Tourism Demand Modelling and Forecasting: A Review of Literature related to Greater China

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Abstract

Greater China, including Mainland China, Hong Kong, Macau and Taiwan, contributes significantly to both regional and global tourism developments. Empirical research on tourism demand modelling and forecasting has attracted increasing attention of scholars both within and beyond this region. One hundred and eighty articles are identified that were published in both English and Chinese language journals since the beginning of the 1990s. This study presents the largest scale of literature survey on tourism demand studies. Furthermore, this is the first attempt in tourism demand review studies that focuses exclusively on one geographic region and covers bilingual literature. Particular emphasis of this review is placed on research development, geographic focus, data type and frequency, measurement of tourism demand, modelling and forecasting techniques, demand elasticity analysis, forecasting exercises and emerging research trends. Comparisons between the two bodies of literature published in two languages show a number of research gaps, such as the diversity and sophistication of the research methodology, rigour of the modelling and forecasting process and theoretical foundations of demand analysis. Correspondingly, constructive recommendations are made to further advance tourism demand studies related to Greater China.

Keywords: Greater China, Tourism Demand, Forecasting, Modelling, Review

旅游需求建模与预测：关于大中华区的文献述评

李刚

包括中国内地、香港、澳门和台湾在内的整个大中华区对亚洲及全球的旅游发展一直贡献巨大。大中华地区内外的学者对旅游需求建模和预测的实证研究也越来越重视。自 1990 年初以来，共有 180 篇关于旅游需求模型和预测的实证研究在中文和英文期刊发表。本文是对旅游需求文献所作的一次最大规模的述评。本文也是首篇集中研究一个地理区以及涵盖中英文文献的旅游需求评论文章。本文的评论重点包括研究发展、地理焦点、数据类型和频率、需求弹性分析、预测活动以及研究趋势。通过比较分析中文和英文文献发现两种语言的文献在许多研究方面都存在差距，如研究方法的多样性和复杂性、建构模型和预测过程的严谨程度以及需求分析的理论基础。本文最后提出相应建议以期进一步推进大中华旅游需求研究的质量。

关键词：大中华, 旅游需求, 预测, 建模, 述评

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1. Introduction

Modelling the effects of various factors on tourism demand and forecasting the future trends are two major focuses of tourism demand studies (Li *et al*., 2005). The analysis of the effects of tourism demand determinants provides important information for formulating and evaluating tourism policies and strategies. Tourism demand forecasting serves the practitioners in both public and private sectors in a number of ways. Firstly, the success of many tourism businesses such as airlines, hotels and tour operators depends largely on the state of tourism demand. Estimates of expected future demand constitute an important element in their planning activities, particularly given the perishable nature of tourism products. Secondly, tourism investment, especially in a destination's infrastructure, requires long-term financial commitments, and the sunk costs can be very high if the investment projects fail to fulfil their design capacities. Therefore, the prediction of long-term demand for tourism-related infrastructure often forms an important part of project appraisal (Frechtling, 2001). Thirdly, accurate forecasts of the scale and growth of tourism demand in a destination help the government decide on and implement appropriate medium-long term policies in order to achieve the sustainable tourism development.

Asia and the Pacific has been one of the fastest growing tourism regions in the world over the past decade and this trend will continue in the forthcoming decades (World Tourism Organization [UNWTO], 2000). Within this region, Greater China including Mainland China, Hong Kong, Macau and Taiwan contributes most significantly to both regional and global tourism developments. According to the UNWTO (2008), tourist arrivals to Greater China reached 88.5 million in 2007, which accounted for almost half of the total in Asia and the Pacific and nearly one-tenth of the world total tourist flows. In particular, Mainland China is the fourth most popular tourist destination in the world and it is predicted to reach the top by 2020 or even earlier (UNWTO, 2000). In addition to a fast growth of 9.2% in Mainland China, Macau obtained an even faster growth of 12.5%, and Hong Kong and Taiwan both gained higher than 5% growth rates, in terms of international tourist arrivals in 2007 against the previous year. Not only has Greater China become one of the most popular tourist destinations, it features as an active source market of international tourism. Mainland China, Hong Kong and Taiwan appeared in the 6^{th}, 14^{th} and 22^{nd} positions in the world respectively, in terms of tourist spending in 2006.

The socioeconomic significance of the rapid tourism development in Greater China has inspired international scholars' interests in researching the determinants and effects of the increasing tourism demand in this region, and predicting the trends of future demand. According to the author's literature search, more than 200 journal articles have been published since the early 1990s in either English or Chinese language, focusing on modelling and forecasting tourism demand for Greater China. Given the importance of tourism demand research and its rapid growth in this region, it is necessary to provide a comprehensive review of the existing studies. By summarising similarities and

dissimilarities of past studies in the this field, and identifying the common trends and issues, this review aims to provide guidance to other researchers interested in undertaking similar tasks in the future. It is expected that this overview will encourage further developments of tourism demand studies related to this region.

2. Literature Review

Tourism demand modelling and forecasting studies have had a half-a-century history. The earliest work can be traced back to the 1960s, notably pioneered by Guthrie (1961). Since then there have been significant developments in the research of this field, in terms of the diversity of research interests, the depth of theoretical foundations, and advances in research methodologies (Li *et al*, 2005). In the earlier three decades, research in this field had a predominant focus on Europe and North America. The majority of publications focused on these regions, either as tourist destinations or source markets. This geographic distribution of tourism demand studies was in line with the general trends of global tourism development. Not until the earlier 1990s was the research attention placed on Greater China, in parallel with the phenomenal growth of the tourism industry of this region.

The developments of tourism demand research were reviewed in a number of literature surveys. In earlier reviews such as Archer (1980, 1987), Bar-On (1984) and Vanhove (1980), considerable attention was devoted to explaining the techniques applicable to tourism demand forecasting. More recently Crouch (1994a, 1994b, 1994c, 1994d, 1995, 1996) conducted a series of more comprehensive reviews covering about 80 econometric studies during the period 1961-1993. In particular, Crouch (1994a, 1994b, 1995, 1996) identified various inter-study differences, principally with respect to demand elasticities. Similarly, Lim (1997a, 1997b, 1999) reviewed 100 papers published during the period 1961-1994. Attention was paid to the choice of dependent and explanatory variables, functional specifications and data in use. Witt and Witt (1995) reviewed 40 empirical studies published prior to 1992, with a particular emphasis on empirical comparisons of forecasting accuracy among different approaches. Li *et al.* (2005) and Song and Li (2008) reviewed the most recent 84 and 121 tourism demand studies, respectively. They identified the latest methodological developments and emerging trends in this field of research.

All of the above review studies are based on publications in English and without a specific regional focus. Moreover, a large body of the literature in Chinese language has been excluded from the above reviews. Although there have been a few general overviews of tourism demand studies published in Chinese language journals, no comprehensive literature survey has been conducted. The objectives of these studies were to introduce the approaches to tourism demand analysis such as Ouyang and Hu (2007) and Ren and Liu (2006b), or to share their general observations on issues and problems of current tourism demand studies, such as Dai (2003). Therefore, they only briefly referred to very few empirical studies either in Chinese or in English as examples of the applications of the introduced forecasting techniques. Thus, there has been a gap in the

literature; that is, no attempt has been made to give a comprehensive review of all tourism demand modelling and forecasting literature focusing on Greater China and published in both Chinese and English languages. This study therefore aims to bridge the gap.

3. Research Design

The purpose of this study is to review and evaluate the existing empirical literature on tourism demand studies with a regional focus on Greater China. This study will investigate the similarities and dissimilarities among the empirical studies, summarise the key issues and trends in the literature, and suggest new directions for future research. In particular, since the studies published in both Chinese and English languages are covered in this review, particular attention is paid to the comparison between the two bodies of literature. Common trends and research gaps are to be identified.

