure was followed to eliminate the unimportant variables which are either insignificant statistically or inconsistent with economic theory (i.e. their coefficients have wrong signs) in Eq. (7) for all the 8 origin countries/ regions. Table 1 presents the estimated final models for all origin countries/regions.

In general, all the models fit the data well with relative high adjusted R^2s ranging from between 0.936 to 0.995. Particularly, the results in Table 1 show that the lagged-dependent variable is significant in the Australia, Japan, Hong Kong and USA models. This suggests that the “word of mouth” effect and/or consumer persistence features importantly in the demand for mainland China tourism by tourists from these four origin countries/regions. This might explain why these four countries/regions are among the top five tourism generating countries/regions for mainland China. The income variable is significant in all but Japan and Hong Kong models suggesting that the income level of the origin country is an important determinant of international tourism demand in mainland China. The price of tourism and substitute price are only significant in 4 out of the 8 models suggesting that the price of tourism and cost of tourism in competing destinations are less important in influencing the demand for mainland China tourism compared with the income variable.

Table 1 Estimates of the demand models: the dependent variable is $LnTA_{it}$

Variable	AUS	CA	JP	KOR	HK	TW	UK	USA
C	-2.403*[a] (-3.844)	-2.086** (-1.974)	0.901 (1.069)	-8.215* (-14.970)	0.294 (0.594)	6.162* (13.600)	0.136 (0.112)	-0.153 (-0.194)
$LnTA_{it-1}$	0.717* (5.871)		0.946* (15.739)		0.988* (34.198)			0.437* (2.506)
LnP_{it}			-0.629 (-2.555)					-0.777 (-3.036)
LnP_{it-1}		-1.230* (-4.739)					-0.930* (-5.473)	-0.694* (-2.309)
LnY_t		7.735* (5.226)		4.841* (39.546)			2.714* (10.207)	1.729* (3.103)
LnY_{t-1}	1.324* 3.443	-4.634* (-3.146)				1.916* (17.967)		
LnP^S_t		-2.410* (-3.269)						-0.592* (-3.389)
LnP^S_{it-1}		2.860* (4.257)		1.316* (4.791)			0.392* (2.404)	
D_{97}				-0.234* (-2.208)				
D_{911}								
D_{SARS}	-0.384* (-3.063)			-0.191* (-1.869)			-0.257* (-2.433)	-0.460* (-4.765)
$\bar{R}^2$	0.973	0.978	0.936	0.995	0.984	0.944	0.973	0.979
AC[b]	-1.300	-1.365	-0.480	-1.702	-2.401	-0.623	-1.715	-1.832
SC[c]	-1.101	-1.066	-0.330	-1.461	-2.301	-0.524	-1.466	-1.483

Note: a: The figures in parenthesis are t-statistics; * and ** represents 5% and 10% significant levels respectively; b: Akaike info-criterion; c: Schwarz criterion.

The Asian financial crisis in 1997 seems to have had a negative impact on the demand for mainland China tourism. In particular, the financial crisis reduced tourism arrivals from South Korea and Hong Kong. The 911 event in the USA does not have any impact on the demand for mainland China tourism by residents from all 8 countries/regions. The SARS epidemic in 2003, had a significantly negative impact on the demand for mainland China tourism, specifically the SARS dummy is significant in the Australia, UK and USA models.

Based on the estimated demand models in Table 1, demand elasticities are derived and are presented in Table 2. The results show that Canada, USA, UK and Japan tourists seem very sensitive to the prices of tourism in mainland China, especially the own price elasticity in the Japan model is as low as -11.75. The demand for mainland China tourism by the UK residents is price inelastic while the tourists from Australia, Korea, Hong Kong and Taiwan seem do not pay much attention to tourism prices when they make travel decisions to mainland China. Ranging from 1.916 to 4.841, the income elasticities imply that a 1-percent increase (decrease) in real GDP in Australia, Canada, Korea, Taiwan, UK and USA would result in more than 1 percent increase in tourist arrivals in mainland China for these countries/region, given that other variables keep unchanged. Therefore, mainland China needs to accurately predict the business conditions associated with these 6 origin countries/regions in order to deal with the fluctuations in the demand for mainland China tourism. In addition, cross price elasticities show that tourists from Canada, Korea and UK are aware of the prices of tourism in the substitute destinations (substitute effect) while tourists from the USA tend to visit mainland China and the competing destinations on the same trip (complementary effect).