In this study, "Greater China" is defined to cover Mainland China, Hong Kong, Macau and Taiwan, in line with the definition of the *Journal of China Tourism Research*. The term "Greater China" emerged in the early 1990s to account for the growing economic interaction and integration as well as socio-cultural ties between the four areas (Peng *et al*., 2001). It has been commonly accepted by scholars especially in the fields of economics and investment (e.g., Harding, 1993; Lin and Lin, 2001). It has also appeared in some tourism literature (e.g., Heung and Qu, 1998). In the contemporary tourism context, the interaction between the four component areas has been increasing. The gradually extended Individual Visit Scheme allows increasing numbers of Mainland Chinese tourists to visit Hong Kong and Macau since 2003 (Hong Kong Economic and Trade Office, London, 2005). The agreement on direct flights between Mainland China and Taiwan implemented in July 2008 is expected to stimulate more intra-regional travel and tourism activities (Chinadaily, 2008). Tourism authorities of Macau and Hong Kong have been cooperating actively in promoting regional tourism together. Given the increasingly close ties between the four areas, it is most appropriate to regard these areas as a whole in this study.

To serve this review extensive literature search was conducted based on various databases such as the social science citation index (SSCI), Google Scholar, ScienceDirect and EBSCOhost. In addition, the Renmin University's Chinese-Language Literature Database was used to search for Chinese articles published in Mainland China. Due to inaccessibility to Taiwan's local literature databases, no articles published in local journals have been collected. However, many Taiwanese scholars published their studies in international journals. These publications have been obtained through the literature search. The preliminary search was based on various combinations of the key words: tourism demand, modelling, forecasting, China, Hong Kong, Macau, and Taiwan. Secondly, the citations from identified articles were traced. Then among the over 200 identified publications, only empirical studies on tourism demand modelling and/or forecasting with a particular focus on at least one of the four areas of Greater China were finally selected. The literature collection was mostly done in January 2008 and an update

of the English language literature search was carried out in June 2008. Finally 180 journal articles were collected, including 43 published in English journals (termed hereafter "international studies") during the period 1992—early 2008, and 137 papers published in Mainland Chinese journals (termed hereafter "Chinese studies") between 1992 and 2007. This study presents the most up-to-date review of the tourism demand modelling and forecasting literature. In terms of the number of articles included in the review, this study is of the largest scale in the research field. In addition, the unique regional focus and the bilingual nature of the literature under review differentiate this study from others.

4. Results and Discussion

The full details of the 43 international studies and 137 Chinese studies are provided in Tables 1 and 2, respectively. The review is therefore based on the 180 studies and the emphasis is placed on the following issues: research development, geographic focus, data type and frequency, measurement of tourism demand, modelling and forecasting techniques, demand elasticity analysis, forecasting exercises and emerging research trends. The findings of this review in these aspects are summarised and discussed below.

{Insert Table 1 about here}
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Research Development

With regard to the development of tourism research related to Greater China, two distinctive time patterns can be identified between the international and Chinese studies (see Figure 1). Tourism demand studies in Mainland China have been growing at accelerating speed over the observation period (1992-2007). The whole period can be divided into three phases: 1992-1999: exploring; 2000-2003: involving; and 2004 onwards: accelerating, according to the number of studies published each year. Overall, the development of tourism demand research in Mainland China is still in its early stage. Both the quantity and quality are to be developed further. In comparison, the growth of international studies on Greater China's tourism demand shows a highly stable pattern. As a new phenomenon and emerging market, Greater China will attract increasing attention of international scholars in the following decades.

{Insert Fig. 1 about here}

Geographic Focus

As Table 3 shows, Hong Kong has attracted overwhelming attention among international studies, followed by Mainland China and Taiwan, all being researched mainly as international tourist destinations. Although both domestic tourism and outbound tourism have developed fast in Mainland China in recent years, only two studies (Cai and Knutson, 1998; Cai *et al*., 2002) investigated the domestic tourism and one (Qu and Lam, 1997) examined outbound tourism to Hong Kong. Song and Witt

(2006) is the only study that examined tourism demand in Macau. A few studies included more than one area of Greater China. The popularity of international tourism research on Hong Kong can be explained by its long history of tourism development. With respect to the studies on Mainland China and Taiwan, their limited data availability has restricted the research development. In particular, the data of Mainland China's outbound tourism demand are not disclosed by the Chinese authority in the public domain. To carry out such research one would have to rely on the statistics provided by the destination countries or regions of Chinese outbound tourists. However, such data could not support a study on the aggregate demand for outbound tourism.

{Insert Table 3 about here}

The Chinese studies spread their geographic focuses among national, regional/provincial, and city/town levels, as well as particular scenic sports. Given the economic significance in terms of foreign exchange earnings, more than half of the studies investigated and predicted the demand by international markets (see Table 3). In particular, Japan and the USA are the most frequently researched short-haul and long-haul markets respectively. Due to data unavailability as discussed above, the same research gap is observed among Chinese studies regarding Mainland China's outbound tourism.

Data Type and Frequency

Almost all of the reviewed studies employed time-series data, with only seven exceptions among the Chinese studies which used cross-sectional data. Where time series data were employed, the annual frequency has dominated both Chinese and international studies (82% and 60%, respectively). Compared with the findings of previous reviews, the common trend is that annual data have been the most popular data frequency for tourism demand studies. However, the new tendency identified in the general tourism demand literature regarding the increasing popularity of quarterly data (see Li *et al*., 2005) is not shown in this review. The use of seasonal data is often associated with seasonality analysis of tourism demand. However, among all the reviewed studies related to Greater China, few have paid particular attention to this issue (with Kulendran and Shan (2002) being an exception). Seasonal patterns of tourism demand and their potential changes over time, the treatment of seasonality (i.e., stochastic versus deterministic seasonality) in tourism demand models and its impact on the forecasting accuracy have been largely ignored in these studies.

In addition to the above mentioned data frequencies, some less commonly used frequencies are identified among the Chinese studies. For example, Wang (2004) and Zhang and Chen (2007) used the data at semi-annual frequencies, and Ge and Hua (2006), Zhao *et al*. (2006) and Wang and Hua (2006) employed daily data. These special data frequencies are usually associated with special events such as the Canton Trade Fair and national golden-week holidays in Mainland China.

Measurement of Tourism Demand

In consistency with the general literature on tourism demand modelling and forecasting, tourism demand for Greater China is usually measured by the number of tourist arrivals and tourist expenditure, with the former being more popular. In a few cases the *per capita* forms of these measures were used too. Among the Chinese studies 72% measured tourism demand by tourist arrivals, 14% by tourist expenditure (or tourism receipts), and 14% by both. As for the international studies, 80% and 16% employed tourist arrivals and tourist expenditure, respectively. In addition, two studies used both measures. The choice of tourism demand measures is mainly driven by the ease of data accessibility, while the purpose of tourism demand studies should also be taken into account. Tourist volumes are important for tourism service suppliers such as hotels, airlines and visitor attractions, because the volume has direct relevance to capacity management. Tourist expenditure (i.e., the receipts of the tourism industry in a destination) is the main concern of governments and central banks because it is the foundation on which the economic impact of tourism activities is assessed and tourism policies are made. Furthermore, different evolution patterns in tourist arrivals and expenditure time series emerge for most destination/origin country pairs. This has been observed by scholars such as Sheldon (1993) and García-Ferrer and Queralt (1997) in their empirical studies on OECD countries and Spain, respectively. However, no studies related to Greater China have been identified to pay attention to the comparison between these two demand measures, or the relationship between the choice of demand measures and the accuracy of demand forecasts.

Among the seven tourist expenditure studies, Au and Law (2000), Au and Law (2002), Cheung and Law (2001) and Law and Au (2000) examined the sub-sector level of tourist spending on sightseeing, dinning, accommodation and shopping, respectively. Besides tourist arrivals and tourist expenditure, the hotel occupancy rate was used in three studies to measure the demand for tourist accommodation. The use of disaggregated data (at the sub-sector or even lower levels) enables scholars to give more insights into these tourism businesses, and draw more specific managerial implications, which are useful for the business operations in the related sub-sectors.

Modelling and Forecasting Techniques

Modelling and forecasting techniques for tourism demand studies have experienced substantial developments. Tourism demand forecasting methods are commonly divided into two categories: quantitative and qualitative methods (Song and Li, 2008; Ren and Liu, 2006b; Witt and Witt, 1995). The majority of published studies in the general tourism forecasting literature used quantitative methods (Song and Turner, 2006). The quantitative forecasting literature has been dominated by causal econometric approaches and non-causal time series models, while some artificial intelligence techniques begin to appear in recent tourism forecasting studies. These trends in the general tourism forecasting literature are also reflected in the studies on Greater China's tourism demand.

Time-series Methods. Eleven time-series forecasting techniques were applied in 17 international studies and 84 Chinese studies. The autoregressive integrated moving

average (ARIMA) model and its seasonal version (i.e., SARIMA model) were used most often among the international studies. This trend is in line with the general tourism forecasting literature (Song and Li, 2008). Since the ARIMA model was initially proposed by Box and Jenkins (1970), researchers have put great effort into its further developments. The applications of these new developments have been seen in some studies. For example, Goh and Law (2002) introduced a multivariate SARIMA (i.e., MARIMA) model which includes an intervention function to capture the potential spill-over effects of the "parallel" demand series on a particular tourism demand series. Their study showed that the MARIMA model significantly improved the forecasting performance of the simple SARIMA as well as other univariate time series models. In another Chinese study, Lei and Chen (2007) combined the ARIMA model with a neural network method. They predicted the linear trend of a tourism demand series using the ARIMA model, and then used the neural network method to forecast the non-linear element of the series that was maintained in the residuals of the ARIMA model. Subsequently, the two parts of predictions were combined to obtain the final forecasts. This combined method showed improved forecast accuracy compared to both component methods.

Other modern and advanced time-series approaches such as the basic structural time series model (BSM) and the generalised autoregressive conditional heteroscadesticity (GARCH) model have been applied in both international and Chinese studies (e.g., Kulendran and Shan, 2002 and Shang and Qin, 2007, respectively), although such applications are still limited. A BSM is based on the identification of unobserved components (including trend, cyclical, seasonal and irregular components) which are directly interpretable out of the data. Then these components are modelled in a state space form and estimated by a powerful recursive algorithm known as the *Kalman filter* (see Harvey (1989) for technical details). The stochastic treatment of the unobserved components such as seasonality is more in line with the actual data properties, and thus the BSM generally provides sound forecasting performance. The family of GARCH models have been widely used in financial modelling. It was introduced into the tourism context recently to investigate the volatility of a demand series and examine the effects of various shocks to a tourism demand system. Shang and Qin (2007) presented the first attempt to successfully apply a GARCH model to tourism demand forecasting. Naïve 1 (i.e., no-change) and naïve 2 (i.e., constant-growth-rate), autoregressive (AR), moving average (MA) and exponential smoothing (ES) models are often used as benchmarks in forecast accuracy comparison studies. Trend extrapolation models (TEMs) in either linear or non-linear forms dominate the Chinese studies on time-series forecasting, with 63 applications being identified. In a TEM, a tourism demand series is regressed against the deterministic time trend, and the selection of the functional forms (linear or nonlinear) is based on trials without any scientific criteria or diagnostic tests. Such a basic regression is unable to cope with business cycles and irregular shocks to the system, and its medium- to long-term forecasts could be seriously misleading (Che, 2004).

Econometric Models. Different from time-series models, econometric approaches include various influencing factors of tourism demand as the independent variables in their model specifications. Nine econometric forecasting methods have been applied in

more than 50% of the international studies but in only 20% of Chinese studies. These econometric models include the autoregressive distributed lag model (ADLM, with the error correction model and static regression model as its specific forms), the ARIMA model augmented with causal variables (ARIMX), cointegration (CI) model, gravity model (GraM), panel data regression (PDR) model, simultaneous equation model (SEM), structural time series model with causal variables (STSM), time varying parameter (TVP) model and vector autoregressive (VAR) model. Two traditional static econometric models: static regression and gravity model, dominate the 27 Chinese studies, while no applications of the advanced econometric models such as ECM, VAR and TVP models have been identified among the Chinese studies. The static models suffer from a number of problems. Firstly, they omit the dynamics of a demand system. In other words, they ignore the "word of mouth" effect or habit persistence of tourism demand (Song and Witt, 2000). Secondly, as we know, tourism demand is not only affected by the current status of economic variables such as income and prices, but also their changes in previous months and years. However, these effects can not be captured by a static econometric model. Thirdly, the stationarity property of the variables is not detected in a static model. As a result, the spurious regression problem is likely to occur (Song and Witt, 2000). Moreover, the often used static model specification—the gravity model—lacks a strong theoretical underpinning, which leads to the *ad hoc* choice of explanatory variables (Che, 2004). The reliability of the estimation results of such a model is questionable.

Among the 23 international studies, there is no dominant econometric approach. Most of the advanced and dynamic forecasting techniques such as the TVP model and the STSM have been employed in these studies. Both models are written in the state space form and estimated by the *Kalman filter* algorithm. As with the BSM, the STSM is useful to model seasonal tourism demand. In addition, inclusion of explanatory variables in a modelling process gives the STSM more explanatory power. The TVP model is often used in conjunction with annual data. Its unique power is on the analysis of tourism demand elasticity evolution. Both the TVP model and the STSM have shown superior performances especially for short-term forecasting. Different from most Chinese econometric studies, all international studies reported necessary diagnostic test results (e.g., nonnormality, heteroscadesticity, autocorrelation, misspecification and forecasting failure) in addition to the commonly reported model fit indicators such as R-squares and F-statistics. These models that passed all or most of the diagnostic tests are therefore more reliable for subsequent demand analyses and forecasting. However, the diagnostic tests were rarely reported in the Chinese studies. Without good knowledge of the properties of the reported models, it is highly risky to rely on their estimates for policy making or business strategy projection.

In line with the general tourism demand literature, the most commonly considered influencing factors of Greater China's tourism demand (both inbound and outbound) are tourist income, tourism prices in the destination, and one-off events such as the Asian financial crisis in 1997, the SARS epidemic in 2003 and the bird flu in 2005. Tourism prices are often measured in a relative term, i.e., tourism prices in a destination relative to those in the source market concerned, adjusted by the relevant exchange rates. In addition, exchange rates are often used especially in the Chinese studies to measure tourism prices.

Although some earlier literature (e.g., Sinclair and Stabler, 1997) suggested the appropriateness of using the exchange rate variable as a proxy of tourism prices, the relative form of tourism prices adjusted by exchange rates takes multiple factors of tourism prices into account and has been more popular in recent international studies.

Artificial intelligence (AI) techniques. The AI technology, as a third branch of forecasting methodologies, has been recently introduced into the tourism demand forecasting literature. The often used AI techniques for forecasting include neural networks, rough sets, genetic algorithm, support vector regression, fuzzy logic, grey theory and their combinations (Goh, *et al*, 2008a; Toshinori, 1998). They can be used as either causal or non-causal forecasting methods, depending on whether any influencing factors of tourism demand are considered. These methods including the combination of the genetic algorithm and the support vector regression have all been applied in the reviewed studies, including 12 international studies and 41 Chinese studies. The grey model is employed most often (particularly among the Chinese studies, with 31 applications), followed by various neural network methods. The merit of AI forecasting techniques is to relax data property requirements such as stationarity and normal distribution. Empirical evidence has shown their sound forecasting accuracy in comparison to their traditional counterparts. However, without a theoretical foundation in social sciences such as economics, it is difficult to interpret the results of these techniques from the economic perspective.

Other Forecasting techniques. Among the Chinese studies some mathematical models that are often used in physics (e.g., Markoff chain) or control engineering (e.g. Hammerstein model) have been introduced into the tourism context for *ex ante* forecasting, such as Zhang (2000) and Zhang and Wang (2002), respectively. However, little justification was provided to explain why and how these models were appropriate to study tourism demand. Moreover, it is necessary to exercise a forecasting competition against other well-performing techniques in order to prove these models' superior predictive power.

A few international and Chinese studies applied multiple forecasting approaches across time-series, econometrics and AI categories. The main purpose is to compare their forecasting performances. This is to be discussed in a later section.