Table 2 Estimated demand elastictities

Country/Region	Own Price Elasticity	Income Elasticity	Cross Elasticity
Australia	—	4.675	—
Canada	-1.230	3.101	0.45
Japan	-11.751	—	—
Korea	—	4.841	1.316
Hong Kong	—	—	—
Taiwan	—	1.916	—
UK	-0.930	2.714	0.392
USA	-2.615	3.073	-1.052

In this study, the following diagnostic tests are carried out: the Breusch (1978) and Godfrey (1978) Lagrange multiplier chi-square test for serial correlation (CSQA), the White (1980) Chi-square test for heteroscedasticity (CSQH), the Jarque and Bera (1980) Chi-square test for nonnormality (CSQN), the Chow (1960) test for model stability (CSQS), Engle (1982) ARCH test (CSQAH) for autoregressive conditional heteroscedasticity and the RESET (Ramsey, 1969) misspecification test (CSQF). If the final model passes all these tests, the models are data admissible, encompassing and consistent with theory (Hendry & Richard, 1983). Table 3 presents the results of all diagnostic tests. The diagnostic statistics show that most models pass all six tests with the Hong Kong model only failed CSQN, and the Taiwan model failed CSQH and CSQAH. Overall, given the small sample size (only 21 observations for all the variables) the estimated demand models could be regarded as well specified and can be used for forecasting.

Table 3 Results of diagnostic tests

TEST	AUS	CA	JP	KOR	HK	TW	UK	USA
CSQA	1.327	0.462	1.696	0.433	2.155	0.027	0.790	0.402
CSQN	0.942	0.198	2.076	0.606	6.421*	1.361	2.061	0.108
CSQH	3.740	8.501	7.678	4.198	0.389	6.155*	11.888	8.171
CSQF	2.208	0.002	0.462	3.347	0.000	0.391	0.022	0.713
CSQS	0.887	0.029	2.058	1.520	1.166	0.039	1.267	0.901
CSQAH	0.027	0.537	0.316	2.466	0.273	9.372*	0.608	0.434

Note: * represents failing to pass the diagnostic test at 5% significant level.

5. Forecasts

The estimated demand models presented in the previous section are used to forecast tourist arrivals for the period 2006-2015.

Before we generate the forecasts of tourist arrivals for each of these origin countries/regions, we need to predict the explanatory variables first. The method used for forecasting the explanatory variables is exponentially smoothing. This method is easy to use and capable of producing reliable forecasting for the explanatory variables in tourism demand models (Song & Witt, 2000). Since all the explanatory variables are annual time series, which have either distinctive trends or stochastic trends, the Holt-Winters non-seasonal models is used.

Once the forecasts of the explanatory variables are generated, they can be substituted into the forecasting models given in Table 1 and the forecasts of the dependent variables are then calculated based on the estimated coefficients of the models. The initial observation in the forecast sample will use the actual lagged value of the dependent variable. The forecasts for the subsequent periods will use the previously forecasted values of the lagged dependent variable. The projected tourist arrivals for all the 8 origin countries/regions are presented in Table 4. Since the variables in the demand models are all in logarithm, the forecast values of tourism arrivals are also in logarithm. The actual tourist arrivals taking the anti-log operation of these values are shown in Figures 1-8.