Demand Elasticity Analysis

Elasticity analysis has its theoretical foundation on demand theory and interprets tourism demand from the economic perspective. Tourism demand elasticities have been discussed extensively in the general tourism literature and some common issues have been summarised in previous review studies such as Crouch (1992, 1994a, 994b, 1995, 1996). However, only a few international studies showed interests into the research in this area, and no Chinese studies have discussed demand elasticities at all. The lack of interest in elasticity analysis among Chinese studies is associated with the unpopularity of the econometric methodology (especially at the advanced level, using CI and ECM approaches for example). Based on the available empirical evidence, some general

findings of tourism demand elasticity analysis are summarised (see Table 4). Consistent with most findings in the general tourism demand literature, international tourism demanded for and by Greater China, including the intra-regional tourism, is generally regarded as a luxury product (i.e., the income elasticity is greater than one), as opposed to the domestic tourism (such as that in Mainland China), which features a necessary product (i.e., the income elasticity is lower than one). In particular, where Hong Kong was studied as an international tourism destination, the average income elasticity across various source markets was consistently estimated as around 2. The implication is that once the tourists' income increased by 10%, their demand for tourism in Hong Kong would be likely to increase by about 20%. This finding suggests that the tourism industry in Hong Kong should closely monitor the economic situations of the key source markets and respond effectively to the changes of their economic status.

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With respect to the price elasticity of tourism demand, the findings based on Greater China are in line with economic theory, that is, an increase in tourism prices in a destination would lead to a decrease in the demand for this destination. In other words, the price elasticity of tourism demand is negative. However, the magnitudes of the price elasticity vary considerably across studies even on the same region. The discrepancy is due to the econometric models adopted and the sample period covered. As discussed above, the evolution of income and price elasticities can be analysed using the TVP model. For example, based on this model Song and Wong (2003) found that the income elasticity of demand for tourism in Hong Kong decreased over time as far as the UK and USA were concerned. The implication is that travelling to Hong Kong has become less and less luxurious for British and American tourists. With regard to the price elasticity, fluctuations were observed in most source markets, especially during oil crises and the world economic depression in the late 1970s. A few studies also examined the cross-price elasticity of tourism demand, but it often appeared insignificant (e.g., Song and Fei, 2007; Song *et al*, 2003). The insignificant substitution effect partially reflects the unique characteristics of the destinations under study and their relatively high competitiveness.

Forecasting Exercises

Four different types of forecasting exercises appeared in 75% of international studies and 85% of Chinese studies. These exercises are: (1) *ex post* forecasting, that is, examining the out-of-sample forecast accuracy of a tourism demand model (Song and Witt, 2000); (2) forecasting competition, that is, comparing alternative forecasting techniques' *ex post* forecast accuracy; (3) *ex ante* forecasting, that is, generating forecasts of future demand; (4) combining the forecasts generated by individual techniques, for which a number of combination methods can be exercised. It should be noted that *ex post* forecasting is different from the within-sample "prediction". The latter is not regarded as real forecasting, but an examination of the model fit to the data in use. To evaluate forecasting accuracy properly, *ex post* forecasting must be conducted. This requires withholding some data at the end of the historical series and using these data to compare with the out-of-sample forecasts.

International Forecasting Studies. Distinctive trends on forecasting exercises are identified between the two bodies of literature (see Table 5). Among the international studies, the most exercised forecasting practice was forecasting competition, which accounts for more than half of the forecasting studies. The objectives of these studies were to introduce new techniques into tourism forecasting research and examine their forecast accuracy in comparison to other approaches. Certain attention was also paid to both *ex post* forecasting and *ex ante* forecasting, but without an attempt to compare different forecasting techniques. Once *ex ante* forecasts were to be generated, *ex post* forecast evaluation was always performed first to justify the robustness of *ex ante* forecasting results.

{Insert Table 5 about here}

Chinese Forecasting Studies. *Ex ante* forecasting dominated Chinese forecasting studies, and very little attention was given to forecasting competition or *ex post* forecasting. Among the 101 *ex ante* forecasting studies, a large proportion reported within-sample "predictive" errors (i.e., residuals of model fit) only, and only 20 of them performed *ex post* forecast evaluation. Another issue is the extremely short historical time series to construct the forecasting model in contrast to the very long forecasting horizons. Although there has not been a commonly agreed guidance in the forecasting literature regarding the ratio between the number of historical data and that of reliable forecasts that can be generated, some scholars suggest a minimum of 5:1 as a rule of thump (Frechtling, 2001). However, in a number of the Chinese studies under review, this ratio is lower than 1:1. Although this ratio may vary between different forecasting methods (for example, a grey model requires less historical data then traditional models), it is always necessary to conduct diagnostic tests for the forecasting model and evaluate *ex post* forecast accuracy prior to *ex ante* forecasting. Only the model that has passed all or most diagnostic tests and shown acceptable *ex post* forecast accuracy should be used for *ex ante* forecasting.

Best Performing Forecasting Method. In spite of different interests into tourism forecasting exercises between international and Chinese studies, some common trends have been identified. With regard to forecasting competition, no single forecasting technique could outperform the others on all occasions. This finding is in line with the general literature reviews (e.g., Li *et al*., 2005). AI techniques have attracted increasing interests among more recent studies. In particular, neural networks and grey models often outperform other traditional time-series methods (e.g., MA, ES, naïve 1 and 2 models), but no attempt has been made to compare the forecasting performance between the newly developed AI techniques and the advanced econometric approaches (e.g. TVP model, ECM and STSM). To fulfil this task, collaboration among researchers with different technical expertise is necessary.

Forecast Combination. Since no single forecasting technique can always outperform others, there have been some attempts in recent tourism forecasting literature to combine individual forecasts. Three Chinese studies (Li, 2001; Zheng and Liu, 2001;

Zhou and Liu, 1996) and one international study (Wong *et al*, 2007) have exercised forecast combination using three different methods: single average, variance-covariance and discounted mean square forecast error methods, and they commonly showed favourable results. Different from the three Chinese studies, Wong *et al*. (2007) included three advanced econometric models (ECM, VAR and ADLM) along with ARIMA into the combination exercise. Even in the general tourism forecasting literature, very few studies have examined this issue. Further research should explore the potential of more accurate forecasts by employing new combination techniques such as nonlinear methods.

Integration between quantitative and qualitative forecasting. In addition to the quantitative *ex ante* forecasting, one study (Guan *et al*., 1998) conducted judgemental forecasting using the Delphi method, which was based on a structured process for collecting knowledge from a group of experts by means of a series of questionnaires. In general, quantitative forecasting is more suitable for short-term demand prediction, while for medium to long-term projections, qualitative approaches should be considered (Uysal and Cromption, 1985). The integration of quantitative and qualitative forecasts reduces the risk of forecasting failure and provides more reliable information for decision makers. However, such attempts are often ignored in tourism forecasting practice.

Emerging Research Trends

Greater China as one of the emerging markets of international tourism has presented its unique characteristics, as either a source market or a destination region. Correspondingly, tourism demand research related to this region shows some distinctive emphases. A certain degree of heterogeneity within this market further leads to divergent research trends in Hong Kong, Taiwan and Mainland China.[2] For example, Hong Kong is always researched as an international tourism destination. Moreover, due to better data quality and availability, tourism demand research has been extended from the industry aggregate level to the sub-sector level, with a particular emphasis on the hotel sector (e.g., Law, 1998 and 2004; Qu *et al*., 2002; Tse, 2001). With respect to Taiwan, given its relatively small scale and fragile nature of the tourism industry, a number of studies assessed the impacts of disasters and crises (such as the earthquake, SARS and bird flu) on its inbound tourism demand (e.g., Huang and Min, 2002; Min, 2005). Mainland China has the richest tourism resources, and attracts the most diverse research interests. Unlike other regions either within or beyond Greater China, domestic tourism in Mainland China has attracted a great deal of research attention. In addition, inbound tourism demand studies have been extended from the national level to provincial and cities levels (e.g., Bian and Song, 2007; Chen and Zhang, 2007; Gao, 2002). Particular attention has been given to the demand for individual scenic sports (e.g., Liu *et al*., 2007; Lu *et al*., 2002; Peng and Qu, 2003) and participation in mega events such as Shanghai World Expo 2010 (Feng, 2004) and the Canton Trade Fair (Zhang and Chen, 2007). Moreover, analysis of tourism cycles has become increasingly popular (e.g., Li, 2003; Sun, 2001; Xie, 2007; Zhang and Lu, 2004).

[2] Macau is excluded from the discussion on research trends because there has been only one study focusing on this region and therefore no trends could be summarised.

5. Concluding Remarks

By comprehensively reviewing 180 empirical studies related to Greater China's tourism demand modelling and forecasting, this study acts as a useful guide and convenient reference for other scholars who are interested in conducting similar research on this region.

It is found that tourism demand research about Greater China shares some similar trends and characteristics to the studies about other regions such as Witt and Witt (1995), Li *et al*. (2005) and Song and Li (2008), in terms of the measurement of tourism demand, data frequency, findings of demand elasticity analysis and lack of consistently top-performing forecasting techniques. For instance, both Witt and Witt (1995) and Li *et al*. (2005) concluded from their reviews that there was no single forecasting technique that outperformed the others on all occasions.

Within this region, Hong Kong, Taiwan and Mainland China have received divergent research interests. Hong Kong has always been studied as an international destination, and increasing attention has been paid to the tourism demand at sub-sector level, particularly for the hotel sector. The effects of disasters and crises have been topical issues of Taiwan's tourism demand studies. The development of tourism demand research in Mainland China has been phenomenal over the past 25 years. Diverse research interests and new research methods especially AI techniques have been explored. However, the comparison between these Chinese studies and those at the international level reveals a number of gaps, such as the diversity and sophistication of the research methodology, rigour of the modelling and forecasting process and the theoretical foundation of demand analysis. To bridge the research gap, the following aspects warrant more attention of Mainland China's tourism demand studies:

- Application of modern and advanced econometric modelling approaches to both demand elasticity analysis and forecasting;
- Diagnostic tests on the demand model to be applied for policy evaluation or forecasting;
- *Ex post* forecast evaluation to be performed prior to *ex ante* forecasting;
- Caution to be exercised when short historical series are used for medium and long-term forecasting.

In addition, some new directions of tourism demand studies on Greater China are identified:

Tourism Seasonality Analysis. Tourism in most destinations presents seasonal variations, and Greater China is not an exception. However, as an emerging market undergoing fast growth, Greater China, especially Mainland China, is most likely to experience changing seasonal patterns. In other words, seasonality in this region should be treated as stochastic rather than deterministic in tourism demand analysis. Such a more appropriate treatment of seasonality in a demand model is likely to lead to the enhanced

performance of seasonal tourism demand forecasting. Research in this direction is worth exploring.

Outbound Tourism Demand Analysis. Extremely few studies have investigated outbound tourism demand from Greater China. Travelling abroad is a new phenomenon especially as far as Mainland Chinese tourists are concerned. Their unique travel behaviour, travel decision making and the impacts of their travel activities on both a destination and their home country/region are all interesting topics for future tourism demand research. Given the data unavailability at the aggregate level, a feasible direction is to examine the outbound tourism demand for individual destinations where the data of China's inbound tourism demand are available.

Turning Point and Directional Change Forecasting, Forecast Combination and Forecast Integration. Tourism practitioners are interested in not only the overall trend of tourism demand, but more importantly the timing of the directional change in tourism growth. This knowledge has important implications on effective business planning and macroeconomic policy making (Song and Li, 2008). Despite the practical importance, there has been limited literature focusing on this issue, even among the general tourism demand literature. To enhance the practical value of forecasting exercises, future forecasting studies on Greater China should focus on not only point forecasting, but also turning point and directional change forecasting. Meanwhile, although there have been a few attempts to combine individual forecasts and to integrate quantitative forecasts with judgemental forecasts, some research gaps are still to be bridged. For example, econometric forecasting and AI prediction have been two isolated research areas. The potential of forecast accuracy improvements should be explored through their combination. Moreover, some AI techniques such as the NN method can act as not only a forecasting technique, but a nonlinear combination approach. No empirical studies have investigated the effects of nonlinear combination in the tourism context. When medium- and long-term projections are concerned, judgemental forecasting should be performed to assist or adjust the quantitative perdition.

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Table 1 Summary of Tourism Demand Modelling and Forecasting Studies on Greater China Published in International Journals (1992-2008)

Legend

1. Data frequency

A: annual
CS: cross sectional
D: daily
M: monthly
Q: quarterly
SA: semi-annual
W: weekly

2. Region focused

D: domestic tourism
I: as a destination
O: as an country/region of origin

3. Dependent variable

EX: exports
HOR: hotel occupancy rate
IM: imports
TA: tourist arrivals
TE: tourism receipts/expenditure

4. Independent variable

BC: business cycle
C: relative tourism price unadjusted by ER
C_d: tourism price in destination
C_o: tourism price in origin country/region
D: dummy variable
Dis: travel distance
DT: deterministic (linear) trend
ER: exchange rate
HR: average hotel rate
LS: length of stay
ME: marketing expenditure
NAC: No. of tourist accommodations
OEI: other economic indicator
P: population
RC: ER-adjusted relative price
RPI: retail price index
SC: substitute price
SF: TC to substitute destinations
TC: travel cost (airfare)
TS: travel cost by surface
TT: travel time
TV: trade volume
Y: income in origin country
Y_d: income in destination country

5. Modelling and Forecasting Methods

ADLM: autoregressive distributed lag model
AR: autoregressive process
AR(I)MA(X) autoregressive (integrated) moving average (cause effect) model
−In: with intervention
BSM: non-causal basic structural model
CI: cointegration
ECM: error correction model
ES: exponential smoothing
FTS: fuzzy time series
GA: genetic algorithm
GARCH: generalised autoregressive conditional heteroscadesticity model
GM: grey model
GraM: gravity model
HM: non-linear Hammerstein model
MA: moving average
MC: Markoff chain
Naïve1: no-change model
Naïve2: constant growth rate model
NN: neural network
PDR: panel data regression
RS: rough sets modelling
SA: spectral analysis
SARIMA: seasonal ARIMA
SES: simultaneous equation system
SR: static regression
STSM: structural time series model
SVR: support vector regression
TEM: trend extrapolation model
TVP: time varying parameter model
VAR: vector autoregression
−B: Bayesian
−U: unrestricted

Note: a method in bold type refers to the best-performing one in forecasting competition

6. Forecasting exercise

CF: combination of forecasts
FC: forecasting competition
Ex ante: forecasting future demand
Ex post: evaluating out-of-sample forecast accuracy (with no competition)

Study	Data Frequency and Sample (1)	Region Focused (2)	Dependent Variable (3)	Independent Variable (4)	Modelling and Forecasting Methods (5)	Forecasting exercise (6)
Athiyaman & Bobertson (1992)	M: 86.01-89.12	Hong Kong from Thailand	TA		Naïve1 MA **ES**	FC
Au & Law (2000)	A: 83-96	Hong Kong (I)	TE-sightseeing	LS OEIs	RS	Ex post
Au & Law (2002)	A: 83-96	Hong Kong (I)	TE- dinning	LS OEIs	RS	Ex post
Cai *et al* (2002)	CS: 97	Mainland China (D)	TE	Y/P D	SR	Ex ante