Table 4 Forecasts of Tourism Arrivals in China

Country/Region	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Annual Growth Rate
Australia	587411	697975	822088	962187	1121083	1301996	1508596	1745073	2016210	2327483	14.9%
Canada	485604	541082	601003	667560	741488	823603	914812	1016122	1128651	1253642	9.9%
Japan	3488422	3611241	3759592	3935050	4139620	4375764	4646425	4955073	5305757	5703172	5.0%
Korea	5027187	5894175	7402129	9295876	11674115	14660798	18411589	23121975	29037458	36466346	2.1%
Hong Kong	76157360	82548439	89391152	96710523	104532473	112883831	121792330	131286610	141396215	152151589	7.2%
Taiwan	4334543	4672144	5060318	5480743	5936098	6429285	6963447	7541989	8168598	8847267	7.4%
UK	417740	449977	494644	543744	597718	657050	722271	793967	872779	959414	8.7%
USA	1928030	2271903	2644967	3063062	3539056	4084886	4712814	5436214	6270123	7231685	14.1%

Figure 1

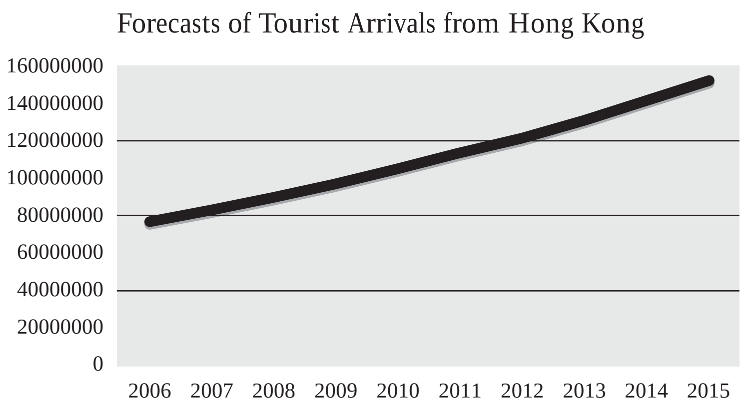


Figure 2

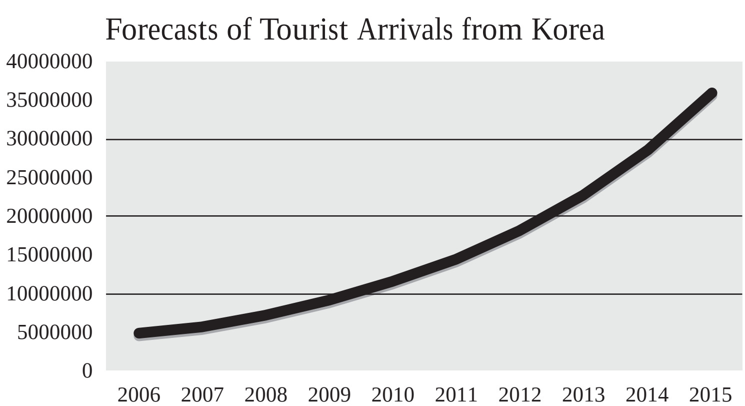


Figure 3

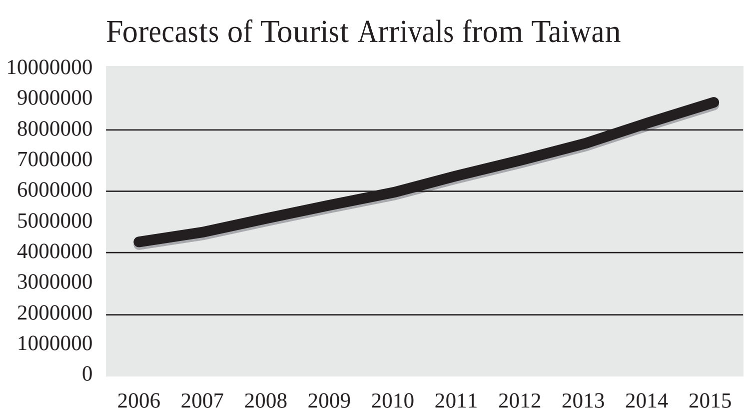


Figure 4

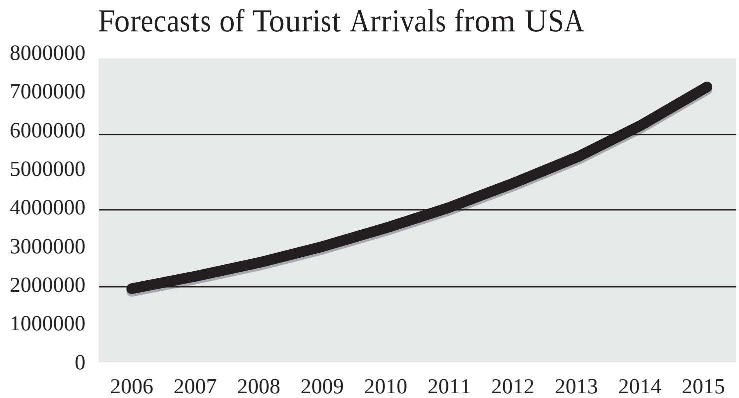


Figure 5

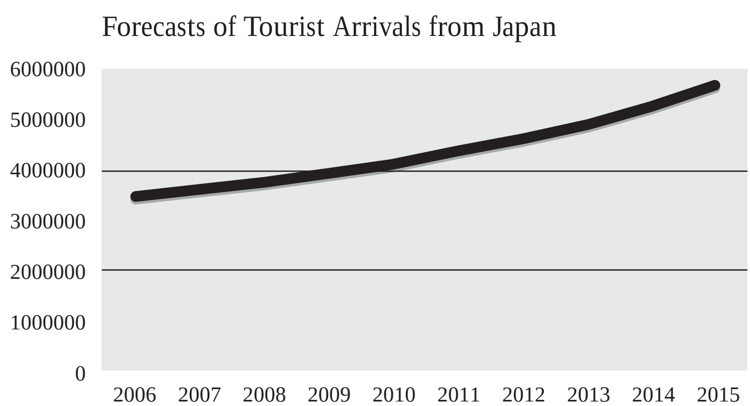


Figure 6

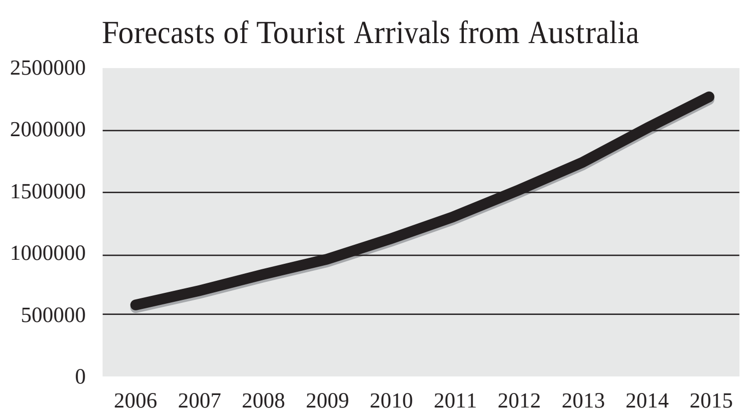


Figure 7

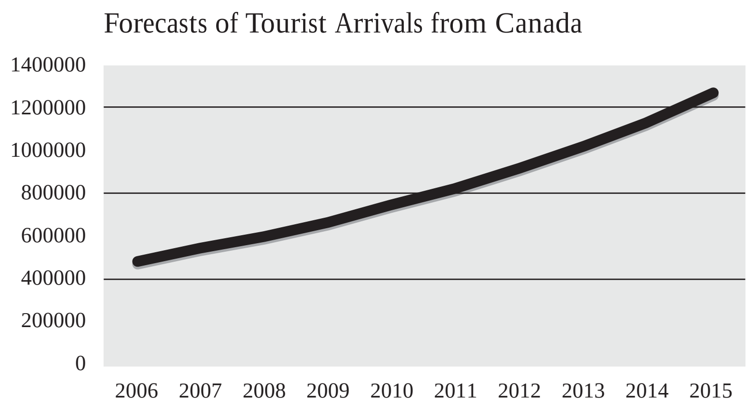
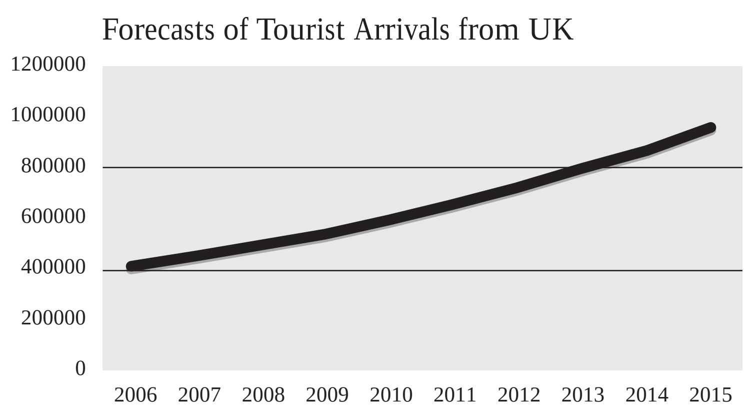