Cai & Knutson (1998)	A: 84-95	Mainland China (D)	TA	Y OEI D	SR	Ex ante
Chen & Wang (2007)	Q: 85.1-01.4	Mainland China (I)	TA		**GA-SVR** NN SARIMA	FC
Cheung & Law (2001)	A: 83-97	Hong Kong (I)	TE-hotels	HR C TA D	SR	
Cho (2001)	Q: 75.1-97.4	Hong Kong (I)	TA	C_o IM EX OEIs	**ARIMAX** ARIMA ES	FC
Cho (2003)	M: 74.01-00.12	Hong Kong (I)	TA		**NN** ES ARIMA	FC
Goh & Law (2002)	M: 80.01-00.08	Hong Kong (I)	TA		**SARIMA-In** SARIMA Naïve1,2 MA ES ARIMA	FC
Goh & Law (2003)	A: 85-00	Hong Kong (I)	TA	Y C P TV ER	RS	Ex post
Goh *et al*. (2008b)	A: 87-02	Hong Kong from UK US	TA	Y RC SC TV P D OEIs	RS	Ex post
Guo & Jin (2007)	M: 82.07-03.06	Zhejiang Province (I)	TA		MA	
Hiemstra &Wong (2002)	M: 90.01-98.12	Hong Kong (I)	TA/P	Y/P C SC ER TC SF D OEIs	ADLM	
Huang & Min (2002)	M: 79.01-00.07	Taiwan (I)	TA		SARIMA	Ex post
Huang *et al*. (2006)	M: 84.01-05.09	Taiwan (I)	TA		**NN-FTS** FTS ARIMA	FC
Kulendran & Shan (2002)	M: 88.01-01.12	Mainland China (I)	TA		**SARIMA** ARIMA AR BSM Naïve1	FC Ex ante
Kuo *et al*. (2008)	M: 01.01-06.09	Mainland China Hong Kong Taiwan (I)	TA	D OEIs	ARMAX PDR	
Law (1998)	A: 73-95	Hong Kong hotels	HOR	TA LS OEIs	**NN** SR Naïve1	FC
Law (2000)	A: 66-96	Taiwan to Hong Kong	TA	Y RC ER P ME HR	Naïve1 ES MA SR NN	FC
Law (2001)	A: 67-98	Hong Kong from Japan	TA	Y HR ER P ME	Naïve1,2 MA ES SR **NN**	FC
Law (2004)	A: 67-98	Hong Kong hotels	HOR		**TEM** ES MA Naïve1,2	FC
Law & Au (1999)	A: 77-97	Hong Kong from Japan	TA	RC P ER ME HR	**SR** Naïve1 ES MA NN	
Law & Au (2000)	A: 83-96	Hong Kong (I)	TE-shopping	LS OEIs	RS	Ex post
Law *et al* (2004)	A: 76-96	Hong Kong from Japan	TA	HR C ER P Y/P ME	RS	Ex post
Lee & Chien (2008)	A: 59-03	Taiwan (I)	TA TE	Y ER	CI	
Lim & Pan (2005)	Q: 86.1-00.4	Mainland China from Japan	TA		AR MA ARMA SARMA	
Min (2005)	M: 79.01-03.11	Taiwan (I)	TA		SARIMA	Ex post
Qu & Lam (1997)	A: 84-95	Mainland China to Hong Kong	TA	Y/P C ER D	**SR**	
Qu *et al* (2002)	A: 80-98	Hong Kong hotels	HOR	HR ER TA Y C_d D OEIs	SES	
Shan & Wilson (2001)	M: 87.01-98.01	Mainland China (I)	TA Y RC IM+EX ER	TA Y RC IM+EX ER	VAR	
Song & Fei (2007)	A: 85-05	Mainland China (I)	TA	Y RC SC D	ADLM	Ex ante
Song & Witt (2006)	Q: 92.1-03.2	Macau (I)	TA	Y RC SC	VAR	Ex ante

Song & Wong (2003)	A: 73-00	Hong Kong (I)	TA	Y RC SC	TVP	
Song *et al* (2003)	A: 73(81)-00	Hong Kong (I)	TA	Y RC SC D	ADLM	FC
Tsai & Wang (1998)	A: 73-94	Taiwan from US, Japan	TA	C ER DT D	SR	
Tse (2001)	A: 73-98	Hong Kong (I)	TA TE/P HOR	Y TA ER LS	ADLM	
Wang (2004)	A: 89-01	Taiwan (I)	TA	DT	FTS GM Markov-GM	FC
Wang & Hsu (2008)	A: 90-02	Taiwan to US	TA		FTSes	FC
Witt & Turner (2002)	A: 82-99	Mainland China (I)	TA	Y RC TC	STSM	Ex ante
Wong (1997)	Q: 75.1-95.4	Hong Kong (I)	TA	DT BC	**TEM**s Naïve1,2 ARIMA	FC
Wong *et al* (2006)	A: 73-00	Hong Kong (I)	TA	Y RC SC D	**VAR-B** VAR-U	FC
Wong *et al* (2007)	Q: 84.1-04.2	Hong Kong (I)	TA	Y RC SC D	SARIMA ADLM ECM VAR	FC CF

Table 2 Summary of Tourism Demand Modelling and Forecasting Studies on Greater China Published in Chinese Journals (1992-2007)

Study	Data Frequency and Sample (1)	Region Focused (2)	Dependent Variable (3)	Independent Variable (4)	Modelling and Forecasting Methods (5)	Forecasting exercise (6)
Bai & Wu (2003)	A: 84-99 CS: 99	Mainland China (I)	TA	Y/P P Dis DT	SR TEMs	Ex ante
Bao (1992)	CS: 85.06	Beijing (D)	TA	Y/P Y/P/TS P Dis TT	GraM	
Bian & Song (2007)	A: 98-05	Jingxia Province (I)	TA		MC	
Bu (2004)	A: 90-00	Nanwan Scenic Spot (D)	TA	DT	TEMs	FC Ex ante
Bu & Zhao (2005)	A: 91-00	Nanwan Scenic Spot (D)	TE	DT	TEM	Ex ante
Cai (2006)	A: 94-04	Nanyue Scenic Spot (D)	TA	DT	TEMs	FC Ex ante
Cai & Wang (2006)	A: 94-04	Nanyue Scenic Spot	TA	DT	TEMs **GM**	FC Ex ante
Cao & Chang (2006)	M: 00.01-04.03	Shanghai (D+I)	TA		ARIMA	Ex post
Cao & Chen (2005)	A: 93-04	Fuzhou Forecast Park (D)	TA	DT	TEMs	FC Ex ante
Che (2004)	CS: 01	Southeast Hubei Province (D)	TA	P Dis OEIs	GraM	
Che & Huang (2003)	CS: 02	Southeast Hubei Province (D)	TA	P Dis OEIs	GraM	
Chen C (2007)	A: 98-05	Taiwan to Fujian Province	TA	DT	GM	Ex ante
Chen (2002)	A: 87-01	Lantsang-Mekong Hypo-region (I)	TA	DT	TEM	Ex ante
Chen (2006)	A: 00-05	Xi'an City (D+I)	TA		GM	Ex ante
Chen YY (2007)	A: 95-03	Henan Province (I)	TA TE/P	DT	TEM	Ex ante
Chen, Chen *et al* (2005)	A: 79-04	Yunnan Province (I)	TA TE		NN	Ex ante
Chen, Liu *et al* (2005)	A: 80-03	Mainland China (D+I)	TA TE		SA	Ex ante
Chen *et al* (2007)	A: 00-04	Tunxi District of Huangshan City (D+I)	TA	DT	TEM	Ex ante
Chen & Zhang (2007)	A: 97-06	Chongqing City (I)	TA TE	DT	TEMs	Ex ante
Deng & Lu (2006)	A: 90-05	Mainland China (I)	TA		TEM ES AR **NN**	FC Ex ante
Dong & Fang (2006)	A: 83-04	Mount Wuyi Scenic Spot (D)	TA	DT	TEM	Ex ante
Fan (2004)	Q: 97.1-03.1	Beijing (I)	TA	DT	TEM	Ex post
Feng (2004)	CS: 99	Yangtzi River Delta (D) to Shanghai Expo	TA	Y P TA/P C_d TS	GraM	Ex ante
Gao (2002)	A: 95-00	Xi'an City (I)	TA		GM	Ex ante
Ge & Hua (2006)	D: 2003/2005-Godden weeks	Yunnan Province (D)	TA	DT	GM	Ex post
Gou & Sun (2000)	A: 78-97	Shanghai (D+I)	TA TE	DT	TEM	Ex ante

Guan (1999)	A: 90-95	Mount Wuyi Scenic Spot (D)	TA	DT	TEM Naïve 2	Ex ante
Guan *et al* (1998)	A: 91-96	Lijiang Region (D)	TA	DT	TEM	Ex ante
Guo (2007)	A: 85-06	Mainland China(D)	TA		ARIMA	Ex post Ex ante
Guo & Ou (2007)	M: 05.01-06.02	Guilin City (D+I)	TA	DT	TEM	Ex post Ex ante
Han & Zhou (2002)	A: 78-00	Mainland China (D+I)	TA TE	Y Y/P DT TA/P P D OEI	SR ES	Ex ante
He & Deng (2007)	M: 99.01-06.10	Guilin City (D)	TA		SARIMA	Ex post
He & Ye (2006)	A: 85-04	Mainland China(D)	TE	Y	VAR	
Huang (2005)	A: 93-05	Mainland China (I)	TA TE	DT	TEM	Ex ante
Jia & Yu (2004)	A: 93-02	Dalian City (I)	TE	DT	TEMs	Ex ante
Jiang *et al* (2007)	A: 93-03	Yunnan Province, Lantsang-Mekong Hypo-region (I)	TA		MA	Ex ante
Kang *et al* (2006)	A: 01-04	Mainland China (D)	TE- e-tourism	DT	TEM **GM**	FC Ex ante
Lei & Chen (2007)	A: 80-04	Mainland China (I)	TA		ARIMA NN **ARIMA+NN**	FC Ex ante
Li (2001)	A: 78-98	Mainland China (I)	TA	DT	TEMs	FC ex ante CF
Li (2003)	A: 78-00	Mainland China (I)	TE	DT	TEM	Ex ante
Li (2005)	A: 95-04	Mainland China(D)	TE	Y/P C_d	ARDL	
Li *et al* (2007)	A: 94-05	Xinjiang Province (I)	TA	DT	TEM	
Li & Su (2006)	A: 95-04	Guilin City (I) from US	TA	TS OEIs	GraM	
Li & Sun (1998)	A: 78-95	Xi'an City (I)	TA	DT	TEM	Ex ante
Li & Xie (1993)	A: 79-90	Huangshan Scenic Spot (D)	TA-by air	Y/P	SR	Ex ante
Liu (2003)	A: 95-01	Shanghai (I)	TA	DT	GM	Ex ante
Liu & Cui (2004)	A: 94-02	Inner-Mongolia Province (D)	TE-on road	DT P Y	TEM SR GM	FC Ex ante
Liu *et al* (2006)	A: 79-04	Jiangxi Province (I)	TA	DT	TEM	Ex ante
Liu *et al* (2007)	A: 00-02	Mianyang Scenic Spot (D)	TA	DT	TEM	Ex ante
Lu (2005)	A: 90-04	Mainland China (I)	TA TE	DT	TEMs	FC Ex ante
Lu (2007a)	A: 93-03	Mainland China(D)	TA TE	C_d OEIs	NN	Ex post
Lu (2007b)	A: 95-05	Mainland China (D)	TA TE	OEIs	SR	Ex post
Lu *et al* (2002)	A: 94-00	Shahu Scenic Sport (D)	TE		GM	Ex post Ex ante
Luo & Hou (2000)	A: 85-99	Hunan Province (I)	TE	DT	TEMs	Ex ante
Luo & Zhang (2005)	A: 95-03	Jiangsu Province (D)	TA TE		GM	Ex ante
Ma (2007)	A: 00-06	Mainland China(D)	TA	DT	TEM	Ex ante
Mao (2000)	A: 85-94	Simian Mountain Scenic Spot (D)	TA	DT	**TEM** MA ES	FC
Mei *et al* (2007)	A: 00-05	Mainland China(D)	TA-by air	DT	TEMs	Ex ante
Nie (2001)	A: 80-98	Mainland China (I)	TA TE	DT	TEMs	Ex ante
Ou & Zhang (2005)	A: 97-02	Hebei Province (D)	TA	DT	GM	Ex post Ex ante

Peng & Qu (2003)	A: 96-01	Yunyang Forest Park (D)	TA		GM	Ex ante
Qin (2000)	A: 73-99	Guilin City (I)	TA	DT	MA+TEM	Ex ante
Qin (2005)	A: 80-02	Guilin City (D)	TA	Y/P	MA SR	Ex ante
Qin *et al* (2006)	M: 89.01-02.12	Guilin City (D+I)	TA-by air		ES SARIMA **NN**	FC
Ren & Liu (2006a)	M: 89.01-04.12	Mainland China (I)	TA		ES ARMA	FC
Shang & Qin (2007)	M: 01.01-05.03	Mainland China (I)	TE		**ARIMA** GARCH	FC
Shen (1999)	A: 90-96	Henan Province (I)	TA	DT	TEM	Ex ante
Shen (2005)	A: 95-04	Henan Province (I)	TA	DT	TEM	Ex ante
Shi (2005)	A: 97-02	Mainland China (I)	TA	DT	GM	Ex ante
Shi *et al* (2007)	A: 96-04	Xinjiang Province (I)	TA TE		TEM	Ex ante
Shui & Teng (2006)	A: 97-02	Leshan Scenic Spot (D)	TA	Y/P C_d OEI	SR	Ex post
Su (2006)	A: 98-04	Qinghai Province(I)	TA	DT	GM	Ex ante
Sun (1998)	A: 84-96	Mainland China (I)	TA	DT	TEMs	Ex ante
Sun (2000)	A: 84-96	Mainland China (I)	TA	DT	TEMs	Ex ante
Sun (2001)	A: 78-99	Xi'an City (I)	TA TE	DT	TEM	
Sun & Hou (2004)	A: 78-04	Mainland China (D+I)	TA TE	Y Y/P DT TA/P P D OEI	SR ES	Ex ante
Sun & Ma (2007)	M: 00.01-02.12	Xi'an City (D+I)	TA	OEI D	SR	
Sun *et al* (1998)	A: 89-95	Kunming City (I)	TA	DT	TEM GM	Ex ante
Sun *et al* (2002)	A: 80-99	Mainland China (I)	TA	DT	TEM **NN**	FC Ex ante
Tang, Zhao & Qin (2007)	A: 97-04	Guilin city (D+I)	TA	DT	GM	Ex ante
Tang, Zhou & Zhang (2007)	Q: 94.1-05.4	Mainland China (D)	TA		ES	
Tang, Zhou, Zhang & Zhang (2007)	Q: 94.1-05.4	Mainland China(D)	TA		ES	Ex ante
Teng & Li (2006)	A: 78-05	Xi'an City (I)	TA		NNs	FC Ex ante
Tian (2001)	A: 91-00	Chongqing City (I) from US	TA	DT	TEM	Ex ante
Wang (2000)	A: 94-04	Zibo City (I)	TA	DT	TEM	Ex ante
Wang (2001)	A: 78-00	Mainland China (I)	TA TE	DT	GM	Ex ante
Wang (2002)	A: 97-00	Fuling District of Chongqing City(D)	TA TA/P	Y/P P OEIs	SR	Ex ante
Wang (2003)	A: 93-00	Mainland China (I)	TA	DT	TEMs	Ex ante
Wang (2004)	W: 00.3rd-04.3rd	Mainland China(D)	TA	DT	GM	Ex ante
Wang (2006)	A: 96-03	Shennongjia District (D)	TE	DT	TEM	Ex ante
Wang & Hua (2006)	D: 05	Yunnan Province (D)	TA	DT	TEM	Ex ante
Wang *et al* (2004)	A: 79-02	Mainland China (I)	TE	Y Y_d OEIs	SR	
Wang *et al* (1997)	A: 83-94	Beijing (I)	TA		TEMs	
Wei (1999)	A: 88-95	Shenzhen City (I)	TA	DT	GM	Ex ante
Wei (2000)	A: 91-96	Shanghai (I)	TA		GM	Ex ante
Wei & Liu (1997)	A: 79-95	Xi'an City (I)	TA		ARIMA	Ex post Ex ante
Wei & Yu (2005)	M: 01.01-02.08	Beijing (I)	TA	DT	TEM	Ex ante