Figure 8



6. Conclusion

In this paper the demand for mainland China tourism measured by tourist arrivals is modelled and forecast using the general-to-specific approach. Tourist arrivals from 8 major origin countries/regions, namely Hong Kong, Taiwan, Japan, Korea, UK, USA, Australia and Canada, are considered. The lagged dependent variable, own price, substitute price, income and several dummy variables were included in the demand models. The sample used in model estimation covers the period 1985-2005. Following a rigorous statistical testing procedure, the models that pass the statistical tests and are consistent with the demand theory were selected for the purpose of policy evaluation and forecasting. The estimates of the demand models show that the demand for mainland China tourism is heavily influenced by the economic conditions in the origin countries/regions except Japan and Hong Kong. Therefore, it is important for policymakers in mainland China to closely monitor the economic conditions in these source markets.

The "word of mouth" effect or the behavioural persistence of tourists features significantly in the demand for mainland China tourism by tourists from Australia, Japan, Hong Kong and USA. This might explain why these four countries/regions are among the top five tourism origin countries/ regions for mainland China. The policy implication of this is that the suppliers of tourism products/ services in mainland China should improve their service quality and upgrade their brand images in order to attract more tourists.

The cost of tourism in mainland China is another noticeable factor that influences the demand for mainland China tourism. The price elasticity ranged from -0.93 to -11.751 suggesting that there is a significant variation between origin countries/regions in terms of the responsiveness of tourism demand to changes in the costs of tourism in mainland China. The price change in mainland China seems to have a larger impact on the demand for mainland China tourism by the Japanese residents (with the outstanding price elasticity of -11.751).

The price of tourism in the competing destinations also has a role to play in determining the demand for mainland China tourism. The effect is, however, comparatively weak as it only affects tourist flows from Canada, South Korea, UK and USA. An increase in tourism price in the alternative destinations will result in a bigger increase in the tourist flow from Korea to mainland China while a similar increase (decrease) in tourism price in the alternative destinations will result in a smaller increase (decrease) in the tourist flows from Canada and UK to mainland China. The cross price elasticity in the USA model indicates that tourists from the USA tend to visit mainland China and the competing destinations on the same trip (complementary effect), as the estimated cross price elasticity is -1.052.

Ex post forecasts over the period 2006 to 2015 are generated from the estimated final models, which provide some useful information for tourism practitioners including recreation facilities providers and government. The forecasting results show that the growth of tourist arrivals from Korea is expected to be the strongest among the eight origin countries/regions. Markets such as Australia, USA and Canada also show significant increases over the forecasting period, but to a less extent. The forecasts for Hong Kong, Japan, Taiwan and UK show that demand for mainland China tourism by residents from these origin countries/regions are likely to increase over the forecasting period, but the growth rates of these countries/regions are much smaller than that of Korea, Australian, USA and Canada. Hong Kong is predicted to be the largest source market for mainland China tourism over the forecasting period.

The forecasts in this study were generated based on the single equation approach and the sample size of the variables is small. It is likely the estimated models may suffer from small sample bias. A future extension of this study could be to use the panel data approach (data on 8 countries/ regions over 20 years) to estimate the demand model with a view to reduce the small sample bias.

Acknowledgement

The authors acknowledge the financial support of the Hong Kong Polytechnic University's Niche Area Research Fund.

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