Wei *et al* (2005)	A: 78-02	Shandong Province (I)	TA	DT	TEM	
Wu *et al* (2002)	A: 67-97	Hong Kong from Japan	TA	C HR EX P ME Y/P	ES MA AR **NN**	FC
Wu & Liu (2001)	A: 78-98	Mainland China (I)	TE		AR MA ARMA	Ex ante
Xie (2007)	M: 97.01-03.08	Beijing (I)	TA		TEM	
Xie & Wu (1998)	M: 93.01-96.12	An unnamed hotel	TA-hotels	DT	TEM	Ex ante
Xu (2000)	A: 83-99	Sichuan Province (D)	TA	Y/P	SR	Ex ante
Xu (2003)	A: 90-01	Mainland China (D)	TA TE	Y/P TA/P OEIs	GM	Ex ante
Xu & Huang (2005)	A: 97-03	Feshan City (D+I)	TE	Y Y/P TA NAC OEIs	GM	Ex ante
Xu & Yu (1997)	A: 82-91	Jilin Province (D+I)	TE	OEIs	SR	
Yan & Meng (2005)	A: 84-02	Suiyang County, Guizhou (D)	TA		TEM	Ex ante
Yang (2001)	A: 84-95	Mainland China (I)	TA	DT	GM	Ex post
Yang *et al* (2003)	M: 99.01-02.12	North Spa Scenic Spot (D)	TA	DT	TEM	Ex ante
Ye (2003)	A: 80-01	Mainland China (I)	TA		TEM	Ex ante
Yin *et al* (2004)	A: 83/94-02	Yunnan Province (D+I)	TA		SVMs	FC
Yu (2006)	A: 95-05	Jilin Province (I)	TE/P	OEIs	SR	
Yu & Wang (2005)	M: 93.01-04.07	Mainland China (I)	TA		ARIMA	Ex post
Zhang EX(2000)	A: 83-97	Mainland China (I)	TA	DT	MC TEM	Ex ante
Zhang (1995)	A: 84-92	Unnamed forecast Park (D)	TA		GM	Ex ante
Zhang (2003)	A: 93-02	Mainland China (D+I)	TE	Y OEIs	SR	
Zhang (2004)	A: 93-01	Mainland China(D)	TA TE TE/P	Y Y/P P Dis DT	SRs TEMs	Ex ante
Zhang (2007)	M: 94.01-05.12	Mainland China (I)	TE	DT D	TEM ARIMA **AR**	FC Ex ante
Zhang & Chen (2007)	SA: 57-06	Canton Trade Fair (D)	TA		ARIMA	Ex ante
Zhang *et al* (2000)	A: 90-97	Hebei Province (I) Aggregate and US	TA	P Dis OEIs	GraM	Ex ante
Zhang *et al* (2007)	A: 95-05	Mainland China (D, I)	TA TE	Y/P	SR	Ex ante
Zhang & Li (2007)	A; 00-05	Hebei Province (I)	TA		GM	Ex ante
Zhang & Lu (2004)	A/M: 78.01-02.12	Mainland China (I)	TA		MA	
Zhang & Ma (2005)	A: 78-03	Mainland China (I)	TA	DT	**AR** GM	FC Ex ante
Zhang & Wang (2002)	A: 92-00	Ningxia Province (D)	TA	Y_d	HM	Ex ante
Zhang & Wang (2005)	A: 98-02	Shaanxi Province (I)	TA TE	DT	TEM	Ex ante
Zhao (2004)	A: 98-02	An unnamed scenic Spot (D)	TA	DT	TEM	Ex ante
Zhao & Jia (2005)	A: 98-02	Anhui Province (D+I)	TE		GM	Ex ante
Zhao *et al* (2006)	D: 00.01.01-02.11.30	Tianyahaijiao Scenic Spot (D)	TA		NN	Ex post

Zhao & Yin (2004)	CS: 02	Shenmu County (D)	TA	Y/P Dis TT OEIs	GraM	Ex ante
Zheng & Liu (2001)	A: 90-99	Xinjiang Province (I)	TA	DT	TEMs	Ex post Ex ante CF
Zheng & Zhu (2006)	A: 97-04	Dazhou City (D)	TA	DT	TEMs	Ex ante
Zhou & Liu (1996)	A: 78-94	Kunming City (I)	TA	DT	TEMs	FC Ex ante CF
Zhou & Ren (2004)	A: 97-02	Mainland China (I)	TA	DT	GM	Ex ante
Zhu *et al* (2005)	A: 78-98	Mainland China (I)	TA	DT	GMs	FC
Zhu *et al* (2006)	A: 00-04	Zaozhuang City (D)	TA	DT	GM+NN	Ex ante
Zhu & Pan (2005)	A: 92-03	Nanwan Scenic Spot (D)	TA		GM	Ex ante

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Table 3 Summary of Geographic Focuses of the Surveyed Studies

International Studies		Chinese Studies		
Geographic focus	No. of studies	Geographic focus	Total no. of studies	No. of studies on international demand
Mainland China	11	National aggregate	45	28
Hong Kong	26	Provinces	42	25
Macau	1	Cities/towns	27	14
Taiwan	9	Scenic Sports	17	--
		Others	6	--

Table 4 Summary of the Calculated Tourism Demand Elasticities

Region under study	Income elasticity	Price elasticity	Source
Hong Kong (I)*	1.948	-1.025	Song *et al* (2003)
	(0.944 ~ 3.620)	(-2.885 ~ -0.206)	
Hong Kong (I)*	1.922	-0.561	Song & Wong (2003)
	(0.233 ~ 2.907)	(-1.013 ~ -0.175)	
Mainland China (I)*	3.387	-4.132	Song & Fei (2007)
	(1.916 ~ 4.841)	(-11.751 ~ -0.930)	
Mainland China (D)	0.733	--	Cai & Knutson (1998)
Mainland China to Hong Kong	1.521	-0.402	Song *et al* (2003)
Taiwan to Mainland China	1.916	--	Song & Fei (2007)
Taiwan to Hong Kong	2.140	-1.729	Song *et al* (2003)

Notes: * refers to the study in which multiple origins of tourists were concerned. Then the average elasticity is calculated based on the reported individual elasticities, the range of which is presented in the parentheses under the calculated average. "(I)" indicates inbound tourism, and "(D)" domestic tourism.

Table 5 Summary of Forecasting Exercises in the Surveyed Literature

	Forecasting competition	*Ex post* forecasting	*Ex ante* forecasting	Forecast combination	No forecasting
International studies	17	8	6	1	12
Chinese studies	21	16	101	3	19

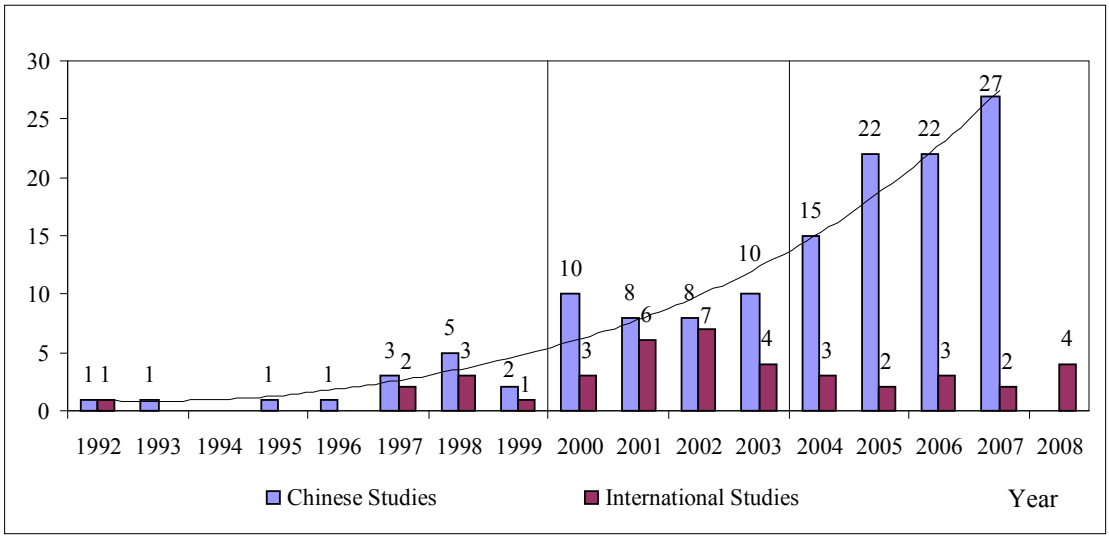

Figure 1. Publications of Tourism Demand Studies on Grater China (1992-2008)